

**CHAPTER VI**  
**REPORT OF DIVISIONS, COMMISSIONS, AND WORKING GROUPS**

**DIVISION I**  
**FUNDAMENTAL ASTRONOMY**

Division I provides a focus for astronomers studying a wide range of problems related to fundamental physical phenomena such as time, the inertial reference frame, positions and proper motions of celestial objects, and precise dynamical computation of the motions of bodies in stellar or planetary systems in the Universe.

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**BOARD**

E.M. Standish	President Commission 4
C. Froeschle	President Commission 7
H. Schwan	President Commission 8
D.D. McCarthy	President Commission 19
E. Schilbach	President Commission 24
T. Fukushima	President Commission 31
J. Kovalevsky	Past President Division I

**PARTICIPATING COMMISSIONS:**

<b>COMMISSION 4</b>	<b>EPHEMERIDES</b>
<b>COMMISSION 7</b>	<b>CELESTIAL MECHANICS AND DYNAMICAL ASTRONOMY</b>
<b>COMMISSION 8</b>	<b>POSITIONAL ASTRONOMY</b>
<b>COMMISSION 19</b>	<b>ROTATION OF THE EARTH</b>
<b>COMMISSION 24</b>	<b>PHOTOGRAPHIC ASTROMETRY</b>
<b>COMMISSION 31</b>	<b>TIME</b>

## COMMISSION 4: EPHEMERIDES

President: H. Kinoshita

Secretary: C.Y. Hohenkerk

Commission 4 held one business meeting.

### Business Meeting, August 26:

During the triennium three members had died, Dr LeRoy Doggett, Dr Bruno Morando and Dr H. Beat Wackernagel, the meeting stood for a moment, in remembrance.

The officers elected to Commission 4 for 1997 to 2000 are, President E. Myles Standish Jr., and Vice-President Jean Chapront.

The following membership of the organizing committee was approved:

V.K. Abalakin	He Miao-Fu	H. Kinoshita	H. Schwan
J.-E. Arlot	C.Y. Hohenkerk	G.A. Krasinsky	P.K. Seidelmann
T. Fukushima	G.H. Kaplan	J.H. Lieske	

The following new members were elected:

Steven Bell	David Harper	Georgiy Eroshkin	Martin Lara
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The following consultants were approved:

J.A. Bangert	J. Meeus
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The total membership of Commission 4, a middle sized commission, is 91. The President reported that the Commission had supported Joint Discussions 3 and 7, which resulted in resolutions B1, B2, B5. being adopted by the GA. The Chairman of the Working Group (WG) on JD and MJD reported that their work had resulted in the adoption of Resolution B1.

### Report on Working Groups of Division 1

Kovalevsky reported on the decisions made by Executive Committee concerning WGs. A WG on general relativity in the framework of the space-time reference and methodology. A joint WG of the IAU, BIPM and IAG. The President would be Petit or Leschinta. The WG is to study the definitions, conventions, and notation at a sufficient level of accuracy.

A WG on general relativity in celestial mechanics and astrometry, Their President is Soffel. The WG is to consider the application of observations to celestial mechanics and astrometry, and study the concepts, algorithms, and constants used in astrometry.

A WG on the ICRS. Their President is Mignard. There are two sub-groups, chaired by Dehant and Helmut. Their job is to consider all consequences of the new reference system, the new nutation series, and the maintenance and extension of the Hipparcos Catalogue, and to liaise with the IERS.

The main tasks of the WG's were stated in resolutions B5 and B2. All those interested in participating should write or send e-mail to the appropriate WG President.

Kovalesky reported on the continuation of the following three WGs. The IAU/IUGG WG on Precession and Nutation, chaired by Dehant. The WG on Astronomical Standards, chaired by Fukushima, with sub-groups, on Best Estimates, chaired by McCarthy, and SOFA, chaired by Wallace. The WG of the IAU/IAG/COSPAR on Cartographic Coordinates and Rotational Elements of Planets and Satellites, now chaired by Seidelmann. The commission asked the chairman to thank Davies, the retiring Chairman for his work over many years.

### The Future for National Nautical Almanac Offices

Yallop gave a talk about Nautical Almanac Offices. The text of his talk will be published in the Commission 4 Newsletter.

## Reports from various Institutions

### HM Nautical Almanac Office

Hohenkerk reported that there have been several changes in staff. Yallop had retired, and Sinclair was now in charge (part-time), and Harper had been appointed.

Collaboration continued with USNO on *The Astronomical Almanac* and other publications. HMNAO continues to produce, enhance and increase its publications as required, and this now includes the financial viability as well as their usefulness and intellectual content. *The Nautical Almanac* is still the core commercial publication. The web, which by its nature freely provides information to all, is a medium that at present causes problems to HMNAO, who must cover costs through sales of almanacs and related data. There are also problems with copyright. We believe that HMNAO has a future. It will be part of

the core of the new RGO, whose business plan is being prepared. We are continuing our work and trying to keep our products up to date as well as developing new ones. We would like to thank all those who wrote letters of support for HMNAO and the RGO.

#### **The Bureau des Longitudes**

Arlot reported on their publications, which are mostly in French, and are Government funded. An important activity was providing the public with information. This was done through the successful MINITEL system. They have now published an *Explanatory Supplement to the Connaissance des Temps*. A web service was being developed (French and English), some sections were available (e.g. physical ephemeris of IO).

#### **Rechen-Institut**

Schwan reported on "The Future of *Apparent Places of Fundamental Stars*". APFS has been published since 1941, and from 1960 this had been done by the RI. From 1988 it was computed from the final FK5 catalogue. The volume for the year 1999 will be published as before. However APFS was under increasing scrutiny. With the release of the Hipparcos catalogue the replacement of the FK5 is being considered. Certainly, apparent places for all Hipparcos stars will not be computed. The FK6 project is considering how to combine these catalogues. The problem arises due to the short period (3.5 years) of the Hipparcos mission, so many of the astrometric doubles have virtually 'instantaneous' proper motions. Thus for epochs 5 years from the mean Hipparcos epoch, the place will be computed on the basis of the FK5 proper motion (a mean motion for most stars), because it averages over about 200 years and will statistically provide better predictions than using the Hipparcos proper motions.

All remarks and suggestions and recommendations were welcome. Please send them to s25@ix.urz.uni-heidelberg.de.

#### **Purple Mountain Observatory**

The Director of the Ephemeris Division had asked Seidelmann to read their report. They have four annual publications, an Astronomical Ephemeris, a Nautical Almanac, a Surveying Almanac, and an almanac with general information. They also have almanacs on various Chinese Calendars and they produce Solar/Lunar eclipse predictions. There is an ephemeris software package for PCs MICE, and graphical software for eclipses and meridian passages.

#### **US Naval Observatory**

Seidelmann reported that Paul Janiczek, head of Astronomical Applications Department, had retired, and they were in transition period. They had produced *The Astronomical Almanac (AsA)*, *The Nautical Almanac*, *The Air Almanac*, *Astronomical Phenomena* each year; the software package MICA v 1.5 1990 - 2005 was available and MICA v 2.0, a major revision for Windows and Mac was being produced. There was other work for the Defense department, including a research into asteroids masses and ephemerides. They are distributing a survey about *The Astronomical Almanac*. How much should be printed, should there be a CD-ROM companion, or should it be on the web. Other considerations; should the Moon polynomial coefficients be printed; what use was the satellite section? USNO had a satellite ephemeris package. Other questions concerned the minor planets, the stars and the observatory list? All comments were welcome.

#### **The National Astronomical Observatory of Japan**

NAOJ produces an Ephemeris of about 100 pages (free), but it is also part of a larger data book on natural science, which is produced commercially. The Hydrographic Office publish the *Japanese Ephemeris* and *Nautical Almanac*.

#### **Jet Propulsion Laboratory**

Standish reported that they had a web page, from which people can get a table of ephemerides --- like AsA, which was mainly used by professionals.

#### **Message from the next president**

Standish said had been thinking about his role, he would be active through e-mail. We are now in the electronic age. He saw that the NAO's were facing problems. Professionals need access to ephemerides. There must be joint effort to provide them with the data they needed.

## COMMISSION 7 : CELESTIAL MECHANICS (MÉCANIQUE CELESTE)

*Report of Meetings, 26 August 1997*

President : S. FERRAZ-MELLO  
Vice-President : C. FROESCHLÉ  
Secretary : A. LEMAITRE

### 1. Business

#### 1.1. ELECTION OF THE ORGANIZING COMMITTEE

The commission elected the following officers and members of the Organizing Committee for the term 1997 – 2000 :

President:	C. Froeschlé
Vice-President	J. D. Hadjidemetriou
Members:	R. Dvorak
	S. Ferraz-Mello ( <i>Past President</i> )
	T. Fukushima
	I. A. Gerasimov
	D. C. Heggie
	Z. Knežević
	J. H. Lieske
	A. Milani
	M. Moons
	J. C. Muzzio
	M. Soffel
	Y.-S. Sun

#### 1.2. ELECTION OF CONSULTANT MEMBERS OF THE COMMISSION

The following non-IAU members were elected as consultant members of Commission 7 for their extended contributions to activities relevant to the Commission: A. Giorgilli (Italy), K. R. Meyer (USA), A. Neishtadt (Russia), C. Simò (Spain), and Z. Xia (USA)

#### 1.3. ELECTION OF NEW MEMBERS OF THE COMMISSION

The following IAU members were approved for membership in Commission 7, following proposals by their National Committees or by members of the Commission's Organizing Committee:

M. Barbosu (Rumania), C. Beaugé (Argentina), E. Bois (France), L. Floria (Spain), T. Fukushima (Japan), T. Gallardo (Uruguay), I. A. Gerasimov (Russia), G. Hahn (Germany), A. Harris (USA), A. Krivov (Russia), A. Morbidelli (France), X X Newhall (USA), I. M. P. Osorio (Portugal), B. Parv (Rumania), H. Rickman (Sweden) V. Sokolov (Russia), N. Sorokin (Russia), B. A. Steves (UK), G. Tancredi (Uruguay), H. Varvoglis (Greece), N. Vassiliev (Russia), N. Watanabe (Japan), O. C. Winter (Brazil), and C. Zhao (China PR).

#### 1.4. DECEASED MEMBERS

At the session opening the presents revered the memory of those Commission members whose decease was brought to our knowledge: E. P. Aksenov, D. Betis, F. Boigey, V. G. Demin, L. Doggett, B. Morando, and J.L. Sagnier.

#### 1.5. REPORT OF ACTIVITIES 1994-1997

The conclusions of the Working Group created by the Commission during the past General Assembly with the objective of redefining the goals of the Commission and to propose the necessary modifications so as to allow its insertion in one of the IAU divisions were the following:

1. The aim of the Commission may comprehend all astronomical problems where Dynamics is the main determining factor. Commission 7 should be renamed as "Celestial Mechanics and Dynamical Astronomy".
2. Commission 7 should remain outside the current IAU divisions as it shares interests with several of them.
3. The triennial report published in the IAU Transactions should continue as it is now, asking specialists to review the progresses in some topics selected in advance. Only modification is the recommendation that a broad sample of people be consulted by the Commission President before selecting the topics to be included in the report. A larger diffusion using e-mail facilities is necessary.
4. Commission 7 should have as policy to propose a Symposium every three years on a subject of actuality considered relevant and broad enough to guarantee the support of a few other IAU Commissions. Nowadays the Commission makes no proposals by itself and restricts its action to the discussion of spontaneous proposals originated from groups of members or organizations.

The Organizing Committee agreed with the proposal of renaming the Commission and communicated it to the EC. The new name "Celestial Mechanics and Dynamical Astronomy" will be in effect after this General Assembly. Taking into account the difficulties experienced for remaining outside the new IAU Divisions, the OC asked the IAU Executive Committee to be affiliated with two of them: Division 1 (Fundamental Astronomy) and Division 3 (Solar System). The answer of the EC was negative. After a long discussion, the OC decided, in 1997, to join Division 1. The OC agrees that the affiliation to one Division impairs its relationship with the others; however it also realized, during the elapsed three years, that the fact of remaining outside the divisional structure was weakening its ties with all divisions and with IAU itself; *the continuation of this situation could impair efforts towards the realization of important commission goals.*

After the past General Assembly the Commission has supported IAU Symposium 172 and co-supported IAU Colloquium 165 as well as 4 of the joint discussions held during this General Assembly. The Commission is also supporting IAU Colloquium 172 "The Impact of Modern Dynamics in Astronomy" and co-supporting IAU Colloquium 173 "Evolution and source regions of asteroids and comets" to be held in Namur and Stara Lesna, respectively, in 1998.

Other activities of the Commission in the period were the active support for the approval, by the NATO Scientific Affairs Division, of a new edition of the Advanced Studies Institute in Celestial Mechanics (see below). The Commission has also proposed the publication of an English version of C. V. L. Charlier's masterwork "Die Mechanik des Himmels", at the centennial of its first edition, in 2002.

## 1.6. CELESTIAL MECHANICS AND DYNAMICAL ASTRONOMY

J. Henrard presented a report on the current situation of the journal *Celestial Mechanics and Dynamical Astronomy*.

The two main problems for the Journal are that it is behind schedule by about six months and that it is not in the list of "source journals" for the *Science Citation Index*. The two problems are connected. The Journal was dropped from the list of "source journals" when it changed name (and ISBN number) several years ago. Since then our efforts to get it back on the list have met with little success. The latest reason given us is that the Journal is too far behind schedule. Now the reason we are behind schedule is a dip in the submission of good papers in 1994 and 1995. We are now receiving and publishing at a correct rate but we are still behind schedule. We plan to fill the gap by scheduling fewer pages for a year or two. Let us hope that these actions will permit *Celestial Mechanics and Dynamical Astronomy* to get back on the list of source journals.

For six months now the refereeing process of the journal has been conducted electronically. Soon the abstracts of published papers will be available on the web. Later on the full articles will be accessible from the computers of the institutions who do have a subscription to the journal.

The Commission decided to contact the Institute of Scientific Information (ISI) in order to manifest its extreme worries with the fact that the journal, still remains outside the source list of the Science Citation Index; it does not appear in the "Journal Citation Report", notwithstanding its quality standards well above those of many other journals considered and indexed by that Institute.

## 1.7. NATO ADVANCED STUDY INSTITUTES IN CELESTIAL MECHANICS

S.Ferraz-Mello read the report written for the Commission by Prof. A. E. Roy, current director of the NATO Advanced Study Institutes in Celestial Mechanics, on the 25 years of the Institute. An abstract of this report is given below:

The series of NATO Institutes in Celestial Mechanics began in 1972 first under the directorship of Professor Victor Szebehely and subsequently under Professor Archie Roy. All except the latest have been held in Cortina d'Ampezzo, Italy. For the last 25 years, these Institutes have played a crucial role in the development of scientists working in Dynamical Astronomy, Orbital Dynamics, Celestial Mechanics and Space Astrodynamics. They involve the coming together for two weeks of some fifteen specialist lecturers of international reputation and some 60 to 70 participants from about 20 different countries scattered around the world. Almost all the present leading scientists in these branches of Science and Engineering Mechanics in North America and Western Europe, have attended at least one of these Institutes. Many of those now active in the field made their first international contacts at these Institutes.

The latest ASI in the series, entitled "The Dynamics of Small Bodies in the Solar System: A Major Key to Solar System Studies", was held recently in Acquafredda di Maratea, Italy. The study of dynamics of asteroids, comets, meteor streams, natural satellites and ring systems currently provides a wealth of information concerning the history and dynamical evolution of the solar system as a whole. Further information about the Institute may be found on the web site <http://www.maths.gcal.ac.uk/natoconf>.

## 1.8. DIVISION I WORKING GROUPS

J. Kovalevsky, president of IAU Division I informed about the Working Groups of interest of Commission 7 (two of them chaired by members of the Commission's Organizing Committee):

- WG on Near Earth Objects (Divisions I and III). Chairman: D. Morrison ([dmorrison@mail.arc.nasa.gov](mailto:dmorrison@mail.arc.nasa.gov))
- WG on Relativity for Celestial Mechanics and Astrometry. Chairman: M. Soffel ([soffel@rcs.urz.tu-dresden.de](mailto:soffel@rcs.urz.tu-dresden.de))
- WG on ICRS. Chairman: F. Mignard ([mignard@ocar01.obs-azur.fr](mailto:mignard@ocar01.obs-azur.fr))
- WG on Astronomical Standards. Chairman: T. Fukushima ([toshio@spacetime.mtk.nao.ac.jp](mailto:toshio@spacetime.mtk.nao.ac.jp))
- WG on Precession and Nutation (IUGG and IAU). Chairman: V. Dehant ([Veronique.Dehant@ksb-orb.oma.be](mailto:Veronique.Dehant@ksb-orb.oma.be))

## 2. Scientific Reports

Three invited reports were presented and the following abstracts were provided by the lecturers:

1. "Kozai Resonance" : H. Kinoshita ([Kinoshita@nao.ac.jp](mailto:Kinoshita@nao.ac.jp))
2. "Hamiltonian Systems and Tangent Space to Invariant Tori" R. Vieira Martins ([rvm@on.br](mailto:rvm@on.br))
3. "The causes of chaotic motion in the Hecuba gap" J. Henrard ([jhenrard@math.fundp.ac.be](mailto:jhenrard@math.fundp.ac.be))

### KOZAI RESONANCE

H. KINOSHITA

Tokyo Astronomical Observatory, Tokyo, Japan

Kozai (1962) found that the argument of perihelion of an asteroid with high inclination does librate and even though the initial eccentricity is very small, the eccentricity becomes very large. This phenomenon is recently called Kozai resonance, since the mean motion of the perihelion longitude is equal to that of the longitude of node. Kozai resonance is now recognized as an important factor in the chaotic dynamical evolutions of the small bodies in the solar system and the exo-planetary systems. Kozai resonance; however, it is a little bit fragile compared with the mean motion resonance and the secular resonances. Kinoshita and Nakai (1991) discussed secular perturbation of fictitious satellites of Uranus, which are disturbed by the Sun and the oblateness of Uranus. Satellites located in the region where the solar perturbation is dominant become highly eccentric due to Kozai resonance. Satellites located in the region where the oblateness perturbation is dominant keep the original small eccentricity since Kozai resonance is suppressed. Innanen *et al.* (1997) investigated the stability of the planetary orbits in binary systems. When the mutual perturbations among planets are neglected, the eccentricity becomes very large due to Kozai resonance. When, however, the mutual perturbations are included, the Kozai resonance is suppressed and the eccentricities of the planets stay small and the orbital planes of the planets move with small mutual inclinations.

### References

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 Kinoshita, H. and Nakai, H. (1991) *Celestial Mechanics* **52**, 293.  
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## HAMILTONIAN SYSTEMS AND TANGENT SPACE TO INVARIANT TORI

R. VIEIRA MARTINS

Observatório Nacional, Rio de Janeiro, Brazil

We consider an integrable Hamiltonian system with  $n$  degrees of freedom. In very general conditions, we know that almost every trajectory of the system is dense on a torus  $T^n$  which is a manifold with dimension  $n$  immersed in the phase space which has dimension  $2n$ .

For every particular solution of the system, and in particular for any arbitrarily chosen solution  $z(t)$  dense on an invariant torus, we can write the variational equations. It is well known that the variational equations associated to the first variation is a system of homogeneous linear equations. For the  $k^{\text{th}}$  variation we have a non-homogeneous linear system which differs from the first variation system by an additive independent term which is function of the solutions of the  $(k-1)^{\text{th}}$  variation systems. In very general conditions, we have the following result concerning the solutions of the variational equations:

“For  $t$  sufficiently large, the ratio of every arbitrary solution of the  $k^{\text{th}}$  variation to  $t^k$  defines a vector which is sufficiently near another vector whose components can be associated to the  $k^{\text{th}}$  derivatives of a parametrization of the invariant torus associated to  $z(t)$ ”.

Thus, with the first variation we can know the tangent space to the torus, with the second variations we can compute the curvatures, and so on.

Some applications follow naturally from this result. For example, if we know the tangent space to the torus, we can evaluate the frequencies associated to the trajectory on the torus. We can also compute the singularities of the projections of the tangent spaces on the configuration space. So, it is possible to know the Lagrangian singularities which define the caustics of the torus in this space. With the higher derivatives of the parametrization of the invariant torus, we can know the higher order Lagrangian singularities. These singularities are interesting in the study of some properties of the Hamiltonian integrable systems orbits in the configuration space.

A proof of this result for the first variation case and its application to the computation of caustics may be found in Stuchi and Vieira Martins (1995).

## References

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## THE CAUSES OF CHAOTIC MOTION IN THE HECUBA GAP

J. HENRARD

Dept. Mathématique, F.U.N.D.P., Namur, Belgium

For about fifteen years now, one of the main goals of dynamicists of the Solar System has been to show that the depletion of the Kirkwood gaps in the asteroid belt is due to close encounters with the terrestrial planets. The favored scenario is that chaotic motion inside the Jovian resonances forces a large increase in the eccentricity of asteroids which then become Mars crossers or even Earth crossers or even Sun-grazers.

This search for chaotic motion as the “smoking gun” of the Kirkwood gap enigma received a dramatic uplift with the investigation of the 3/1 gap by Wisdom (1983). The mechanism responsible for the chaotic zone investigated by Wisdom is the *periodic crossing of the separatrix* of the circular averaged restricted problem (Wisdom, 1985) due to the eccentricity of Jupiter. The mechanism does not cover the full extent of the 3/1 Kirkwood gap and account only for an increase in eccentricity just large enough to force asteroids to become Mars crossers but the search was on. It was later found out that there is a path to much higher eccentricities (Ferraz-Mello and Klafke, 1991) and that a stronger mechanism, *the overlap of secular resonances*, account for a much extended chaotic zone with a much shorter time scale for eccentricity increase (Moons and Morbidelli, 1995). The overlap of secular resonance is also responsible for the depletion of several other gaps (Morbidelli and Moons, 1995).

But the first order resonances (2/1 and 3/2 being the most important one in the asteroid belt) are much stronger than higher order resonances. The separatrix crossing exists but affect only a very small volume of phase space; the overlap of secular resonances exists but affects only orbits which are high eccentric to start with (Morbidelli and Moons, 1993).

Wisdom (1987) produced strong numerical evidences that another chaotic zone exists at low eccentricity and hinted that orbits starting in this zone could reach high eccentricities by going through a high inclined episode. This chaotic zone had been discovered much earlier (Froeschlé and Scholl, 1976) but its importance overlooked because, in the planar problem, it was not responsible for any dramatic increase in the eccentricity. Later on the existence of this low eccentric chaotic zone was explained as due to *secondary resonances* between the frequency of libration and the pericentric frequency (Lemaître and Henrard, 1990) and the bridge, between this low eccentric zone and the high eccentric zone due to secular resonances, explained as being due to the  $\nu_{16}$  resonance in inclination (Henrard *et al.*, 1995).

Between these two zones of chaotic motion, in both the 2/1 and the 3/2 resonances, there still remained a large size volume of phase space, at moderate eccentricities and low inclination, apparently non chaotic. It is precisely in this zone that the Hilda family is found in the 3/2 resonance, while this zone is almost devoid of asteroid in the 2/1 resonance. In the 2/1 resonance this zone is cut in two by the  $\nu_{16}$  resonance in inclination (Michtchenko and Ferraz-Mello, 1997) but this does not seem to be enough to explain the depletion. In the same paper the authors make a strong point about the importance of the "great inequality", this 5/2 quasi resonance between the mean motions of Jupiter and Saturn, something which had already been hinted by Ferraz-Mello *et al.* (1996).

Very recently, a large scale numerical survey of the first order Jovian resonances (Nesvorný and Ferraz-Mello, 1997) confirms the existence and the location of all the sources of chaotic motion mentioned above, while an ad-hoc numerical exploration (Henrard, 1997) shows that high order secondary resonances with the great inequality is responsible for a weak chaoticity which leads to a slow random walk in the amplitude of libration; this is enough, on time scale of hundreds of millions of years, to dump orbits in the  $\nu_{16}$  resonance in inclination; the orbit is then very quickly "lifted" to the strong chaotic zone sitting at high inclination and high eccentricity.

## References

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**COMMISSION 8: POSITIONAL ASTRONOMY**  
**COMMISSION 24: PHOTOGRAPHIC ASTROMETRY**

*Business Sessions: Saturday, 23 August 1997 and Tuesday, 26 August, 1997*

PRESIDENT, COMMISSION 8: Thomas E. Corbin

PRESIDENT, COMMISSION 24: Catherine Turon

VICE-PRESIDENT, COMMISSION 8: Heiner Schwan

VICE-PRESIDENT, COMMISSION 24: Elena Schilbach

**ORGANISING COMMITTEES**

COMMISSION 8: P. Benevides-Soares, L. Helmer, Xu Jiayan, J. Kovalevsky, L. Lindegren,  
J. A. Lopez, L. Morrison, F. Noel, D. Polojentsev, Y. Requieme,  
R. Stone, Jin Wenjing, M. Yoshizawa

COMMISSION 24: C. de Vegt, P.D. Hemenway, P.A. Ianna, K.J. Johnston, I.I. Kumkova,  
C.E. Lopez, E. Schilbach, H.G. Walter, J.J. Wang, G.L. White

**1. Commission 8: business session 23 August 1997**

**1.1. INTRODUCTION**

The President presented the agenda for the business meetings to the members for their approval. He summarized the steps that had been taken to address the question of merger with Commission 24 over the past three years. *The membership in general and the Organizing Committee in particular took an active and responsive part in this process, and this was greatly appreciated. Special thanks must go to Dr. J. Kovalevsky, President of Division 1, and Dr. C. Turon, President of Commission 24 for their collaboration, help and friendship which turned a chore into a pleasure. Great appreciation is also due to Monique Orine and Julie Saucedo, office of the IAU Secretariat, for their help with all of the support needed to run the commission these past three years. Nearly instant response with accurate information was always their hallmark.*

**1.2. IN MEMORIAM**

A moment of silence was observed by members of commission noting the deaths of the following colleagues: V. V. Konin, A. A. Nemiro, K. Pilowski, and J. von der Heide.

**1.3. MEMBERSHIP**

Although it had been the intent of the previous president to reduce the size of the commission by eliminating inactive members, the list received in 1994 from the Secretariat, when corrected for some omissions, totaled 169 names. One member, Joseph M. Chamberlain, resigned. The following were proposed for membership and received unanimous approval from the members:

Anna A. Androva	Pulkovo Observatory	Russia
Christian Delmas	OCA-CERGA	France
Alexander V. Devyatkin	Pulkovo Observatory	Russia
Yu Fan	Yunan Observatory	China

Gueorgui A. Gontcharov	Pulkovo Observatory	Russia
Irina S. Guseva	Pulkovo Observatory	Russia
Alexei E. Ilin	Pulkovo Observatory	Russia
Carme Jordi	Universitat de Barcelona	Spain
Andrei V. Kuzmin	Sternberg Astronomical Institute	Russia
Qi Li	Beijing Astronomical Observatory	China
Zheng Xing Li	Purple Mountain Observatory	China
Olexandr Molotaj	Astronomical Observatory (Kyiv)	Ukraine
Kouji Ohnishi	Nagano National College	Japan
Thomas Schildknecht	Astronomical Institute (Bern)	Switzerland
Sean Urban	U. S. Naval Observatory	USA
Miguel Vallejo	Observatorio de la Armada	Spain
Norbert Zacharias	U. S. Naval Observatory	USA
Zi Zhu	Shaanxi Observatory	China

#### 1.4. COMMISSION 8 OFFICERS FOR THE NEXT TRIENNIUM: 1997-2000

President:	Heiner Schwan (Astronomisches Rechen Institut, Germany)
Vice-President:	Wenjing Jin (Shanghai Observatory, China)
Organising Committee:	T.E. Corbin (USA), J. Kovalevsky (France) J.A. Lopez (Argentina), L.V. Morrison (UK), F. Noel (Chile), G. Pinigin (Ukraine), D. Polojntsev (Russia), R. Stone (USA), J. Xu (China)

Their e-mail addresses are given below:

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Corbin	tec@sicon.usno.navy.mil
Kovalevsky	kovalevsky@mfg.cnes.fr
Lopez	celopez@unsjfa.edu.ar
Morrison	merlp@ast.cam.ac.uk
Noel	fnoel@calan.das.uchile.cl
Pinigin	pinigin@mao.nikolaev.ua
Polojntsev	ddp@mahis.spb.su
Stone	rsc@nofs.navy.mil
Xu	TT.WW@company.BJBTA.chinamail.sprint.com

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#### 1.5. MERGER WITH COMMISSION 24

During July, 1997, a referendum on merger with Commission 24 and a vote on new Commission 8 officers were held. The President reported on the results.

**Issue 1: Merger of Commissions 24 and 8.** This will become effective at the conclusion of the XXIVth General Assembly in 2000. For the triennium 1997 to 2000 the two commissions will have a common vice-president who will become the first president of the new commission for the triennium 2000 to 2003. The first vice-president of the combined commission will be elected by a vote of the combined membership of the two commissions by the close of the XXIVth General Assembly. The Organizing Committee of the new commission will be formed by combining the existing Commission 24 and 8 Organizing Committees.

FOR: 55      AGAINST: 3      ABSTAIN: 0

**Issue 2: Election of Commission 8 Vice-president.** Based on the recommendation of the Commission 8 Organizing Committee and the comments of the Commission 8 membership, Dr. Jin Wenjing will serve as Vice-president of Commission 8 for the triennium 1997 to 2000.

FOR: 52      AGAINST: 2      ABSTAIN: 4

**Issue 3: Organizing Committee.** The Organizing Committee of Commission 8 is being reduced in membership for the next triennium. This is in anticipation of the merger in 2000. No new members have

been added and those who have served the longest on the current committee have been dropped. The resulting committee for 1997 to 2000 would then be:

J. Kovalevsky, J. A. Lopez, L. Morrison, F. Noel, G. Pinigin, D. Polojentsev, R. Stone, Xu Jiayan and T. Corbin (as ex-president).

FOR: 55      AGAINST: 1      ABSTAIN: 2

**Issue 4: Name of the combined commission.** Please submit your suggestion for the name of the new commission. If there is an overwhelming preference in both commissions for a particular name, no vote will be needed at the Kyoto business sessions. Otherwise, the two or three names that receive the most support will be the candidates, and a vote will be taken.

The three names receiving the most votes: Astrometry-23, Fundamental Astrometry-3, Positional Astrometry-3.

**Issue 5: Membership in the new commission.** During the triennium 1997 to 2000 the members of Commissions 24 and 8 will be polled by the presidents of the two commissions. Only those requesting membership in the new commission will become members. The intent here is to eliminate those who no longer have an interest in astrometry.

FOR: 54      AGAINST 2      ABSTAIN 2

The report was approved by the members.

## 1.6. SPONSORSHIP OF IAU SYMPOSIA AND COLLOQUIA

- Symposium 172:  
Dynamics, Ephemerides and Astrometry in the Solar System, Paris, France, July 1995.
- Colloquium 165:  
Dynamics and Astrometry of Natural and Artificial Bodies, Poznan, Poland, July 1996.
- Symposium 179:  
New Horizons from Multi-Wavelength digital Sky Surveys, Baltimore, USA, August 1996.

## 2. Commission 24: business session 23 August 1997

### 2.1. INTRODUCTION

During the triennium 1994-1997, yearly circular letters and many circular e-mails have been circulated to Commission 24 members. The major difficulty was to update the address and electronic address lists. It is important to stress the crucial role of electronic mailings, saving a lot of effort and money to the Commission President, and allowing an immediate forward of any relevant information or request coming either from the Commission itself, from a working group or from Division 1. In addition, a WWW page was established for Commission 24, giving easy access to information, texts, reports, membership list, announcements of meetings relevant to the activity of the Commission, etc. The triennial report is also accessible from this page.

As a wish for the future, members are urged to communicate their e-mail address to the new president, if they do not have already done so, and any change in their address.

### 2.2. IN MEMORIAM

A minute of silence was observed in memory of the members who left us during the last triennium: Thomas E. Lutz, Willem J. Luyten, and Peter van de Kamp.

### 2.3. MEMBERSHIP

The following new members were approved, under the reservation that they are or become IAU members:

Frédéric Arenou	Observatoire de Paris-Meudon	France
Christine Ducourant	Observatoire de Bordeaux	France

Nina V. Kharchenko	Kiev Observatory	Ukraine
Chunlin Lu	Purple Mountain Observatory	China
V.P. Rilkov	Pulkovo Observatory	Russia
K.V. Kuimov	Sternberg Institute	Russia

A list of the membership was circulated during 1996 to all members, asking for updating of membership, address, phone, fax and e-mail. The following members asked to be deleted from Commission 24 membership because of a change in their activities or of retirement: Jean Delhaye (France), Denis Harwood (Australia), Wulff D. Heintz (USA), Aden B. Meinel (USA), Franz V. Prochazka (Austria), Gerard Scholz (Germany).

#### 2.4. OFFICERS FOR THE NEXT TRIENNIUM: 1997-2000

During the Business Meeting, held on Saturday 23 August, the officers proposed by the Organising Committee, and approved by a ballot organized by mail and e-mail through all members of the commission before the meeting of the General Assembly in Kyoto, were confirmed:

President:	Elena Schilbach (Germany)
Vice-President:	Jin Wenjing (China)
Organising Committee:	Michel Crézé (France), Paul D. Hemenway (USA), Irina I. Kumkova (Russia), Imants Platais (USA), Siegfried Röser (Germany), Catherine Turon as ex-President (France), Jia-Ji Wang (China)

Their e-mail addresses are given below:

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M. Crézé	michel.creze@iu-vannes.fr
P.D. Hemenway	paul@astro.as.utexas.edu
W.J. Jin	jwj@center.shao.ac.cn
I.I. Kumkova	kumkova@ipa.rssi.ru
I. Platais	imants@astro.yale.edu
S. Röser	s19@ix.urz.uni-heidelberg.de
E. Schilbach	eschilbach@aip.de
C. Turon	catherine.turon@obspm.fr
J.J. Wang	wangjj@center.shao.ac.cn

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#### 2.5. MERGER WITH COMMISSION 8

A preliminary circular letter to the members of Commissions 8 and 24 was sent during the summer 1996. It was asking for the opinion of the members on the possibility of a merger between our two commissions. As a vast majority of answers were highly positive about this merger, we went on with its preparation in both Commissions: we proposed the same Vice-President for the two Commissions for the triennium 1997-2000, and reduced the number of members of the Organising Committees.

The third step was the organization of a ballot, in each Commission, last summer, before the General Assembly (as it appeared that many members will not attend the Kyoto meeting). 92 % of the answers in Commission 24 were in favour of the merger. The name 'Astrometry' is proposed for the new Commission.

*The current plans are the following:*

- The merger of Commissions 8 and 24 will become effective at the conclusion of the XXIVth General Assembly in 2000.
- For the triennium 1997 to 2000 the two Commissions will have a common Vice-President who will become the first President of the new Commission for the triennium 2000 to 2003.
- The first Vice-President of the combined Commission will be elected by a vote of the combined membership of the two Commissions by the close of the XXIVth General Assembly. The Organising Committee of the new Commission will be formed by combining the existing Commission 24 and 8 Organising Committees.

Results of the ballot (see above for the complete texts submitted to ballot):

**Issue 1: Merger of Commissions 24 and 8**, following the plans given above.

FOR: 37 AGAINST: 2 ABSTAIN: 1

**Issue 2: Election of Commission 24 Vice-president.** Based on the recommendation of the Commission 24 Organizing Committee and the comments of the Commission 24 membership, Dr. Jin Wenjing will serve as Vice-president of Commission 24 for the triennium 1997 to 2000.

FOR: 35 AGAINST: 1 ABSTAIN: 4

**Issue 3: Organising Committee.** The resulting committee for 1997 to 2000 would then be: M. Crézé, P.D. Hemenway, W.J. Jin, I.I. Kumkova, I. Platais, S. Röser, E. Schilbach, C. Turon (as ex-president), J.J. Wang.

FOR: 36 AGAINST: 1 ABSTAIN: 3

**Issue 4: Name of the combined commission.** The three names receiving the most votes: Astrometry-23, Fundamental Astrometry-2, Positional Astrometry-2.

**Issue 5: Membership in the new commission.** During the triennium 1997 to 2000 the members of Commissions 24 and 8 will be polled by the presidents of the two commissions. Only those requesting membership in the new commission will become members. The intent here is to eliminate those who no longer have an interest in astrometry.

FOR: 37 AGAINST 2 ABSTAIN 1

After one session of separate business meetings in each Commission, the three other sessions (business and science, including the Working Groups reports) were held in common, and their report is given below.

It is important to acknowledge the high spirit of cooperation with which all this process was completed, and we are looking forward to seeing the new input to astrometry given by this new Commission.

## 2.6. SPONSORSHIP OF IAU SYMPOSIA AND COLLOQUIA

– Symposium 179:

New Horizons from Multi-Wavelength digital Sky Surveys, Baltimore, USA, August 1996.

## ACKNOWLEDGEMENTS

The President would like to thank all members who answered the inquiries or requests for inputs for the triannual report. Such exchanges made a lively communication among the members of the Commission.

The President would also like to express her gratitude to the IAU secretariat officers, Monique Orine and Julie Saucedo, for their constant support and kindness, and their permanent patience to answer any kind of questions.

## 3. Joint Session of Commissions 8 and 24: 23 August 1997

The two presidents reported on the results of the votes on the merger referendum from each commission. The combined membership gave final approval to the merger and to the name of 'Astrometry' for the new commission when merger takes place in 2000. The Division 1 President, J. Kovalevsky, stated that the new commission would be referred to as Commission 8, that being the lower number, unless a different number was requested by the membership. The combined membership then approved Commission 8 (Astrometry) as the title for the new commission.

The President of Division 1, J. Kovalevsky, differentiated the objectives of two of the working groups. The IAU-BIPM Joint Committee on Relativity (IAU WG on Relativity for Reference Systems and Metrology) is to establish conventions, definitions and uniform notations in order to provide a coherent frame for space-time references for all uses (Astronomy, Geodesy and Meteorology). After consultation with the BIPM, it has been agreed that the chairman will be G. Petit. A second IAU working group, Relativity for Celestial Mechanics and Astrometry, chaired by M. Soffel, is charged with defining how these concepts are to be applied to specific problems of Astrometry and Celestial Mechanics.

#### 4. Reports of the Working Groups: joint session 23 August 1997

##### 4.1. ASTROGRAPHIC CATALOG PLATES - PRESENTED BY CORBIN

Jones (Chairman), Bucciarelli, Corbin, Dahn, de Vegt, Röser, Urban, Smart.

1. Great progress has been made on re-reducing the published AC Catalogue. The USNO has now re-reduced all the AC Zones and Kuzmin and colleagues in Moscow have done the same. Kuzmin presented a poster of their work at IAU Symposium 179 in Baltimore. All zones of AC data are presently being converted to the Hipparcos system within the framework of the Provisional Tycho Reference Catalogue (pTRC), a collaboration between Moscow, Copenhagen and Heidelberg. Conversion will be completed by the end of September. Publication of pTRC is expected at the end of 1997.

The pilot TRC reported at the Venice Symposium showed that AC and Tycho could yield 1.5-2.0 mas/yr proper motions for nearly all Tycho stars; but this is just an internal (random) accuracy. The same is not expected for the pTRC because Hipparcos is poorly suited for the purpose of AC calibration, being too bright and sparse. Further announcements about the pTRC are expected at Kyoto. The faint limit varies from zone to zone and is usually around  $B = 12$ . The positional errors of the different zones were established by Röser and Høg from positions on overlapping plates; they varied between 0.43 and 0.23 arcsec.

These errors arise from several causes; normal astrographs are neither normal, nor the same; the observation logs are missing or incomplete for many zones, so exposure details and meteorological data are unavailable. Different observatories used different measurement techniques; the eyepiece grid, the eyepiece scale or the eyepiece micrometer. The last seems to be the most accurate.

The name of the USNO AC catalog is 'AC 2000'. A poster paper can be found at Joint Discussion 7. The main characteristics of the catalog are the following:

- Number of stars in AC = 4.62 million
- Number of images = 8.63 million
- Zone with lowest precision/image = Sydney ( $0^{\circ}48$  in ra,  $0^{\circ}43$  dec)
- Zone with highest precision/image = Algiers ( $0^{\circ}19$  in ra,  $0^{\circ}19$  dec)

These precisions are based on overlapping plate data and are means of all stars within the zone. The USNO positions are currently being converted from the ACRS to the Hipparcos system. Further details can be found at the web site <http://aries.usno.navy.mil/ad/ac.html>.

2. The chart plates were not taken for all the zones. When they were taken the corresponding atlas was sometimes not published (eg Cape). The limiting magnitude of most chart plates is about  $B = 15$ . Most chart plates have three exposures in form of a small equatorial triangle. The problem of centering on these images has been attacked by several colleagues. Earlier attempts were done by the MAMA team of the Observatoire de Paris (J. Guibert and coworkers) in collaboration with M. Geffert (Bonn). The results and an astronomical application along with references have been published by Geffert et al. in *A&A Supp* 118. Meanwhile other colleagues (P. Brosche, W. Dick, R. Galas, M. Hiesgen) have made new efforts mainly under a European network project 'Salvaging an Astrometric Treasure' under the leadership of P. Brosche (Bonn). The project was summarized by Hiesgen et al. in a poster displayed at IAU Symposium 179 in Baltimore. Methods and techniques will be described in detail by Ortiz-Gil et al. in the *A&A Supp.* series (in press). Accuracies in the range 0.1 - 0.2 arcsec are attainable.

A project has been started at Bordeaux Observatory with the aim of systematically measuring all Carte du Ciel plates of the Bordeaux zone on an automatic plate scanning machine within the next 3 years. The goals of this project are to preserve the information content of these old observations in digital form and to derive high accuracy proper motions for stars as faint as 14th or 15th magnitude. In support of the latter, a systematic re-observation of the Bordeaux zone with the Bordeaux CCD meridian circle has started in 1997 February. The project is therefore run under the title 'Meridien 2000'. As a pilot study, they are currently dealing with the derivation of proper motions in the region of the open cluster NGC 2355 and in a region intersecting the galactic disk close to the galactic anticenter.

Some zones (eg Greenwich) took single images on their chart plates. Such plates have been measured with an accuracy between 0.07 and 0.11 arcsec (see Odenkirchen et al. in *A&A Supp* 124).

Fresneau is completing a study dealing with the measurements of 60 Carte du Ciel plates distributed along the Vulpecula Rift. The measurements were performed with the fast measuring machine, MAMA,



located at the Paris Observatory and the plates scanned are stored in the plate vault there. The celestial coordinates are compared to the GSC survey in order to derive proper motions and the AC is used to calibrate metric and radiometric properties of these deep plates (identical to the plates used for the AC). This study rediscovers the molecular clouds associated with the Vulpecula OB association at a distance of 300 pc and locates the boundary layer between the CO maps and the IRAS 100 micron maps. The observing procedure of making three exposures is also quite useful for investigating variable stars. This study also locates the variable stars associated with nebulosities and spectroscopic follow-up observations are planned. The combination of the POSS I and II surveys can doubtless provide more accurate data. A careful analysis of a real improvement by Carte du Ciel plates has still to be made.

3. Jones has measured six plates kindly loaned by the Vatican Observatory on the RGO 10x10 PDS bought in 1974. A preliminary report on this work was presented at IAU Symposium No 179 'New Horizons from Multi-wavelength Sky Surveys'. Those reductions were made relative to the ACRS catalogue.

Now that Hipparcos is available the error budget for a single coordinate of a single image is as follows:

Reproducibility of PDS in one orientation	0.05 arcsec
Comparison between two measures at 0 and 90	0.09 arcsec
Comparison between 6 and 3 min exposures	0.11 arcsec
Comparison with Hipparcos	0.19 arcsec
Errors in Hipparcos proper motions	0.12 arcsec

The Hipparcos proper motion errors were assumed to be 1.5 mas/yr and the time-base 80 years. Subtracting the fifth quantity quadratically from the fourth yields 0.15. Thus an accuracy between 0.11 and 0.15 arcsec in one coordinate can be achieved which in conjunction with Tycho should yield proper motions in the range 1.4 - 1.9 mas/yr; comparable to the accuracy of Hipparcos. In general there are two images of every star and the majority of stars appears on two plates so that the accuracy of most star positions can be reduced to 0.08 arcsec.

The PDS used is very slow. To rasterise a row of three images on a catalogue plate takes 1.9 minutes in one orientation and 0.8 in the other. With roughly 2000 stars per plate and 1000 plates per zone it would be uneconomic to attempt to re-measure a complete zone with this machine. The above reductions were made with a simple circular Gaussian centering algorithm and a six component linear fit. Both could doubtless be improved on. Images within 8 arcsec of a reseal line were ignored. One of the more time-consuming tasks lay in deciding which images were 'good' and which were too poor to include in the fit. There is a trade-off between accuracy and limiting magnitude.

4. The availability of the original plates varies from zone to zone. Some have been destroyed and some observatory directors are hesitant to let the plates leave their observatories. The number of people who know exactly where the plates are stored is steadily decreasing. Jones visited the Cape in January 1997 and spent about a week finding the plates and their records and making a superficial assessment of their quality. A pilot programme is under way to measure a number of these plates at the USNO. There is also a whole unmeasured AC Zone at the Santiago Observatory. The Melbourne and Sydney Observatories are now closed but their plate collections are held at Macquarie University Library, in Sydney. They have about 20,000 plates which were mainly taken between 1890 and 1964. The current curator of Sydney Observatory (which has now become a museum) says these plates are available to anyone who could be interested. The Greenwich and Oxford I and II plates are held in Cambridge.

The most critical AC zone is Potsdam, which was redistributed among Oxford, Hyderabad and Uccle where plates were taken around 1930-1940. If the original Potsdam plates could be measured (they are believed to have been destroyed in World War II) it would greatly improve the proper motions in the +32 to +39 degree declination zones.

5. It is concluded that there would be real scientific benefits in re-measuring both the chart and catalogue plates. The million stars in Tycho are currently being combined with the published AC positions to derive proper motions. For the best zones the accuracy will be comparable with Hipparcos but for the worst zones the errors will be doubled. After the second Tycho processing the number of stars will rise to three million.

To add to this work both in accuracy and number of stars the first priority should be the chart plates which have never been measured before. The majority of stars will be too faint to appear in Tycho but GSC1.2 and the USNO A1 and UJ catalogues and their successors will provide good modern positions. A

proper motion accuracy of 6 mas/year should be attainable. More than seven million stars are expected in this sample of which 4.6 million are in the published AC catalogue. Seven million is a 'whole sky' number and the extant chart plates cover only about half the sky. The number is critically dependent on the limiting magnitude and may be much larger.

The USNO are projecting a new survey in the Southern hemisphere to reach 16th magnitude with an accuracy of 40 mas; comparison with re-measured chart plates should yield a proper motion accuracy of 1.6 mas. The USNO intend to continue this work in the north after the completion of the one in the south.

The catalogue plates have a lower priority. The zones of lower accuracy as determined by modern re-discussion of the published positions (eg Sydney, Vatican) should be measured first. Again many stars will be too faint to appear in Tycho as presently available but most should be present in the second Tycho processing.

These priorities will be subject to the availability of the plates. However, nothing worthwhile can be achieved without a measuring machine an order of magnitude faster than a PDS, and the same astrometric accuracy, which could be allocated to this project for a period of years. Designs have been suggested for a dedicated machine but there does not seem to be any immediate hope of finding the money to build one.

6. We recommend that the Working Group continue for another three years but with a revised membership list. The following have expressed their willingness to serve on a new Working Group: Fresneau, Jones (but not as chairman), and de Vegt. We gratefully acknowledge the contributions of many colleagues to this report: Brosche, Eichhorn, Fresneau, Geffert, Hög, Kuzmin, Odenkirchen, Ortiz-Gil, Smart, and Urban.

\* After the report was given there was discussion on continuing the work. It was decided by the members attending that the WG would continue with the focus on surveying AC and CdC plates available for measuring and available machines that are capable of doing the work. Jones resigned as chairman and Fresneau was elected chairman of the working group for the term 1997 - 2000.

#### 4.2. ASTROLABES - PRESENTED BY CHOLLET

Chollet (Chairman), Benevides, Gubanov, Noel, Vondrak, Xu

Observations of the Sun: At this time astrolabes are the best instrument for measuring the solar diameter, and it is expected that they will also give the best positions of the Sun. With help of stations as CERGA, San Fernando, Malatya (Turkey), Santiago, Sao Paulo, and Rio de Janeiro, we will have a good set of observations. In the future data from additional stations will be added, particularly from Eastern Europe and China.

Reference Frames: Astrolabes will be able to make a good contribution to linking the Dynamical System to the ICRS by referring observations of Solar System objects to Hipparcos. Astrolabes can also contribute to the internal connection between different dynamical systems by observing planets, minor planets and the Sun.

Future observations: As new and better methods are developed, continue for some time the observations with astrolabes in order to connect old and new observations. Discontinue after that as we have for the star positions applied to Earth rotation.

#### 4.3. ASTRONOMICAL STANDARDS - PRESENTED BY MCCARTHY

Fukushima (Chairman). See WGAS Notice Nos. 17 and 18 for membership.

In 1994, the IAU approved the continuation of the WG on Astronomical Standards (IAU/WGAS) for one more triennium. T. Fukushima (NAO, Japan) continued to serve as chairman. The mission of this WG were

- 1) to maintain the 'two-tier' mechanism on astronomical constants and the numerical values of related quantities,
- 2) to investigate the issue on general relativistic definitions of astronomical units and constants, and

3) to implement the proposal to collect and authorize some basic software for fundamental astronomy, to be named as SOFA (Standards Of Fundamental Astronomy).

Three sub-groups were set up in the WG:

- 1) Maintenance Committee of Astronomical Constants chaired by D.D. McCarthy (USNO, USA),
- 2) General Relativity Sub-Group chaired by V.A. Brumberg (IAA, Russia), and
- 3) Review Board of SOFA chaired by P.T. Wallace (STARLINK, UK).

The maintenance committee prepared the IAU (1997) Best Estimates of Astronomical Quantities following the Chapter 4 of IERS Convention (1996) (McCarthy - IERS Tech. Note No.21). For the moment, the WG sees no necessity to update the IAU (1976) System of Astronomical Constants. It is still to be used for creating long-time standards such as nautical almanacs and star catalogs.

The general relativity sub-group has exchanged opinions through e-mail extensively. In the course of discussions, the issue of the transformation of GM values was highlighted. This is one of the by-products caused by the change of astronomical time arguments adopted by the IAU in 1991.

The SOFA Board of Review has actively discussed the necessary items to prepare computational codes needed for the basic calculations and to provide them electronically. The Announcement of Opportunity for institutions to bid to become the SOFA Center was published at the beginning of 1997, in IAU Bulletin 79 and elsewhere. In June 1997 the Board endorsed Rutherford Appleton Laboratory as the SOFA Center. The Center will be operated in parallel with the Starlink service and will employ the same techniques as Starlink's 'Software Store'. It is intended that the service provided by the SOFA Center will be monitored by a management board. This board will present reports and assessments at each triennial General Assembly of the IAU. The management board will initially be the WGAS.

#### 4.4. REFERENCE FRAMES - PRESENTED BY MORRISON

Membership: L.V. Morrison (Chairman)

Members of Working Group on Reference Frames 1994-1997

Arias, F.	FCAG La Plata, Ar	Miyamoto, M.	NAO, Jp
Carter, W.E.	NOAA, USA	Morrison, L.V.	RGO, UK
Charlot, P.	Paris Obs, Fr	Nicholson, G.D.	HRAO, Za
Corbin, T.E.	USNO, USA	Nothnagel, A.	Bonn, De
Eubanks, T.M.	USNO, USA	Preston, R.A.	JPL, USA
Feissel, M.	Paris Obs, Fr	Réquième, J.	Obs de Bordeaux, Fr
Fey, Alan	USNO, USA	Reynolds, J.	Aust Tel Nat Fac, Au
Fukushima, T.	NAO, Jp	Shuhe, W.	Shanghai Obs, Cn
Gontier, A-M.	Paris Obs, Fr	Sovers, O.	JPL, USA
Jacobs, C.	JPL, USA	Standish, E.M.	JPL, USA
Johnston, K.J.	USNO, USA	de Veigt	Hamburg Obs, De
Kovalevsky, J.	Obs Côte d'Azur, Fr	Walter, H.H.	ARI, De
Kumkova, I.	Inst Appl Astr, Ru	White G.	Univ of Sydney, Au
Lestrade, J-F.	Obs de Paris, Fr	Williams, J.G.	JPL, USA
Li, Z.	Shanghai Obs, Cn	Yatski, Ya.S.	Kiev Obs, Ue
Ma, C.	GSFC, USA	Zacharias, N.	USNO, USA
McCarthy, D.D.	USNO, USA		

Key dates and decisions:

Aug 94: Terms of reference set by IAU94 at The Hague;

- main task - produce list of VLBI positions to replace the previous frame (FK5)
- appointment of members of WG

Feb 95: Meeting of WGRF at CERGA, Grasse

- VLBI sub-group formed to produce ICRF
- Chopo Ma (GSFC), Coordinator

Felicitas Arias (FCAG), Anne-Marie Gontier (IERS)  
 Chris Jacobs, Ojars Sovers (JPL)  
 Marshall Eubanks, Alan Fey (USNO)

- recommended IERS to set up a VLBI Coordinating Centre (US National Earth Orientation Service selected)
- May 95: VLBI sub-group (and Chairman) met at Paris Observatory
- laid down timetable for forming ICRF
- Nov 95: Hipparcos deadline for ICRF
- ICRF fixed and preliminary subset released to Hipparcos
- Apr 96: Hipparcos fixed to ICRF
- mainly by radio stars (0.6 mas; 0.25 mas/yr)
- Apr 96: Issue of report on the maintenance of the Hipparcos reference frame by Jean Kovalevsky
- methods include VLBI, VLBA, MERLIN radio astrometry of Hipparcos radio stars, photographic/CCD astrometry of ICRF sources, interferometry (NPOI), and future astrometric space missions
- Oct 96: Meeting of WGRF at Paris Observatory in conjunction with IERS96 Workshop
- discussion of ICRF accuracy - influence of atmospheric models, source structure
  - maintenance of ICRF
  - recommended that IERS and new IAU WC should promote, monitor observations associated with maintaining and extending the reference frame
  - JPL ephemerides of Solar System tied to ICRF with an accuracy of  $\sim 1$  mas for planets Mercury to Mars
- Oct 96: Commission 8/24 review of current and planned work on the optical-radio link
- Publication of the review
- Jul 97: Issue of IERS TN23 with positions of 608 ICRF sources;
- 212 defining sources with  $\sigma \sim 0.5$  mas (mainly in N. hemisphere)
  - 294 candidate sources
  - 102 other sources useful for the radio-optical link
- Jul 97: Issue of Hipparcos & Tycho Catalogues
- Hipparcos median accuracy  $\sim 1$  mas
- Aug 97: Resolution to IAU97 (Kyoto);
- adoption of ICRF as the primary reference frame
  - adoption of Hipparcos Catalogue as the realization of the ICRF at optical wavelengths

#### 4.5. STAR LISTS - PRESENTED BY HELMER

Helmer (Chairman), Abalakin, Carrasco, Corbin, Jin, Klemola, Li, Luo, Miyamoto, Morrison, Polojentsev, Requieme, van Altena, Yatskiv.

Since the last GA in den Haag two large databases have been under consideration by the WGSL.

1. The extension of the fundamental reference frame to fainter magnitudes. Stars at a density of 1 per square degree have been selected mainly from the various zones of the AC, from the north pole down to a declination of  $-40$  degrees in the magnitude interval 11.5 to 13.0. A total of 35 600 stars were selected and put on the observing list of the Carlsberg Automatic Meridian Circle (CAMC) at La Palma for a second epoch. The observations are virtually completed, and proper motions for all these stars have been computed using the AC position, transformed to the FK5 reference frame, as first epoch. The AC positions on FK5 were kindly provided by Siegfried Röser of the Astronomisches Rechen-Institut in Heidelberg. Due to the large difference in epoch, and the accurate second epoch observation, these stars have proper motion errors of typically 0.003 arcsec/year in each coordinate. The errors of a catalogue position range

from 0.07 - 0.14 arcsec, depending on zenith distance. At zenith distances greater than 45 degrees the errors in declination become slightly worse and reach 0.20 arcsec at 70 degrees. The observations were originally made relative to the FK5 system, but when the Hipparcos catalogue became available, this was used as the reference catalogue. All the positions and proper motions for these stars are found in the Carlsberg Meridian Catalogue No. 9, which is now available on CD-ROM from the consortium running the CAMC (Royal Greenwich Observatory, Instituto y Observatorio de la Armada en San Fernando and Copenhagen University Observatory).

2. Faint reference stars surrounding extragalactic radio sources. To aid in making links between the ICRS and the optical frame, a high density of accurate, faint, reference stars is needed in the vicinity of each radio source, in order to overcome the magnitude problem. Work on this has been carried out at several observatories for some time, but without real coordination, especially in selecting the reference stars. At the XXIIInd GA an informal group was formed to collect in one database reference stars suitable for photographic or CCD observations of positions of optical counterparts of such sources. The database is maintained at the Kiev University Observatory, Ukraine, and consists of stars at magnitudes 12 - 14 in 1/2 degree fields around approximately 600 radio sources from the IAU list. The fields are being observed photographically in Kiev and Bucharest, and, starting in 1996, with the automatic CCD meridian circle of Nicolaiv Observatory (Tel'nyuk-Adamchuk, V., Pinigin, G., Ukraine, Stavinsky, M., Romania and Polojentsev, D., Russia).

It was suggested that the Working Group on Star Lists should be discontinued, and reformed under the new ICRS Working Group as a subgroup with L. Helmer as its chairman. The subgroup's main task would be to coordinate efforts to extend the optical reference frame to fainter magnitudes. This was approved by the members.

## 5. Individual Reports: joint session 26 August 1997

### 5.1. CMC - MORRISON

Carlsberg Meridian Catalogue La Palma Number 9 (CMC9) contains all the data obtained with the Carlsberg Meridian Telescope in the period May 1984 to March 1995. It comprises 141 593 positions, and magnitudes of 138 603 stars north of declination  $-40$  deg, 117 559 proper motions, and 19 585 positions and magnitudes of 97 Solar System objects. It also contains the nightly value of the atmospheric extinction (in V) and all the meteorological data. These are available by ftp and will be issued on CD-ROM in Oct 97.

About 60 000 of the stars are common to the Hipparcos Catalogue and details of the systematic differences Hipparcos-CMC9 have been derived in position and proper motion. The systematic differences are in the range  $\pm 60$  mas in RA and  $-40$  to  $+120$  mas in Dec, and their general behaviour is similar to Hipparcos-FK5. The systematic differences in proper motion are in the range  $\pm 3$  mas/yr in RA and Dec. These systematic differences have been removed from CMC9, thus referring the positions and proper motions to the ICRF.

Slightly under half of the stars in CMC9 are fainter than  $V=10.5$  and are generally not in the Hipparcos or Tycho catalogues. The progress of these observations from CMC9 through CMC10 (May 84-Dec 96, to be issued in Jan 98) is reviewed here under the headings of the various observational programmes. The figures quoted are the cumulative number of observations: CMC10 includes CMC9. The lower declination limit in all cases is  $-40$  deg, unless otherwise specified.

- Global net of reference stars; 1 star per square deg,  
10.5 < mag < 13.5; target list = 35 000 stars; positions in CMC9 = 30 000
- Reference stars in fields of ICRF sources, 10.5 < mag < 13.5; list = 11 400 stars, CMC9 = 13 000
- Grid of reference stars in Schmidt fields, 10h to 24h RA,  $-3 < \delta < +11$ ;  
two lists: mag  $\sim 12.5$  (12 000 stars) and  $\sim 13.5$  (6000 stars); CMC10 = 16 000
- Reference stars for Veron/Cetty galaxies,  $-35 < \delta < +30$ , mag  $\sim 12$ ; list = 4200; CMC10 = 3500
- Luyten (NLTT),  $\mu > 0.3$ /yr; list = 3000, CMC10 = 2000
- Luyten (NLTT),  $\mu > 0.18$ /yr; list = 7500, CMC10 = 1800
- Variable stars (GCVS),  $12 < \text{mag}_{\text{min}} < 14$ ; list = 3500, CMC10 = 2500
- Third Catalogue of Nearby Stars (CN3);  $12 < \text{mag} < 14$ ; list = 2600, CMC9 = 2600

- Astrographic Catalogue stars not in HST GSC,  $V > 12$ ,  $-40 < \delta < +30$ ; list = 3000, CMC10 = 1300
- Reference stars CCD search for occultations by Neptune/Pluto,  $V \sim 13$ ; list = 1500, CMC10 = 1200
- Planets/satellites/asteroids, in support of space missions; list = 7 objects, CMC9  $\sim 20\,000$ .

Since April 97 the telescope has been operated remotely via the InterNet. The nightly observations are transferred daily to the home base where the observational catalogue is compiled.

The present scanning-slit micrometer is to be replaced by a CCD camera at the beginning of 1998. The main observational programme will be associated with the transfer of the Hipparcos Catalogue reference frame to fainter magnitudes, with particular emphasis on improving the accuracy of the astrometry that can be obtained from Schmidt survey plates. The programme will also include astrometry of the major planets in the outer Solar System and asteroids, in support of space missions and the determination of masses by mutual perturbations between the latter.

## 5.2. PROGRESS IN ASTROMETRY AT THE USNO - CORBIN

USNO home page: <http://www.usno.navy.mil/>

AC 2000 - Work has been completed at the USNO on the long-term project to make new reductions of the Astrographic Catalog zones and combine them on a common system. The ACRS was used to do the individual plate reductions. The plates of each zone were then combined and the magnitudes from the plates reduced to the Tycho B system. After the zones were combined, the positions were reduced to the Hipparcos system at the mean epochs of the AC plates. The result is a catalog of positions of 4.62 million stars at an average epoch of 1907 and with errors in the range of 0.13 to 0.32 arcsec (average of two plate positions). The AC 2000 has been combined with the Tycho catalog to produce improved proper motions of 988 758 Tycho stars. The errors of these new proper motions are in the range of 1 to 4 mas/year. The resulting catalog is named ACT (Astrographic Catalog/Tycho), and the results have been referred to the epoch J2000. Both catalogs will be made available via CD-ROM in one to two months. For more information, contact S. Urban at: [seu@pyxis.usno.navy.mil](mailto:seu@pyxis.usno.navy.mil).

TAC (Twin Astrograph Catalog) - The TAC, with an average epoch of 1981, is the result of a four-fold astrograph program, in two colors, that extends from declinations 90 deg to -20 deg. The density is about 25 percent greater than that of Tycho. The version of TAC on the FK5 system has been available on CD-ROM since early this year. The plates are currently being given new reductions using Hipparcos that will yield positions accurate to between 50 and 60 mas, and the catalog will be available in two to three months. This version will be combined with the AC 2000 to give proper motions comparable in quality to ACT.

NPOI (Navy Prototype Optical Interferometer) - Imaging observations started in November 1996 with a three baseline configuration. During this initial phase an average of 600 observations per month has been made. Sufficient observing of several close (under 10 mas) binaries has already been made to permit orbital solutions with errors in the 0.2 mas range. In addition, limbdarkened stellar angular diameters are now being regularly achieved with accuracies of 0.1 percent. The complete imaging array is scheduled to begin operations in 1999 with a four element array that will be capable of imaging binaries separated by as little as 0.1 to 0.2 mas.

Wide angle astrometry is due to begin in the next three to four months. It is expected that a catalog of about 1000 stars will be completed in late 1998 that will give a rigid frame at the 1 - 3 mas level and will be rotated into the ICRS system via observations of radio stars. This will provide the first rigorous test of the Hipparcos proper motion system.

WDS (Washington Double Star database) - The WDS 1996.0 has been finished and distributed. This contains 451 546 measures of 78 100 systems. It is available at the USNO web site. Since then 5 461 new measures and 1 109 new systems have been added. The 3 001 new systems resulting from the Hipparcos program are also being added. A new orbit catalog is in preparation, and this will be available in January 1998.

Observations of doubles and problem stars identified in Hipparcos are being actively pursued through speckle programs and now on the optical interferometer. Success with the problem stars has not been good, and it is believed at this point that most of these are doubles with large values of  $\delta$ -m. These stars will probably prove to be a challenge to double star observing for some time to come.

**FASTT** (Flagstaff Astrometric Scanning Transit Telescope) - The program currently consists of differential observations (calibration fields for SDSS), wide angle observations (systematic distortions in FK5 and, more recently, observations for the linkage of the radio and optical frames), and minor planets. A limiting magnitude of 17.5 is regularly reached and 50 mas achieved for differential observations using Tycho positions as reference. Preparations are now underway to begin a much more extensive minor planet program on the new 1.3 m astrometric reflector when it goes into operation in 1998.

**Hamburg/USNO Radio-Optical Link Program** - This program helps establish the tie between the radio and optical frames through the observations of primary and secondary reference stars and deep frames to the optical counterparts of the ICRF sources. This was one of the contributors to the Hipparcos-ICRS tie, but only about 80 fields had been done at that time. About 400 fields have now been observed and reduced, and the link for each source will be 10 to 20 mas once the reference stars of the UCAC program (see Zacharias below) are available. Globally, this will provide a link at the 1 mas level for the continued maintenance of the optical frame.

**PMM** (Precision measuring Machine) - A series of very high density catalogs resulting from measuring Schmidt plates at the USNO Flagstaff Station:

- 1.) USNO A1.0 results from measuring: the first epoch plates of the Palomar Observatory Sky Survey (POSS-I), the UK Science Research Council survey (SRC-J) plates, and the European Southern Observatory survey (ESO-R) plates. This has yielded a catalog of 488 006 860 stars with positional accuracies of 250 mas for a single image but without proper motions. It is available on a ten CD-ROM set that has been sent to libraries, data centers, etc.
- 2.) USNO SA1.0 is a subset of the USNO A1.0. It contains 55 000 000 evenly distributed over the sky and is available on CD-ROM (see USNO web site).
- 3.) USNO A-2 will result from new reductions of the USNO A1.0 using the ACT catalog. It will have the same number of stars as USNO A1.0, but the single image accuracy is expected to improve to 150 mas.

Currently the PMM is being used to measure the second epoch Palomar Schmidt plates (POSS-II) and those of the SERC survey. It also has been proposed to measure the Edinburgh AAO plates to provide second epochs south of -20 degrees. When the positions resulting from all of these data are combined with the USNO A1.0 a catalog of positions and proper motions of almost half a billion stars reaching to 21st magnitude will result.

### 5.3. MIRA - YOSHIZAWA

MIRA is the series name of ground-based optical/infrared interferometer arrays for astrometry and astrophysics at the 1 mas - 0.1 mas level of accuracy. At present we are operating at Mitaka campus of NAOJ a two-element interferometer MIRA-I for stellar fringe detection and tracking experiments.

The main characteristics of MIRA-I are as follows:

- Baseline is south-north 4m and siderostats of 30cm $\phi$ .
- Beam transfer is inside evacuated pipes (transfer length >30 m; beam size of 30mm $\phi$ ).
- Train-type fine/fast delay lines carrying a retro-reflector and a Cassegrain telescope with a piezo-actuating flat mirror at its Cassegrain focus.
- Fringe detection with photon-counting APD's.

MIRA-II is a multi-element (four fixed and three moveable siderostats), long baseline (longer than 500 m at the maximum) optical/infrared (up to K-band) interferometer with laser metrology units for global astrometry to be constructed at Mitaka. Our final goal is a very large array MIRA-III, which should be constructed at one of the best sites in the world for astronomical observations.

Several of the most important astronomical targets that we will try to investigate with the MIRA's are:

1. Global astrometry and construction of an optical reference frame with an accuracy better than 10 mas to 1 mas level.
2. Galactic dynamics; determination of structure, kinematic properties, and dynamical evolution of our Galaxy, through a deep survey in the near-infrared.
3. Stellar astrophysics; observations of surface structure of various kinds of stars and the determination of their radii, pulsating variations, orbits and masses of binary stars, etc.
4. Stellar formation; structure and physical processes of proto-stellar disks and proto-planetary disks by high resolution imaging and spectroscopy.

#### 5.4. USNO POLE TO POLE PROGRAM - RAFFERTY

Between the years 1985 and 1996 the U.S. Naval Observatory carried out a program of absolute observations covering the entire sky. Two transit circles were involved, one located in Washington, DC (USA) and the other in Blenheim, New Zealand. Over 672 000 nighttime observations were made, including over 318 000 observations of International Reference Stars (IRS), and over 12 000 observations of all the major planets (except Pluto) and nine minor planets. Over 55 000 observations were obtained of day-time objects including the Sun, Mercury, Venus, Mars, and bright stars. The objective was to form a self-consistent, all-sky catalog of absolute positions which could be linked by rigid rotations to the dynamical system. However, with the success of Hipparcos, the objective has been modified in that the interest has now shifted from the positions of the stars to the positions of the planets. Instead of rotating the stellar instrumental frame into the dynamical frame as defined by the planetary observations, the planets will be rotated into the Hipparcos frame by means of the stars.

The reductions of the Pole-to-Pole observations will differ from some of the methods used in past USNO catalogs. Enough daytime observations of stars were made with the transit circle in New Zealand that daytime determinations of the clock correction will be possible. A daytime correction to the constant of refraction should also be possible for each transit circle. Using the daytime and nighttime observations of Mars should be an important step in testing the night-minus-day corrections (see Rafferty and Loader in A&A 271). The traditional determinations of the instrumental flexure, using horizontal collimators, and of the correction to the constant of refraction, from circumpolar observations, were found to be unreliable for each instrument. New methods for determining the flexure and the correction to the constant of refraction have been developed utilizing star observations over the entire sky. Only the correction to the assumed latitude will be determined from the circumpolar observations. The traditional equator correction determined from solar system observations has been dropped. Instead the instrumental system, as defined by the star observations only, will be considered rigid and the solar system observations will be used to rotate it to the dynamical frame if desired, as discussed by Holden and Rafferty in A&A (in press). Or, as mentioned earlier, the planets, which are on the stellar instrumental frame, can be rotated into the Hipparcos frame.

#### 5.5. REPORT OF THE CENTRAL BUREAU OF IERS

##### 5.5.1. INTRODUCTION

The activities of the Celestial System Section of the IERS Central Bureau are performed at Paris Observatory, under the scientific responsibility of E. F. Arias (La Plata Observatory). During 1993-1997 they were mostly dedicated to the construction of the new International Celestial Reference Frame (ICRF), in close relationship with the IAU Working Group on Reference Frames (WGRF), to which four members of the IERS Central Bureau belong. The ICRF was adopted by IAU at its 23rd General Assembly (see Recommendation B2). The Hipparcos stellar reference frame was astrometrically aligned with ICRF to within  $\pm 0''.0006$  at the epoch 1991.25 and to within  $\pm 0.00025''/\text{year}$  in rotation. This is discussed by Kovalevsky *et al.* in A&A 323, and it provides the primary realization of ICRS in optical wavelengths.

##### 5.5.2. THE INTERNATIONAL CELESTIAL REFERENCE SYSTEM (ICRS) [Arias *et al.* 1995]

Equator/Pole of ICRS: Using VLBI data, one can estimate that the pole at J2000.0 is shifted from the ICRS pole by 17.2 mas in the direction 12h and by 5.1 mas in the direction 18h, with uncertainties smaller than 1 mas. The ICRS celestial pole is consistent with that of FK5 within the uncertainty of the latter ( $\pm 50$  mas). See Arias *et al.* in A&A 303.

Origin of right ascensions of ICRS: The origin of right ascensions of ICRS was defined by fixing the right ascension of 3C273B to its FK5 value. Using VLBI and LLR data, Folkner *et al.* in A&A 287 estimated that the mean equinox at J2000.0 is offset from the origin of right ascensions of ICRS by  $78 \pm 10$  mas. The origin of right ascensions of ICRS is consistent with that of FK5 within the uncertainty of the latter ( $\pm 80$  mas).



### 5.5.3. THE INTERNATIONAL CELESTIAL REFERENCE FRAME (ICRF)

A complete description of the ICRF, labelled RSC(WGRF) 95 R 01 in the IERS terminology, is given in the IERS Technical Note No 23 by Ma and Feissel, and is available on request to [iers@obspm.fr](mailto:iers@obspm.fr). The frame is realized by the J2000.0 VLBI coordinates of 608 extragalactic radio sources evenly distributed on the sky. Objects in RSC(WGRF) 95 R 01 are divided into three categories: defining, candidate and other sources. The 212 defining sources proved to be high-quality objects over the total the period of observations; they served to set the orientation of axes in coincidence with those of ICRS. Most of the 294 candidate sources are compact sources with still too few observations; they are likely to climb up to the 'defining' category when more observations are made. Finally, 102 other objects were included in the frame either for the sake of densification or just because they contributed to the link of other frames to ICRF. The complete frame, as well as separate lists with the three categories of sources, are available via *anonymous ftp* from [hpiers.obspm.fr](http://hpiers.obspm.fr) (145.238.100.28), directory *iers/icrf/iau/icrf\_src* (files *icrf.rsc*, *icrf.def*, *icrf.can*, *icrf.oth*).

IERS/CB also maintains a compilation file that gives physical information on about 2000 extragalactic radio sources, including the type of object, redshift, spectral index, visual magnitude. This information is collected from astrometric and astrophysical surveys. The file was updated with recent information (ftp file *iers/icrf/iau/icrf.car*). A complete dictionary gives, for each ICRF source, its designation as well as all the aliases currently used (ftp file *iers/icrf/iau/icrf.dico*). All these files can also be accessed through the World Wide Web site <http://hpiers.obspm.fr>

### 5.5.4. Maintenance of ICRF

The non-rotating character of the frame results from the assumption that extragalactic radio sources have no detectable proper motions; nevertheless, some objects showed apparent proper motions due to structure effects at mas-scale: radio sources may undergo unpredictable changes in their structure which can affect their positions. Regular checks of defining and candidate sources positional behaviour are necessary to assess the stability of their direction. As VLBI observations and modeling progress, more accurate radio source positions will be determined, and new sources will be incorporated to densify the frame.

In the course of the 1996 IERS annual analyses, extragalactic celestial frames were submitted by seven VLBI Analysis Centres. The source coordinates in these solutions were compared to those in ICRF in order to check possible significant changes in coordinates that could be caused by observations accumulated since the completion of ICRF or by evolution in the analysis procedures. Eight objects among the defining sources were found to have inconsistencies in some individual reference frames. These results on the defining sources should be interpreted as very preliminary, since it will be necessary a more extended period of observation and a confrontation with other analysis to give some conclusion. The same analysis will be performed on candidate sources in the next years. New sources were observed since the implementation of ICRF.

A total of 28 extragalactic radio sources not included in RSC(WGRF) 95 R 01 were provided in the new solutions. Preliminary ICRS positions were computed.

## 5.6. GSC 1.2 AND STARNET ( 4 MILLION PROPER MOTIONS) - RÖSER

GSC 1.0 has been reduced by Lasker using AGK3 in the northern, SAOC in the southern hemisphere. Röser *et al* (see IAU Symposium 179) have made a completely new reduction of GSC onto the system of PPM. The plate-dependent distortions have been reduced using a numerical filter as described by Röser *et al.* in ASP Conference Series, Vol. 84. After removal of the plate-dependent distortions, the remaining distortions were shown by Morrison in AJ 111 to be magnitude dependent. These distortions were removed using the Astrogaphic Catalog, which, however, has an epoch difference of about 80 years with respect to GSC. At the first glance this seems impossible or wrong, but it could be shown that there was a radial dependence of the magnitude effect from the GSC plate centres. Piling up the GSC plates on top of each other, i.e. plotting the coordinate differences GSC - AC as functions of the GSC plate coordinates, the effects of individual proper motions, solar apex motion and galactic rotation cancel out, and the systematic errors of the GSC plates remain. This new version is called GSC 1.2. The details of the catalog and the methods used are described the proceedings of IAU Symposium No. 179 (in press).

Using GSC 1.2 and the Astrographic Catalog, a new catalog of 4.3 million stars with positions and proper motions was constructed. This catalog, STARNET, has an average star density of 100 stars per square degree, a median magnitude of  $B = 12.0^m$  on the southern hemisphere and  $V = 11.5^m$  on the northern hemisphere. The present-day rms-accuracy of the positions is 0.3 arcsec, that of the proper motions 5 mas/year. See Röser in IAU Symposium No. 172.

### 5.7. THE UCAC-S PROJECT - ZACHARIAS

The U.S. Naval Observatory CCD Astrograph Catalog South (UCAC-S) project is scheduled to start in January 1998 at Cerro Tololo (CTIO), Chile, to cover the entire Southern Hemisphere in a 2-fold overlap down to 16th magnitude. The program should be completed with 2 years of observing. The goal is to produce a high density, high accuracy, astrometric catalog in the Southern Hemisphere.

A 4k by 4k CCD camera will be used in combination with the 5-element, 0.2-meter aperture lens in a 579-642nm bandpass covering a field of 61 arcminutes square at 0''9/pixel. The Kodak CCD chip is of high cosmetic quality with no dead pixels in the light sensitive area. Mounted in parallel to the red-corrected lens, is a yellow-corrected lens of the same aperture, which is used for guiding with an ST-4 autoguider sitting on a moveable x,y-slide. Focusing is performed with a Hartmann screen. The telescope is fully automated, and all components are under computer control.

Each field will be taken with a long ( $\approx 120$  sec) and a short ( $\approx 30$  sec) exposure to extend the dynamic range and to check for magnitude dependent systematic errors. Additional calibration observations will be made in selected fields with the telescope and camera being in various orientations with respect to the sky.

Full astrometric reductions will be run within 24 hours of the data acquisition. Tycho stars (from the ACT catalog) will be used for preliminary reductions, and a direct tie to the Hipparcos stars is feasible with block adjustment techniques. A catalog accuracy of 20 mas per coordinate is expected for stars in the 7 to 14 magnitude range. Additional longer exposures ( $\approx 300$  sec) are planned around extragalactic reference frame sources. The optical counterparts of these radio sources will be observed with larger telescopes quasi simultaneously. Thus a strong tie to the ICRF is expected, allowing for a re-determination of the radio-optical reference frame link at an epoch of about 1999. Nights with minimal sky conditions will be used to observe bright minor planets ( $9^m - 14^m$ ) on the 30 mas level of accuracy.

The raw pixel data will be compressed (lossless) and saved on tapes and CD-ROMs. Over 3 Gbytes of data are expected from a single night. After 2 years, an archive of about 100 000 frames (1.7 Tbytes) will have been collected. The project will start at the South Celestial Pole and epoch differences to overlapping fields will be kept small.

This project will be a major contribution for a densification of the reference frame, with a density exceeding that of the Guide Star Catalog and an accuracy similar to the Tycho Catalogue. The UCAC-S will have numerous applications: Schmidt survey astrometric reductions, calibration of field distortions in other telescopes, accurate positioning of fiber optics, input catalog for future space missions, reference stars for minor planet observations, high accuracy proper motion determinations.

**COMMISSION 19: ROTATION OF THE EARTH  
ROTATION DE LA TERRE**

PRESIDENT: Jan Vondrák

VICE-PRESIDENT: Dennis D. McCarthy

ORGANIZING COMMITTEE:

F. Arias, N. Capitaine, V. Dehant, J. O. Dickey, S. Dickman, M. Feissel, Y. Fumin, B. Kołaczek, S. Manabe, W. Melbourne, L. Morrison, D. Robertson, L. Rykhlova, V. Tarady, Ch. Veillet, P. Wilson

**1. Introduction**

Because of the large number of working groups and other cooperating bodies under Commission 19 we held two business sessions plus two Working groups sessions at the 23rd IAU General Assembly.

**2. Business Meetings (Saturday, August 23, 1997)**

The meetings were chaired by the President of the Commission, Jan Vondrák. The following issues were discussed:

**2.1. REPORT ON THE ACTIVITY OF COMMISSION 19 SINCE THE 22ND IAU GA**  
(J. Vondrák reported)

It was noted that the detailed report on scientific activities of Commission 19 for the years 1993.5–1996.5 had been published in I. Appenzeller (ed.) *Reports on Astronomy*, Vol. XXIII, IAU 1997, 81–96. The reprints were sent to all members of the Organizing Committee of the Commission plus all contributors to the Report. The following persons (in the order as they appear in the text) sent their contributions, often covering a broader region than their own institutions:

M. Feissel (France),  
D. D. McCarthy (USA),  
J. O. Dickey (USA),  
Jin Wenjing & Yang Fumin (China),  
S. Manabe (Japan),  
V. Dehant & P. Pâquet (Belgium),  
L. Rykhlova (Russia),  
Ya. Yatskiv & A. Korsuń (Ukraine),  
N. Capitaine (France),  
M. Stavinschi (Rumania),  
B. Kołaczek & A. Brzeziński (Poland),  
M. Meinig (Germany),  
H. Jochmann (Germany),  
L. Morrison (UK),  
S. Dickman (USA),  
I. Pešek & J. Vondrák (Czech Republic).

The President thanked all of them for their input and commented briefly on the discussion of these reports that took place at the Commission Presidents' meeting with the Executive Committee. He expressed his opinion that these reports are useful, and are the important part of the work done by Commission membership and should be continued.

In the past three years the Commission co-operated closely with the following bodies:

- a) IAU/IUGG International Earth Rotation Service (IERS) (chaired by Ch. Reigber, Germany),

- b) IAU WG on Astronomical Standards, supported by Commissions 4, 5, 8, 19, 24 and 31 (chaired by T. Fukushima, Japan),
- c) IAU WG on Reference Frames, supported by Commissions 4, 8, 19, 24 and 31 (chaired by L. Morrison, UK),
- d) IAU/IUGG WG on the Non-rigid Earth Nutation Theory, supported by Commissions 4, 7 and 19 (chaired by V. Dehant, Belgium),
- e) IAU Commission 19 WG on Earth Rotation in the Hipparcos Reference Frame (chaired by J. Vondrák, Czech Republic),
- f) IAG International GPS Service for Geodynamics (chaired by G. Beutler, Switzerland),
- g) IAG SSG 5.173 Interaction of the Atmosphere and Oceans with the Earth's Rotational Dynamics (chaired by C. Wilson, USA).

All of these bodies were represented at the IAU GA at Kyoto, either by taking part in Joint Discussions 3 and 7, or by presenting their reports at Commission 19 Working Group Sessions.

Commission 19 had also formally supported or co-supported a number of international scientific meetings:

- IAU Colloquium No. 165 *Dynamics and Astrometry of Natural and Artificial Celestial Bodies*, July 1–5, 1996, Poznan, Poland,
- Joint Discussion 3 *Precession-nutation and Astronomical Constants for the Dawn of the 21st Century*, August 21, 1997, Kyoto, Japan,
- Joint Discussion 7 *The New International celestial Reference Frame*, August 22, 1997, Kyoto, Japan,
- Joint Discussion 12 *Electronic Publishing: Now and the Future*, August 25, 1997, Kyoto, Japan,
- Joint Discussion 14 *The First Results of HIPPARCOS and TYCHO*, August 25, 1997, Kyoto, Japan.

## 2.2. MEMBERSHIP MATTERS

(J. Vondrák reported)

According to the President's knowledge, two members of the Commission passed away since the last General Assembly: S. K. Runcorn (UK) in December 1995 and W. Jakš (Poland) in January 1997. The attendees observed a minute of silence in their memory.

According to the statutes of the IAU, the President accepted the following IAU members to Commission 19, during his three-year presidency:

J. Souchay, France,  
 P. Shelus, USA,  
 A. Cazenave, France,  
 G. Petit, France,  
 M. Bougeard, France.

The total number of members is 138, out of which 87 are accessible by e-mail; the number of consultants was 16, 10 of which are accessible by e-mail. There were also 'lost' members whose correspondence was returned. These included Tsao Mo, Taipei, and Han Tianqi, Wuchang, China. The President also received a list of newly proposed IAU members who expressed their wish to become members of Commission 19 and announced their names:

P. Defraigne, Belgium  
 A. Gozhy, Ukraine  
 Zhen-Nian Gu, China  
 Yan-ben Han, China  
 A. Korsuń, Ukraine  
 W. Kosek, Poland  
 Jinling Li, China  
 Qi Li, China  
 De-chun Liao, China  
 Chopo Ma, USA  
 Z. Malkin, Russia

C. Ron, Czech Republic  
 Jing Tian, China  
 Kemin Wang, China  
 Zhifang Zeng, China  
 Min Zhong, China.

From their records all appeared to be active in the field, with the exception of Qi Li who seemed to be more involved in positional astronomy. Consequently, the Vice-President consulted with the President of Commission 8 and considering that only one Commission membership is allowed for the first three-year period, Qi Li was accepted in Commission 8.

### 2.3. ANNOUNCEMENT OF THE NEW OFFICERS OF THE COMMISSION (J. Vondrák reported)

Elections of new officers was organized before the General Assembly, in June 1997 in order to permit all members of the Commission to vote. The members leaving the Organizing Committee (OC), due to their second term expiring, are:

S. Dickman, USA,  
 W. Melbourne, USA,  
 D. Robertson, USA,  
 Ch. Veillet, France - resigned due to his new responsibilities,  
 P. Wilson, Germany.

The candidates for the vacancies were proposed by the existing OC members and ballots with their names (two candidates for vice-president, ten candidates for the new OC members) were sent to all Commission members for their votes. 66 ballots were returned by June 25, 1997, with the following results:

D. D. McCarthy (USA), President,  
 N. Capitaine (France), Vice-President,  
 A. Brzeziński (Poland), new OC member,  
 Ya. Yatskiv (Ukraine), new OC member,  
 G. Beutler (Switzerland), new OC member,  
 P. Brosche (Germany), new OC member,  
 R. Gross (USA), new OC member.

These are added to those who continue their OC membership:

E. F. Arias, Argentina,  
 V. Dehant, Belgium,  
 S. Manabe, Japan,  
 L. Morrison, UK,  
 L. Rykhlova, Russia,  
 V. Tarady, Ukraine,  
 Yang Fumin, China

and the three ex-officio members (the first two as representatives of the collaborating bodies):

M. Feissel (France), IERS,  
 C. Wilson (USA), IAG SSG 5.173,  
 J. Vondrák (Czech Republic), past President.

The OC members also proposed the following Consultants for the next three-year period whose names were submitted to the IAU General Secretary:

B. Chao, USA,  
 R. Eanes, USA,  
 T. Herring, USA,  
 H. Jochmann, Germany,  
 J. Kouba, Canada,  
 P. Mathews, India,  
 J. Nastula, Poland,  
 A. Nothnagel, Germany,

K. Nurutdinov, Ukraine,  
 Ch. Reigber, Germany,  
 B. Richter, Germany,  
 S. Rudenko, Ukraine,  
 D. Salstein, USA,  
 H. Schuh, Germany,  
 C. Wilson, USA,  
 V. Zharov, Russia.

#### 2.4. SCIENTIFIC DISCUSSION ON FUTURE PLANS FOR STUDYING EARTH ROTATION

The following contributions were presented:

B. Kolaczek: *On future plans of deeper investigations of El Niño influences on Earth rotation,*  
 R. O. Vicente: *On terrestrial and celestial reference frames,*  
 Wu Hong-qi, Yu Nanhua, Zheng Dawai: *New contribution of AAM data.*

In the discussion that followed it was decided that Commission 19 would not propose any resolution of type C since it was felt that all problems specific to this commission were covered by type B resolutions already endorsed by the first session of the GA. It was stressed that, for the sake of the future of Lunar Laser Ranging, it would be necessary to better present its importance to other members of the astronomical community. The importance of satellite methods for studying Earth orientation parameters was also discussed, as well as the necessity of studying the El Niño effects in exciting Earth orientation.

#### 3. Working Group meetings (Tuesday, August 26, 1997)

These two extra meetings (chaired by J. Vondrák and D.D. McCarthy) were devoted mostly to the reports and information of the bodies co-operating with Commission 19. The following reports were presented:

##### 3.1. FINAL REPORT ON THE ACTIVITY OF THE WG ON EARTH ROTATION IN THE HIPPARCOS REFERENCE FRAME

(presented by its chairman, J. Vondrák)

It was stated that the WG (that was set up by IAU Commission 19 in 1988) proposed the algorithms of the solution at the IAU GA in 1991. Its activity was then prolonged, and it was prolonged again at the 22nd IAU GA in 1994. The data from 48 instruments at 31 observatories were collected since then and re-calculated into the most recent astronomical constants and standards. In the absence of the final Hipparcos Catalogue, 11 intermediary solutions were made, first with local star catalogues, later with preliminary (H30, H37, H37C) catalogues. Very recently, when the final Hipparcos Catalogue became available, two solutions were made and the first results presented at the Venice Hipparcos symposium (May 1997) and at JD3, JD7 and JD14 of the 23rd IAU GA (as posters). The data, procedures used, and results will be described in detail in a special volume of the Publications of the Astronomical Institute of the Academy of Sciences of the Czech Republic that will be widely distributed. The chairman then proposed to close the activity of this WG since it successfully fulfilled its task.

##### 3.2. REPORT ON THE ACTIVITY OF THE INTERNATIONAL GPS SERVICE FOR GEODYNAMICS

(presented by its chairman, G. Beutler)

G. Beutler described the recent activities of the IGS that closely cooperates with the International Earth Rotation Service. The service uses the observations of the GPS satellites to monitor the motions of observing sites on the Earth, but it also determines the orbits of the observed satellites and some of the Earth orientation parameters (polar motion, length-of-day changes on a short time scale and, most recently, also the first time derivatives of celestial pole offsets).

##### 3.3. REPORT ON THE ACTIVITY OF THE INTERNATIONAL EARTH ROTATION SERVICE

(reported by the director of its Central Bureau, M. Feissel, in collaboration with D. Gambis and by the director of the Sub-bureau for Rapid Service, D. McCarthy)

M. Feissel gave the global overview of the service and its activities during the last three years. D. Gambis then discussed the results in more detail, describing the input of individual techniques (VLBI, LLR, SLR, GPS, DORIS). The most recent technique, DORIS, is active since 1995 and now achieves the accuracy of 2mas. The precision and accuracy of the combined solution further improved to the level of 0.2 mas, with better and quicker availability of the results. Plans for the future include improvement of the combination methods, studying geophysical effects (atmosphere, oceans, groundwater) and clarification of polar motion and nutation in subdiurnal periods. D. McCarthy spoke about rapid service that now makes use of electronic distribution (twice-weekly) and uses also IGS products. The dominant contribution in polar motion is GPS, and for UT1 it is VLBI. Predictions for one year in advance are made with a precision of 0.02" in polar motion and 0.06s in UT1.

### 3.4. DISCUSSION ON THE NEW WORKING GROUPS

(reported by Division 1 President, J. Kovalevsky)

J. Kovalevsky outlined the results of the recent meeting of presidents and vice-presidents of Division 1. Following the type B resolutions endorsed at the first session of the GA, several working groups are formed:

- a) *Committee on General Relativity in the Framework of Space-time References and Metrology.*  
This body is common to IAU, BIPM and IAG and it should be concerned with definitions, conventions and notations at a sufficient level of accuracy.
- b) *IAU WG on Relativity in Celestial Mechanics and Astrometry.*  
This WG should address relativity issues relating to celestial mechanics and astrometry in general (application, concepts, algorithms and constants).
- c) *IAU WG on the International Celestial Reference System.*  
This WG should interact with the IERS in the maintenance and extension of the ICRS, and formulate the new definitions of the celestial reference pole, sidereal time and the transformation between the celestial and terrestrial reference frame.

In addition to these, three more WG's supported by Division 1 will continue their activity; IAU/IUGG WG on Non-rigid Earth Nutation, WG on Astronomical Standards and WG on Cartographic Coordinates and Rotational Elements of Planets and Satellites.

### 3.5. REPORT ON THE ACTIVITY OF THE IAG SPECIAL STUDY GROUP 5.173 AND IAU WG ON NUTATION

(reported by the chairwoman of the WG, V. Dehant)

The IAG SSG created a WWW page that contains member reports and results. They organized a number of special sessions at scientific meetings (1995 Fall AGU, 1996 EGS, 1996 Spring AGU, 1996 Fall AGU, 1997 EGS, 1997 Spring AGU, 1997 IAPSO meetings). The SSG was also active during the IERS Workshop 1996 to improve studies of the interaction of the oceans and atmosphere with the rotating Earth and made new initiatives in gravity and geocenter studies.

The IAU 1980 standard nutation theory differs from the observations by about 10 mas indicating that a new Earth's transfer function is required which takes into consideration a realistic seismic model of the rheological properties of the Earth. A hydrostatic equilibrium model does not fit with the observed Earth orientation parameters of the free-core nutation. The rigid Earth nutation which serves as the basis for any non-rigid model, also needs improvement.

## COMMISSION 31 TIME (HEURE)

*Minutes of the Commission 31 Business Meetings held at the XXIIIrd IAU General Assembly in Kyoto, Japan*

HENRY FLIEGEL (Commission President)

PRESIDENT: Toshio Fukushima

VICE-PRESIDENT: Gerard Petit

Commission 31 held business meetings during three sessions on Tuesday, 26 August 1997. The first two sessions were devoted to reports and summaries organized by G. Petit (Chairman of the Commission 31 Working Group on Pulsars and Timing) and by B. Guinot (ex Director of the former BIH). In the third session, reports were received from agencies to which the IAU sends Representatives, and Commission members discussed our relations with those agencies, and the future role of Commission 31 Working Groups, and their relationship with Division 1 Working Groups.

Also in the third session, the following list of officers and members of the Organizing Committee, which had been nominated and elected by votes solicited by all the members by correspondence in January-April 1997, was approved without dissent.

for President: Toshio Fukushima (Japan)

for Vice-President: Gerard Petit (France)

as members of the Organizing Committee:

Donald Backer (USA)  
Gerhard Beutler (Switzerland)  
Victor Brumberg (Russia)  
Henry Fliegel (USA)  
Sigfrido Leschiutta (Italy)  
John Luck (Australia)  
Paul Paquet (Belgium)  
Edoardo Proverbio (Italy)  
Qi Guan Rong (China)  
Claudine Thomas (France)  
Christian Veillet (France)  
Gernot Winkler (USA)  
Zhai Zao-Cheng (China)

In addition, William Klepczynski (USA) was named IAU Representative to the International Telecommunication Union Radiocommunication Bureau (ITU-BR) and to its Study Group 7; and Paul Paquet (Belgium) to the Federation of Astronomical and Geophysical Data Analysis Services (FAGS). These names had been reported and accepted by the IAU Executive during the meeting of Commission Presidents, on 25 August. There was some discussion concerning nominations for the IAU Representative to the Consultative Committee for the Definition of the Second (CCDS). Jean Kovalevsky, as President of Division 1, suggested that the IAU Representative should not be a member of the Bureau International des Poids et Mesures (BIPM) or of the CIPM or CCDS. Members voted to propose Henry Fliegel (USA)



as the IAU Representative to the CCDS/BIPM, succeeding Gernot Winkler, pending the expected invitation of such a Representative from the CCDS to the IAU, and subject to consideration by the new Commission 31 President, Toshio Fukushima.

The following are the reports given in support of the Representatives and of the Working Groups of the Commission.

### 1. Session 1

This session, on "Implications of Pulsars and Dynamical Time Scales" was organized by Gerard Petit.

E. Myles Standish spoke on "Relations Between the Pulsar Timing Data and the Planetary Ephemerides". Especially noted was the difficulty in separating long-term changes in pulsar periods from systematics in the Earth's ephemeris, and the importance of this issue to the problem of constructing a truly independent and dynamical time scale from pulsar measurements.

D. N. Matsakis, J. H. Taylor, and T. M. Eubanks authored a paper on "Pulsar Time Scales and Sigma - z".

G. Petit presented a summary of "Pulsars and Atomic Time Scales".

Short summaries were provided in absentia of two papers: "An Astronomical Time Scale Based on the Orbital Motion of Pulsars in a Binary System" by Yu P. Iyasov, S. N. Kopeikin, and A.E. Rodin; and "Binary Pulsars as Detectors of Ultralow Frequency Gravitational Waves" by S. M. Kopeikin.

In the discussion of these papers, questions were raised whether estimates of a possible secular drift of pulsar-based dynamical time with respect to TAI might be corrupted by uncertainties in the planetary perturbations, and whether the distribution of pulsar observations was optimal to decide such questions. It was agreed that possible timing applications have low visibility to the radio astronomical community, and that members of the Working Group might profitably examine and recompile existing data to provide a basis for further work in timing.

### 2. Session 2

This session, on "Time, Metrology, and Physics" was organized by Bernard Guinot.

F. Riehle of the Physikalisch - Technische Bundesanstalt [PTB], Braunschweig, Germany, opened by reviewing the definitions of time standards in the framework of the International System of Units (SI). Of the seven base units of the International System, the unit of time (the second) can be realized with the lowest uncertainty. Consequently, if the definitions of other base units can be based on the second and on known physical laws, the uncertainties of the values of those base units can be much reduced.

Michito Imae surveyed the "Research Work in Time and Frequency at the Communications Research Laboratory [CRL], Tokyo, Japan". The CRL has responsibility for time and frequency standardization in Japan. CRL is developing frequency standards (optically pumped cesium, cesium fountain, H-maser, and cesium ensemble), and time transfer techniques, and disseminates time via JJY (HF), JG2AS (LF), telephone JJY dial-up service, and NTP = Network Time Protocol. Other time-related research includes development of an Acoustic Optic Spectrometer (AOS), exploration of general relativity, GPS and space-borne techniques, and observations using the 34m radiotelescope at Kashima Space Research Center.

William Klepczynski reported the work of the CIPM Working Group on Two-Way Satellite Time Transfer (TWSTT). The major issues with which the WG is concerned were reported to be (a) exchange of data between participating stations, (b) length of the observing sessions, (c) frequency of data collection, (d) the precision of the technique, (e) the accuracy of the technique, and (f) its long term stability.

Bernard Guinot concluded the Session by summarizing the Report of the CCDS Working Group on Relativity and Metrology, recently published in *Metrologia*, **34**, 261-290 (1997). It concludes that the base units of physics must be proper quantities provided by local standards, established directly by local experiments, and that the present definitions of the SI base units are compatible with this requirement.

### 3. Session 3

The following reports were presented on behalf of IAU Representatives.

The chairman presented charts summarizing the work of the Federation of Astronomical and Geophysical Data Analysis Services (FAGS), which had been prepared by Paul Paquet. Since 1997, FAGS supports 11 services, of which 6 are directly related to IAU activities: (1) International Earth Rotation Service (IERS); (2) Quarterly Bulletin on Solar Activity (QBSA); (3) International Space Environment Service (ISES); (4) Centre de Données Stellaires (CDS); (5) Sunspot Index Data Center (SIDC); and (6) International Geodynamic Service (IGS).

William Klepczynski reported on the work of the International Telecommunication Union, with special focus on its Study Group 7. The ITU combines the previous International Consultative Committee for Radio (CCIR) and the International Consultative Committee for Telegraph and Telephone (CCITT), to coordinate all telecommunications, radio, and wire (fiber optics). Its Study Group 7 (continuing the former CCIR Study Group 7) comprises four Working Parties: 7A, Time and Frequency; 7B, Space Applications; 7C, Earth Observations; and 7D, Radio Astronomy. Of these, Working Party 7A, chaired by Gerrit de Jong, is of primary interest to Commission 31; it provides Reports and Recommendations for Standard Frequency and Time Broadcasting Stations.

The chairman asked Jean Kovalevsky, the President of Division 1, to describe the charters of the Division Working Groups [WG's]. The Division supports five WG's: (1) The joint IAU- BIPM - IAG Committee on General Relativity in the Framework of Spacetime Relations and Metrology; (2) the IAU WG on General Relativity in Celestial Mechanics and Astrometry; (3) the WG on the Maintenance of the International Celestial Reference Frame [ICRS]; (4) the IAU WG on Non-Rigid Earth Nutation Theory; and (5) the IAU WG on Astronomical Standards.

The members were then asked to comment on proposals for Commission 31 WG's. It was voted to continue the WG on Pulsar Timing, under its present chairman, Gerard Petit. Members were asked to comment on a proposal to continue the WG on Time Transfer, with an extended charter "(a) to advise CCDS on the applicability of laser ranging techniques to the maintenance of TAI; (b) in collaboration with the CSTG SLR/LLR Subcommittee, to define standards and formats for data exchange; (c) to recommend appropriate calibration and verification procedures". The members agreed with the Session chairman that we must not duplicate the work of the CCDS groups, and we cannot separate laser from radio techniques (VLBI, GPS), since often a combination of techniques is necessary to transfer time on a continuing basis - e.g., when using LASSO. Commission members recommended that the decisions whether to continue the WG on Time Transfer, and if so with what chairman, members, and charter, should be left to the discretion of the incoming Commission President, Toshio Fukushima.

**DIVISION II**  
**SUN AND HELIOSPHERE**

Division II provides a forum for astronomers studying a wide range of phenomena related to the structure, radiation and activity of the Sun, and its interaction with the Earth and the rest of the solar system.

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**BOARD**

Ai Guoxiang	President Commission 10
A. Benz	Vice-President Commission 10
S. Solanki	Vice-President Commission 12
F. Verheest	President Commission 49
M. Vandas	Vice-President Commission 49
O. Engvold	Past President Division II

**PARTICIPATING COMMISSIONS**

<b>COMMISSION 10</b>	<b>SOLAR ACTIVITY</b>
<b>COMMISSION 12</b>	<b>SOLAR RADIATION AND STRUCTURE</b>
<b>COMMISSION 49</b>	<b>THE INTERPLANETARY PLASMA AND THE HELIOSPHERE</b>

## DIVISION II: THE SUN AND THE HELIOSPHERE

**Commission 10: Solar Activity**

**Commission 12: Solar radiation and structure**

**Commission 49: The interplanetary plasma and the heliosphere**

President Division II: O. Engvold  
President (10): O. Engvold Vice-President: Ai Guoxiang  
President (12): F.-L. Deubner Vice-President: Peter V. Foukal  
President (49): H. Ripken Vice-President: F. Verheest

This report was prepared by the three commissions belonging to DIVISION II and it describes their activities during the 23<sup>rd</sup> General Assembly of the IAU.

The IAU Division II meeting held on August 23, 1997 in Kyoto included presentations from the Working Groups on Eclipses, on the Quarterly Solar Activity Bulletins, on the Sunspot Index Data Center, and on a compilation of solar activity. The IAU's newly adopted divisional structure, its impact on the Commissions, and on structure of the IAU were presented. Discussion followed on ideas for increasing participation in the divisional IAU business meetings. J. Pecker urged that the new divisional structure not be allowed to split up the IAU, as he felt has happened at the IUGG.

At the second meeting of the Division II, were also discussed plans for a strong solar and heliospheric program at the next General Assembly in Manchester, U.K.

### 1. The reorganization of IAU Commissions

The joint business meetings reflect the consolidation of our three Commissions into IAU Division II "The Sun and the Heliosphere", which was implemented at the 22<sup>nd</sup> General Assembly of the IAU in The Hague, The Netherlands, August 1994. The increased interdisciplinary contacts and cooperations between the Commissions that have taken place under this new structure, have been most helpful. The three Commission Presidents expressed the opinion that the new structure is mutually beneficial and may serve to strengthen and further the science of our fields. It was expected that its detailed form may be improved and shaped in the next triennia ahead.

It was suggested that the name of the Division should be brought into proper English and the Executive Committee had accepted that the new name for Division II shall be *Sun and Heliosphere*. In the same vein, the President of Commission 49 had also asked that Commission 49 be called *Interplanetary Plasma and Heliosphere*, respectively, *Plasma Interplanetaire et Heliosphere*, which was subsequently granted by the EC.

### 2. Reports of the WG on Eclipses and the representatives of the International Programmes

#### 2.1. WG ON SOLAR ECLIPSES

The Chairman of the Working Group Solar Eclipses of the International Astronomical Union, Prof. J. Pasachoff, presented overviews of Eclipses since 1994, and of future Eclipses towards solar cycle maximum. For information on the activities of this working group is referred to:

[http://www.williams.edu/Astronomy/IAU\\_eclipses/](http://www.williams.edu/Astronomy/IAU_eclipses/)

## 2.2. ISSA

The "International Services for Solar Activity" (ISSA) is a board in charge of the distribute funds from the "Federation of Astronomical and Geophysical Data Analysis Services" (FAGS) between Quarterly Bulletin on Solar Activity (QBSA), the Sunspot Index Data Center (SIDC), and the Debrecen Photoheliographic Data (DPD) Center. The members of the ISSA Board are: Prof. Franca Chiuderi Drago, Italy (Chair), Prof. Pierre Lantos, France, Dr. Rainer Schwenn, Germany, and Ms. Helen Coffey, USA.

### 2.2.1. *Quarterly Bulletins on Solar Activity (QBSA)*

The Quarterly Bulletin on Solar Activity (QBSA) provides definitive sunspot numbers, the daily spotted area and the central zone sunspot numbers. The definitive sunspot numbers and their North and South components are published in Solar-Geophysical Data (NOAA, Boulder).

### 2.2.2. *Sunspot Index Data Center (SIDC)*

Dr. Pierre Cugnon, Belgium, presented a comprehensive report on the Sunspot Index Data Center to IAU for the period 1994-97. The SIDC has collected data from 34 (July 1994) to 49 (August 1997) cooperating centers in order to calculate the provisional daily and monthly International Sunspot Number  $R'_i$ . Since 1993 the SIDC network for the provisional sunspot number  $R'_i$  appears stabilized regarding as well the quantity as the quality of the observations.

The SIDC has been accessible on the World Wide Web since 1995 at the address:

<http://www.oma.be/KSB-ORB/SIDC/index.html>

### 2.2.3. *Debrecen Photoheliographic Data (DPD)*

Dr. Pierre Lantos presented, on behalf of Dr. Andreas Ludmany, a summary of the recent state of our catalogue activities of the photoheliograph catalogue work in Debrecen, Hungary.

The series of the Greenwich Photoheliographic Results (GPR) has been finished with the publication of the material for the year 1976. The IAU has charged the Heliophysical Observatory of the Hungarian Academy of Sciences to continue this work.

Three scientists of the Debrecen team L. Dezso, A. Kovacs and O. Gerlei started compiling the Debrecen Photoheliographic Results with the year 1977. Their program was more ambitious than the original GPR which was restricted to the mean positions and total areas of the sunspot groups. The DPR also included single spot data, magnetic polarities of the sunspots (from external sources) and the life of the groups was also followed. This work resulted in the DPR data for the years 1977 and 1978. The data for 1977 are available both in hardcopy and by ftp, the data for 1978 are accessible by ftp.

A separate group of the Debrecen team started a parallel project under the title Debrecen Photoheliographic Data (DPD). This is essentially based on the same methodology as the DPR, so that its reliability in the position and area measurements is the same. It does not contain, however, polarity data and it does not follow the history of single spots. This work resulted in the DPD data for the year 1986 which is available both in hardcopy and by ftp, the material of the first half of the year 1987 is available by ftp as a preliminary material, the second half has yet to be completed with the area data.

A major advancement is expected from a new procedure and software developed by Dr. L. Gyori. The method uses a combination of some absolute position measurements and the automatic evaluation of the CCD-scans of the active regions; in this latter step the software finds automatically the borders of the umbrae and penumbrae and determines their positions and areas. A significant speed up may be expected from this methodological advancement. Materials of the years 1993 and 1994 are being processed presently in this way. Full coverage of the missing years will be achieved by an appropriate schedule.

The anonymous ftp address of the presently accessible materials is as follows:

<ftp:fenyi.sci.klte.hu/pub/DPR>, or /DPD.

## 3. Election of commission officers and new Organizational Committees

At the end of the second meeting were elected new commission officers and Organizing Committees.

Members of Commission 10 elected the following Organizing Committee for the period 1997-2000: President: Ai Guoxiang, China, Vice-President: A. Benz, Switzerland, and Secretary: K.P. Dere, USA. Members of the OC are: N. Gopalswamy, USA, A. Hood, UK, B.V. Jackson, USA, I. Kim, Russia, P.C. Martens, The Netherlands, G. Poletto, Italy, J.P. Rozelot, France, A.J. Sanchez, Spain, R. Hammer, Germany, K. Shibata, Japan, L. van Driel-Geztesy, France, and O. Engvold, Norway (Past President).

Members of Commission 12 elected the following Organizing Committee for the period 1997-2000: President: P. V. Foukal, USA, Vice-President: S. Solanki, and Secretary: J. Mariska, USA. Members of the OC are: S. Baliunas, USA, D. Deming, USA, T. Duvall, USA, D. Dravins, Sweden, C. Fang, China, V. Gaizauskas, Canada, P. Heinzel, Czechia, J. Karpen, USA, E. Kononovich, Russia, S. Koutchmy, France, D. Melrose, Australia, M. Stix, Germany, Y. Suematsu, Japan, and F.-L. Deubner, Germany (Past President).

Members of Commission 49 elected the following Organizing Committee for the period 1997-2000: President: F. Verheest, Belgium, and Vice-President: Marek Vandas, Czechia. Members of the new OC are: B. Buti, India, N. Cramer, Australia, M. Dryer, USA, S. Habbal, USA, J. Hollweg, USA, M. Huber, The Netherlands, M. Kojima, Japan, and H. Ripken, Germany (Past President).

The following new Organizing committee of the IAU Division II was elected for the period 1997-2000: President: Peter V. Foukal, USA (P., Com 12). Members of OC: Ai Guoxiang, China (P., Comm 10), F. Verheest, Belgium (P., Comm 49), A. Benz, Switzerland (V.P., Comm 10), S. Solanki, Switzerland (V.P., Comm 12), M. Vandas, Czechia (V.P. Comm 49), and O. Engvold, Norway (Past P. Div II).

#### **4. Commission Membership**

The commissions were pleased to welcome 38, 9 and 3 new members to, respectively, commissions 10, 12, and 49.

Franz Ludwig Deubner read the names of the deceased members of Commissions 10 and 12, and those attending the session rose in their honor.

**DIVISION III**  
**PLANETARY SYSTEM SCIENCES**

Division III gathers astronomers engaged in the study of a comprehensive range of phenomena in the solar system and its bodies, from the major planets via comets to meteorites and interplanetary dust.

**PRESIDENT:** Michael F. A'Hearn  
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**BOARD**

M.F. A'Hearn	President Division III
V. Zappalá	Past President Commission 15
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D.K. Yeomans,	Past President Commission 20
S. Bowyer	President Commission 21
C. Leinert	Past President Commission 21
W.J. Baggaley	President Commission 22
I.P. Williams	Past President Commission 22
F.R. Colomb	President Commission 51
J.C. Tarter	Past President Commission 51

**PARTICIPATING COMMISSIONS:**

<b>COMMISSION 15</b>	<b>PHYSICAL STUDY OF COMETS, MINOR PLANETS AND METEORITES</b>
<b>COMMISSION 16</b>	<b>PHYSICAL STUDY OF PLANETS AND SATELLITES</b>
<b>COMMISSION 20</b>	<b>POSITION AND MOTIONS OF MINOR PLANETS, COMETS AND SATELLITES</b>
<b>COMMISSION 21</b>	<b>LIGHT OF THE NIGHT SKY</b>
<b>COMMISSION 22</b>	<b>METEORS AND INTERPLANETARY DUST</b>
<b>COMMISSION 51</b>	<b>BIOASTRONOMY: SEARCH FOR EXTRATERRESTRIAL LIFE</b>

## COMMISSION NO. 15

*Physical Studies of Comets, Minor Planets, and Meteorites*  
*L'Etude Physique des Comètes, des Petites Planètes et des Météorites*

PRESIDENT: Michael F. A'Hearn  
VICE-PRESIDENT: Vincenzo Zappalá  
SECRETARY: Hermann Bönhardt

### 1. Commission Membership

The president opened the meeting, welcoming members and interested guests. There were 29 in attendance, including at least 25 members of the commission. The agenda as previously posted on the commission's WWW site was adopted. The members stood for a moment of silence in honor of the six esteemed members of the commission who had died: M. P. Candy 04/11/94, R.A. Lyttleton 16/05/95, R. Smoluchowski 12/01/96, A. Mrkos 29/05/96, J. Rahe 18/06/97, E. Shoemaker 18/07/97, and V. Vanysek 27/07/97. The commission then elected new members K. Muinonen (Finland), S. Price (USA), and J. Watanabe (Japan). Furthermore, the following IAU membership nominees were elected to the commission pending their confirmation as IAU members at the second session of the General Assembly: J.-P. Barriot (France), T. Bonev (Bulgaria), A. Fitzsimmons (United Kingdom), D. Foryta (Brazil), S. Ibadov (Tajikistan), Y. Ma (PR China), P. Magnusson (Sweden), F. Marzari (Italy), A. Nakamura (Japan), P. Rousselot (France), A. S. Sharma (USA), and J. Zhu (PR China).

### 2. Commission Officers

The commission, noting that nominees for president and vice president had already been forward to the IAU Executive Committee, elected officers for the next triennium, doing so by acclamation for president, vice-president, secretary, chairman of the working group on asteroids, and continuing members of the OC. The new officers will be: President - V. Zappalá (Italy), Vice-President - H. U. Keller (Germany), Secretary - K. Muinonen (Finland), Chair of the WG on Comets - W. Huebner, Chair of the WG on Asteroids - E. Tedesco, and Members of the OC - M. Bailey (United Kingdom), R. Binzel (USA), M. T. Capria (Italy), P. D. Feldman (USA), J. Fernandez (Uruguay), C. Lagerkvist (Sweden), A.-C. Levasseur-Regourd (France), K. Meech (USA), J. Watanabe (Japan), and R. M. West (Germany).

### 3. Commission Organization and Communication

The president reported on the IAU's plans for greater involvement of the new divisions in the running of the IAU. One major role expected for the divisions is in the screening and ranking of proposals for IAU-sponsored scientific meetings. He also reported very briefly on the structure of Division III - Planetary System Sciences.

No initiative was undertaken to reinstall the former WG on Meteorites. However, this subject matter will still be covered in the triennial report as far as it is related to the commission's interests.

A particular endorsement of the Working Group on Interplanetary Pollution was not deemed necessary by the commission since the report of the WG had been submitted to Division III and they had forwarded it with a divisional resolution to the IAU Resolutions Committee.

The out-going commission officers have initiated the distribution of commission communication via electronic media. The commission web page can be found at [www.ss.astro.umd.edu/IAU/comm15/](http://www.ss.astro.umd.edu/IAU/comm15/) and can also be reached directly from the IAU web pages. Email addresses are available for almost 80 percent of the commission members for use in internal communication. In the future, the commission newsletters will be disseminated via email in one or more, widely used formats (LATEX, DVI, POSTSCRIPT) and they will be posted on the web pages. Members for whom email addresses are not now available will receive a last mailing indicating that they should respond with an email address or indicating that they do not have email access and must continue to receive printed mailings.



## 4. Resolutions

### 4.1. COMA PARAMETERS

The commission discussed the confusion that arises when researchers try to compare water production rates reported by different investigators due to the use of different models and different parameters for the models. It was noted that the problem is more widespread than just indices for release of water, involving a lack of a standard way of reporting release of dust and also the lack of any standard for determining the nuclear magnitude of a comet. After a proposal to create a special working group, it was decided that the Working Group on Comets, augmented as seen fit by the chairman of the working group, should be charged with addressing this problem and the commission passed, unopposed, the following resolution as a charge to the working group:

IAU Commission 15, noting the great confusion that arises when comparing molecular production rates from various papers in the refereed literature and noting that much of this confusion is due to the wide range of models and parameters used therein to interpret the fluxes from emission features, resolves that the Working Group on Comets should appoint a subgroup charged with proposing a standard set of parameters for deducing a water release index. This group is charged with considering both the physical correctness of the parameters and the ease of application by astronomers in all situations. The working group should also consider whether other parameters, such as nuclear magnitudes, indices of dust release, and indices of gas/dust ratio, should similarly be standardized. This group will report back to Commission 15 in time to consider resolutions for adoption at the 24th General Assembly.

### 4.2. MINOR PLANET CENTER

The funding situation of the Minor Planet Center (MPC) was discussed briefly, noting the cessation of IAU support, the increasing workload at the MPC, the declining subscription revenues, and the temporary support provided by NASA. Although the MPC reports to Commission 20, its work is crucial in enabling the members of Commission 15 to carry out their work and Commission 15 therefore passed a resolution requesting that the IAU provide financial support to the MPC and authorizing the officers of Division III to provide a final wording that would make the actions of commissions 15 and 20 self-consistent. It was noted that a formal financial proposal would be necessary before any action was taken by the IAU and that this would be done through Commission 20 and Division III.

### 4.3. THE LEONID METEOR STREAM

A resolution supporting airborne campaigns to study the Leonid meteor showers in 1997 was introduced. After considerable discussion, an alternative resolution was passed by a vote of 8 to 4:

Commission 15, recognizing the unique opportunity of the 1998-1999 Leonid meteor showers for meteor studies, for cometary studies, and for studying the hazard of future meteor storms to spacecraft, and considering that this is a one-of-a-kind opportunity both because of the expected intensity of the events and because precession of the orbits will inhibit such intense activity for the foreseeable future (i.e., for centuries), urges all national and international agencies and organizations with relevant resources to encourage, coordinate, and support as wide a range of studies as possible, including airborne and spaceborne studies as well as amateur and professional ground-based investigations.

## 5. Triennial Report

The further issuing of the triennial report of the commission was discussed. Roughly one half of the commission members present find the triennial report useful for their scientific work. Several options of formats for the report were discussed, consistent with discussions at the IAU Executive committee, i.e.,

- printed report in previous format to become an IAU publication
- 2-3 pages printed summary supplemented by a reference list sorted by subject for publication by the IAU
- 2-3 pages printed summary of the report for publication by the IAU every third year supplemented by an annual detailed version to be put on the commission web page.

The exact format of the next report will be worked out between the responsible commission officers, the president and the vice-president of the commission.

## 6. Future Meetings

Due to the increasing number of workshops and conferences related to subjects of interest to our commission, some degree of coordination of the meetings both in subject and dates would be highly desirable for the interested scientists. Several ideas for an improvement of the situation were discussed, i.e.,

- information exchange between the organizers well in advance of the meeting
- installation of a joint webpage for advertizing the meetings of interest
- keeping a fixed 3 years meeting cycle like IAU GA in year 1, ACM in year 2, other topics in year 3.

The discussion concluded that most likely any type of coordination of meetings is at present difficult to achieve since it may put unwanted constraints on the organizers of the meetings.

The president urged the incoming president to push for at least two sessions for the business meeting at the next General Assembly since it had been impossible to even get to potential new business from the floor at the present meeting which extended fully into the break.

**COMMISSION 16: PHYSICAL STUDY OF PLANETS & SATELLITES**  
**ETUDE PHYSIQUE DES PLANETES & SATELLITES**

MIKHAIL MAROV

*Keldysh Institute of Applied Mathematics, Russian Academy of Sciences, Miusskaja 4, Moscow 125047, Russia, e-mail: marov@spp.keldysh.ru*

Commission 16 held its Business Meeting during the 97 General Assembly on the 26th of August as it was scheduled.

The Commission accepted the report of the President on the Commission's activities for 1994-1997 and expressed its satisfaction that all main foals planned at the 1994 General Assembly were achieved, hence contributing to the revitalization of Commission 16 activities.

Five meetings were co-sponsored or organized by other bodies jointly with Commission 16, and two important events Assembly were held upon the Commissions's initiative. :

JD 6 Interactions between Planets & Small Bodies  
and

SPS 1 The Galileo Mission to the Jupiter System during the 1997 General

International programs of coordinated observations of Mars and Jupiter were successfully continued.

The Commission also heard and approved progress report of IAU/IAG/COSPAR Working Group on Cartographic Coordinates and Rotational Elements of the Planets & Satellites and report on the current status of activity on preventing Interplanetary Pollution, presented by Dr. K. Seidelman and Dr. C. Keay, respectively.

**Organizing Committee 1997-2000**

In accordance with the IAU bye-laws, Commission 16 elected new President, Vice-President, Secretary and Organizing Committee for the period 1997-200 as follows:

PRESIDENT	Catherine de Bergh	France
VICE-PRESIDENT	Dale P Cruikshank	USA
SECRETARY	Angioletta Coradini	Italy
	Michael J S Belton	USA
	Carlo Blanco	Italy
	Guy Joseph Consolmagno	USA
	Daniel Gautier	France
	Mikhail Ya Marov	Russia
	David Morrison	USA
	Keith Stephen Noll	USA
	Tobias C Owen	USA
	Viktor G Tejfel	Kazakhstan
	Andrzej Woszczyk	Poland

**Membership**

For the interim time Commission 16 lost its distinguished members J. Pollack, C. Sagan and J. Rahe. Seventeen new IAU members applied for the Commission membership and were accteped.

**Acknowledgement**

Generous contribution of the Commission's Organising Committee members to the reviewed activities is acknowledged.

**COMMISSION 20:**

**POSITION & MOTIONS OF MINOR PLANETS, COMETS  
& SATELLITES**

**POSITIONS & MOUVEMENTS DES PETITES PLANETES,  
DES COMETES & DES SATELLITES**

**Report not received**

## COMMISSION 21

### LIGHT OF THE NIGHT SKY / LUMIÈRE DU CIEL NOCTURNE

*Report of the business meeting, Kyoto, August 26, 1997*

PRESIDENT: Christoph Leinert  
VICE-PRESIDENT: Stuart Bowyer

The president opened the meeting by welcoming the members present. He asked for a moment of silence in remembrance of Ed Ney who had died during the past triennium.

#### 1. REPORT OF THE PRESIDENT

Large part of the commission activity related to conferences, often organised by commission members:

“Unveiling the cosmic infrared background”, College Park, April 23-25, 1995, was organised by the COBE team. The proceedings appeared in the AIP series as volume 348 with E. Dwek as editor.

“Physics, chemistry, and dynamics of interplanetary dust”, Gainesville, August 14-18, 1995, IAU colloquium No. 150, was the traditional meeting of the interplanetary dust community happening since 1969 about every five years. Sponsored by commissions 21 and 22, the proceedings appeared in the ASP conference series as volume No. 104, with B. Gustafson and M. Hanner as editors.

“Diffuse infrared radiation and the IRTS”, Tokyo, November 11-14, 1996, was organised by T. Matsumoto. The proceedings appeared in the ASP conference series as volume No. 124, with H. Okuda, T. Matsumoto and L. Roellig as editors.

At the general assembly in Kyoto commission 21 has been

- co-sponsoring JD5 “Preserving the astronomical windows”, organiser S. Isobe (commission 50)
- sponsoring SPS 2 “Highlights of the ISO mission”, organiser D. Lemke
- supporting the “Workshop on zodiacal cloud sciences”, Kobe, September 1-3, 1997, organised by T. Mukai.

The next IAU colloquium on interplanetary dust and zodiacal light is planned for spring 2000 in Canterbury, England, with T. McDonnell as host.

Communication with the members was based on a yearly newsletter. A poll among the commission members confirmed the preliminary decision from the general assembly in den Haag that commission 21 should join division III (Planetary system sciences). The triennial report for the IAU transactions on the scientific activities in the field was prepared with important help from S. Bowyer and K. Mattila and sent to the members with the January 1997 newsletter.

Commission 21 was represented in the inter-commission working group on “The prevention of interplanetary pollution” (convenor C. Keay) by B. Gustafson and A.-Ch. Levasseur-Regourd. The working group report led to a resolution at the Kyoto general assembly.

#### 2. MEMBERSHIP

By vote the following colleagues were formally added to the membership list: Peter Abraham (Hungary), Sergeij Dodonov, Alexander Kopylow, Sergeij Neizvestny (Russia), William Reach (USA), Wolfhard Schlosser (Germany). Also Jakob Staude and Jerry Weinberg returned to membership.

New consultants are the younger scientists Rebecca Bernstein (USA) and Andreas Wicencec (Germany).

At present there are 108 members and 14 consultants to the commission.

### 3. ELECTION OF OFFICERS

President: Stuart Bowyer (USA)

Vice-President: Philippe Lamy (France)

Organising committee: President, Vice-President and E.Dwek (USA), Bo A. Gustafson (USA), M.S. Hanner (USA), A.-Ch. Levasseur-Regourd (France), J.S. Mikhail (Egypt), I. Mann (Germany), T. Mukai (Japan), T. Matsumoto (Japan)

It was the opinion of the commission members present that in the future membership in the organising committee should be limited to three consecutive periods.

### 4. STANDARD VALUES OF NIGHT SKY BRIGHTNESS

The president reported that the summary paper "The 1997 reference of diffuse night sky brightness" had been finished and submitted to A&A supplements. He thanked all the members who had contributed and helped to close this long-standing action item for commission work, at least for the time being.

### 5. COMMUNICATION WITHIN THE COMMISSION

The incoming president, S. Bowyer, explained that he intended to use the possibilities offered by internet for an improved communication. In particular he plans to set up a suitable commission page with relevant informations on the World Wide Web, linked to the IAU pages.

### 6. TRIENNIAL REPORT

The matter of writing this report was also discussed, with an outcome similar to the one at the meeting of commission presidents a few days ago. The reports are useful and should be continued; they help to integrate the commission and are a readily available starting point for outsiders on ongoing research in the field. However, they should not try to be complete but concentrate on important developments and references. In addition much freedom should be given to those actually composing the report. The combination of a short report, giving a reliable overview for a certain date, with frequently updated information available on the internet would be a possible way to go.

### 7. RESOLUTIONS

After short discussion, the members present gave support to further resolutions to be promoted by division III: to encourage studies of the 1998-1999 Leonid meteor showers which are expected to be exceptionally rich, and to request further IAU support for the Minor Planet Center.

### 8. SCIENTIFIC REPORTS

In the short time left at the end of the meeting S. Bowyer reported on the existing observational limits on the Far UV diffuse background and, in particular, on the limits from 50 nm to 110 nm. J. Overduin then discussed the implications of these background limits on the radiative decay of fundamental particles in the universe.

## COMMISSION 22: METEORS AND INTERPLANETARY DUST

I.P.WILLIAMS  
*Astronomy Unit*  
*Queen Mary*  
*London E1 4NS*  
*UK*

The meeting was held on Thursday 1997 August 21 at 14.00 hours with the President of the Commission, I.P.Williams taking the chair. Also present were Vice-President W.J.Baggaley, Secretary R.L.Hawkes and about 30 other members. The President reported the death of two of the commission members, Jachia and Yamakoshi. The meeting stood in silence for one minute in their memory.

### 1. Report On The Last Trienium

The report of the last Trienium has been published in Reports on Astronomy volume XXIIIA and reprints were distributed to the attendees. The report had also been circulated to members electronically. The report was formally approved by the meeting.

### 2. Report Of Intercommission Working Groups

#### 2.1. THE PREVENTION OF INTERPLANETARY POLLUTION

This report has also been published in Reports on Astronomy. The commission accepted the report and recommended that Division 3 should request the IAU also to accept the report and to take further steps so that the main recommendations of the report could be implemented.

#### 2.2. NEAR-EARTH OBJECTS

This report has also been published in Reports on Astronomy. The commission accepted the report and agreed to support the proposition that the Working Group should become a Division 3 Working Group for the next three years.

### 3. Report Of Commission Working Groups

#### 3.1. PROFESSIONAL-AMATEUR COOPERATION

A verbal report of the activities of the group was given by Hawkes (present chair). It was agreed with no dissensions that the Working Group should continue, though some discussion took place regarding future activity.

### 4. News Of Future Meetings

#### 4.1. MEETING IN NANJING

The president reported that a meeting entitled "Cometary Nuclei in Space and Time" was proposed to be held in Nanjing on 1998 May 18-22. He had supported the proposition to the Executive Committee on behalf of the Commission.

#### 4.2. MEETINGS AT TATRANSKA LOMNIKA, SLOVAK REPUBLIC

Two adjacent meetings were proposed to be held at Tatranska Lomnika, "Meteoroids 1998" on 1998 August 16-22 and "Evolution and source regions of Comets and Asteroids" to be held on August 24-28. The membership were requested to note both of these interesting meetings.

## 4.3. ACM 99

The membership were informed that this meeting would be held at Cornell University, USA.

## 4.4. PHYSICS AND CHEMISTRY OF INTERPLANETARY DUST

The commission agreed to support an application to the IAU for a further Colloquium in the above series to be held at the University of Kent, UK in the year 2000.

**5. Elections**

The following were elected unopposed:

President: W.J.Baggaley (New Zealand)

Vice President: V.Porubcan (Slovakia)

Secretary: R.L.Hawkes (Canada)

Organizing Committee: The above three plus P. Babadzhanov (Tajikstan), B. Gustafson (USA), I. Mann (Germany), G. Elford (Australia), I. Hasegawa (Japan), C. Koeberl (Austria), P. Spurney (Czech Republic) and I. Williams (UK).

## 5.1. EXISTING IAU MEMBERS WISHING TO JOIN COMMISSION 22

The following were duly accepted and welcomed

Kosi, Lipschutz, Rickman, Tatum, Watanabe.

## 5.2. NEW MEMBERS

The following New Members of the IAU had expressed interest in becoming Members of Commission 22. They were all accepted.

Cooper, Jenniskens, Jopek, Kalenichenko and Lemaire.

## 5.3. CONSULTANTS

The following were elected as *Consultants*.

Adolfson, Dr. Lars G. (USA) Andreev, Dr. Gennadij (Russia) Asher, Dr. David (Japan) Beech, Dr. Martin (Canada) Betlem, Mr. M.J. (The Netherlands) Bone, Mr. Neil (UK) Brown, Mr. Peter (Canada) de Lignie, Mr. Marc (The Netherlands) Getman, Dr. Vladimir (USA) Jones, Dr. William (UK) Kessler, Dr. Donald (USA) Klar Renner, Mr. Gilberto (Brasil) Mathews, Dr. John D. (USA) Murad, Dr. Edmond (USA) Nakamura, Dr. Takuji (Japan) Nagasawa, Dr. Koh (Japan) Obruchov, Prof. Yuri V. (Russia) Ocenas, Mr. Daniel (Slovak Republic) Ohtsuka, Mr. K. (Japan) Pellinen-Wannberg, Dr. Asta (Sweden) Rendtel, Mr. Jurgen (Germany) Richardson, Mr. James (USA) Roggemans, Mr. Paul (Belgium) Sidorov, Prof V. (Russia) Suzuki, Mr. Satoru (Japan) Voloshchuk, Prof. Y. (Ukraine) Wood, Mr. Jeff (Australia) Wu, Zidian (Canada) Xu, Pinxin (P.R. China) Yoshida, Mr. Takatsugu (Japan) Zook, Dr. Herb (USA).

## 5.4. REPRESENTATION ON DIVISION WORKING GROUPS

Near Earth Objects: I. Williams, V. Porubcan.

## 5.5. COMMISSION WORKING GROUP

*Professional-Amateur Working Group*

Chair: P. Jenniskens

Members: Betlem, Bone, Brown, Cooper, Hasegawa, Hawkes, Klar-Renner, Rendtel, Richardson, Yoshida.

**6. Other Business**

The incoming President thanked the outgoing President, Secretary and all the other members who had worked hard for the commission over the last triennium.



# REPORT OF COMMISSION 51: BIOASTRONOMY MEETING KYOTO GENERAL ASSEMBLY

J.C. TARTER  
*SETI Institute*  
2035 Landings Drive, Mountain View, California USA 94043

## 1. Commission Business

Attendance at the two business meetings of Commission 51 was much lighter than has been experienced in the recent past. The meetings conflicted with very interesting scientific sessions. As a result, during a subsequent meeting with other Commission Presidents and the IAU Secretariat, I suggested that in the future, specific times be set aside for Commission meetings and other business during which there would be no scientific sessions; my personal preference being one hour at the end of each day during the General Assembly. The intent of this recommendation received strong support. I look forward to the implementation strategy for the next General Assembly.

The first order of business was the election of a new slate of officers for the term 1997-2000. Although Vice President Fernando R. Colomb could not be present at Kyoto, he sent acknowledgment of his eagerness to assume the duties of Commission President. The officers and new Organizing Committee of Commission 51 are:

President - Fernando R. Colomb (Argentina)

Vice President - Stuart Bowyer (USA)

Organizing Committee:

Fernando R. Colomb (Argentina)

Stuart Bowyer (USA)

Jill Tarter (USA)

Ivan Almar (Hungary)

Kelvin Wellington (Australia)

Alain Leger (France)

Toby Owen (USA)

Woody Sullivan (USA)

Michel Mayor (Switzerland)

Frank Drake (USA)

There are four new Commission 51 members. They are:

Dr. Nirupama Raghavan (Nehru Planetarium, New Delhi, India)

Igor Kapisinsky (Slovak Academy of Sciences, Bratislava, Slovak Republic)

Alan Hale (South West Inst. for Space Research, Cloudcroft, New Mexico, USA)

Yaohui Qiu (Yunnan Observatory, Kunming Yunnan, PRC)

## 2. Scientific Matters

Stuart Bowyer reported on IAU Colloquium 168, The Fifth International Conference on Bioastronomy held in Capri, Italy on July 1-5, 1996. Bowyer was chair of the Scientific Organizing Committee, and Cristiano Cosmovici chaired the Local Organizing Committee. The meeting was an enormous success, attended by over 200 people from 27 countries who presented 60 papers and 44 posters. The proceedings have already been published as *Astronomical and Biochemical Origins And The Search For Life In The Universe*, Editrice Compositori (1997). The multi-disciplinary nature of the meeting can be seen in it's session titles:

Astronomical Origins  
Significance of Asteroid and Comet Impacts  
Protostellar Structures  
Discovery of Extrasolar Planets  
Origins of Life  
Evolution of Intelligence  
Searches for Evidence of Extraterrestrial Intelligent Activity

The Sixth Bioastronomy Conference will be held August 2-6, 1999 on the Big Island of Hawaii. The chair of the LOC, Karen Meech presented a summary of various possible locations, with the Hapuna Prince Hotel being the current favorite. Every attempt will be made to keep the daily costs for participants at a minimum and less expensive alternatives to hotels will be arranged (though they will require rental cars for transportation). Tours to volcanoes and the telescopes on Mauna Kea will augment the scientific content of meeting. Representatives of the scientific community in Iceland formally announced their intention of proposing to host the Seventh Bioastronomy Conference in Reykjavik in 2002.

An outline of the Commission's Triennial Report, prepared for this General Assembly was presented with thanks to the contributing authors; Toby Owen (USA), Michel Mayor (Switzerland), Andre Brack (France), Lori Marino (USA), Jill Tarter (USA). The format of these Triennial Reports has been criticized by a number of Commission Presidents. It was subsequently decided that a very brief two-page report format could be adopted by all Commissions whose subject matter was regularly reviewed in the literature, with references provided to those reviews. For Commission Presidents who so choose, additional space will be provided so that the traditional summary of scientific and scholarly activities of their Commissions can be continued to be captured in the Triennial Reports.

The only other business was the announcement that the Organizing Committee had decided to implement a resolution passed during the First Bioastronomy Conference in 1984 to award a Bioastronomy Medal for significant advances in our field. There were four recipients of this medal who were honored for their work in the detection of extrasolar planets; Prof. Michel Mayor and Dr. Didier Queloz of Switzerland and Prof. Geoff Marcy and Dr. Paul Butler of the USA. I presented Dr. Butler with his medal (actually an engraved glass award) during Joint Discussion 13 on the Detection of Extrasolar Planets, which Commission 51 co-sponsored. The other medals were mailed to the recipients, all of whom were on mountain tops at the time!

## **DIVISION IV**

### **STARS**

Division IV organises astronomers studying the characterisation, interior and atmospheric structure, and evolution of stars of all masses, ages, and chemical compositions.

#### **PRESIDENT:**

Lawrence E. Cram  
*School of Physics, University of Sydney, Sydney, NSW 2006, Australia*  
*Tel.: +61 2 9351 2537*  
*Fax.: +61 2 9660 2903*  
*E-mail: L.Cram@physics.usyd.edu.au*

#### **BOARD**

H. Zinnecker	President Commission 26
B. Barbuy	President Commission 29
J.-P. Zahn	President Commission 35
R. Pallavicini	President Commission 36
M. Gerbaldi	President Commission 45
D. Lambert	Past President Division IV

#### **PARTICIPATING COMMISSIONS:**

<b>COMMISSION 26</b>	<b>DOUBLE AND MULTIPLE STARS</b>
<b>COMMISSION 29</b>	<b>STELLAR SPECTRA</b>
<b>COMMISSION 35</b>	<b>STELLAR CONSTITUTION</b>
<b>COMMISSION 36</b>	<b>THEORY OF STELLAR ATMOSPHERES</b>
<b>COMMISSION 45</b>	<b>STELLAR CLASSIFICATION</b>

**COMMISSION 26:**

**DOUBLE & MULTIPLE STARS/ETOILES DOUBLES ET MULTIPLES**

Report by Charles E. WORLEY  
President 1994-97

**Organizing Committee 1997-2000**

PRESIDENT:	H. Zinnecker	Germany
VICE-PRESIDENT:	C. Scarfe	Canada
ORGANIZING COMMITTEE:	C. Allen	Mexico
*	J. Armstrong*	USA
	W. Hartkopf	USA
*	R. Mathieu*	USA
	A. Tokovinin	Russia
*	M. Valtonen*	Finland
	C. Worley (ex-officio)	USA

\* Incoming member of the OC

**Membership**

**NEW MEMBERS:**

R. Hindsley (USA), C. Hummel (Germany), D. Jassur (Iran), E. Martin (Spain), R. Mathieu (USA), C. Prieto (Spain), G. Torres (USA), S. Soederhjelm (Sweden) & J. Wang (China PR).

**CONSULTANT:**

B. Mason (USA)

**NECROLOGY:**

I regret to inform you of the deaths of the following members: P. Baize, W. Luyten, A. Shul'berg & P. van de Kamp

**Business Meeting**

The attendance was small (9 members). Results of the mail ballot resulted in the election to office of those names starred above. As is customary, the former Vice-President, Dr. Zinnecker, succeeds to the Presidency.

There was a brief discussion of the future direction the Commission might take, and there was general agreement that this would undoubtedly involve the combination of the classical astrometry and spectroscopy of binary stars with rapidly growing and much more accurate modern techniques. Also, it was emphasized that a true understanding of the mechanisms of star formation cannot be attained without accounting for the large number of binary and multiple stars extant.

Two important meetings concerning binary and multiple stars occurred in 1995 (Calgary, Canada) and 1996 (Santiago de Compostela, Spain). Dr. Zinnecker tentatively proposed a future Symposium about the year 2000 on general topics of interest. Worley reported on the present status of the Washington Visual Double Star Catalog and the Orbit Catalog, as well as the progress of the speckle program and the Navy Prototype Optical Interferometer.

**COMMISSION 29:**

**STELLAR SPECTRA/SPECTRES STELLAIRES**

**Report not received**

**COMMISSION 35:**

**STELLAR CONSTITUTION/CONSTITUTION DES ETOILES**

JEAN-PAUL ZAHN

*Observatoire de Paris, F-92195 Meudon, France,*

*Tel: (33) 1 45 07 78 04, Fax: (33) 1 45 07 78 72, e-mail: zahn@obspm.fr*

Kyoto, Aug. 25, 1997

The audience was extremely sparse at this business meeting, mainly because most members of the commission stayed on Kyoto only during the first week, in which were gathered most meetings of prime interest to stellar physicists, such as symposia 183, 185 and 187, and the first joint discussion.

**Organizing Committee 1997-2000**

The incoming President Jean-Paul Zahn reported the results of the consultation which was held by e-mail to renew the Organising Committee:

PRESIDENT	Jean-Paul Zahn	France
VICE-PRESIDENT	Don VandenBerg	Canada
	Romanon M. Canal	Spain
	Cesare S. Chiosi, ex officio	Italy
*	Wojciech Dziembowski	Poland
*	Joyce Guzik	USA
*	Georges Meynet	Switzerland
	Georges J. Michaud	Canada
	Alvio Renzini	Italy
*	Hideyuki Saio	Japan
	A.V. Tutukov	Russia
	Gérard P. Vauclair	France

\* Incoming members of the OC

The president greeted the newcomers, and expressed his gratitude to the four officers who were leaving the OC: Pierre Demarque, Icko Iben, André Maeder and Ken Nomoto.

The 13 candidatures for membership of the commission were all approved, giving a total membership of 334.

**Business Meeting**

The president gave a brief account on the commission presidents' meeting and recalled that one of the main tasks of the commissions is to approve the symposia and colloquia which are sponsored by the IAU. Alavaro Gimenez announced that he intended to organize during the fall of 1998 a workshop on the treatment of stellar convection.

**COMMISSION 36:****THEORY OF STELLAR ATMOSPHERES/****THEORIE DES ATMOSPHERES STELLAIRES**

PRESIDENT: Lawrence Cram  
VICE-PRESIDENT: Roberto Pallavicini

The business meeting of Commission 36 was held on Friday, 22 August. It was attended by the President (L.E. Cram) and Vice President R. Pallavicini, approximately 12 members of the Commission, and the President of Division IV, D. Lambert. Attendance was reduced by the fact there were several parallel sessions of direct relevance to members of the Commission.

The President reported on the main activities of the Commission over the past 3 years, and raised some issues of general interest. He described the process of generating the Commission Report, noting the existence of a view by some members of the IAU that Reports no longer have an abiding significance. During the discussion of this matter, several points were raised: (1) old Commission reports (prior to approx 1965) often provide a good way for an astronomer working in a particular field now to get a picture of the development of the field at that time, (2) the volume and diversity of work within a Commission's sphere of interest is very large and difficult to cover properly, (3) readership of the Reports may be small, (4) it would be easier to prepare contributions for the reports if authors accepted the task at the beginning of the 3-year period, and (5) it is not clear whether a contribution to the report should attempt to be "complete" or composed of "highlights." The President and Vice President noted these comments.

In response to a question about a test e-mail message sent some time ago, the President explained that this test had confirmed that the IAU Secretariat's e-mail list was so incomplete and out of date that it was not useful for contacting Commission members. Methods for repairing this situation were discussed.

The President invited R. Cayrel to speak to his proposed resolution concerning the zero point of the scale of bolometric magnitudes. After a constructive discussion which clarified certain points, the Commission formally resolved as follows:

**On the Zero Point of the Scale of Bolometric Magnitudes**

Noting the absence of a strict definition for the zero point of bolometric magnitudes, and the resulting proliferation of different zero points in the literature, Commission 36 resolves to define the zero point by specifying that the absolute radiative luminosity,  $L$ , of a star of absolute bolometric magnitude  $M_{\text{bol}} = 0$  has the value:

$$L = 3.055 \times 10^{28} \text{ W.}$$

This choice is intended to be close to the most current practice, and its equivalent to taking the value  $M_{\text{bol}} = 4.75$  (C. Allen, "Astrophysical Quantities") for the nominal bolometric luminosity adopted for the Sun by the international GONG project ( $L_{\odot} = 3.846 \times 10^{26} \text{ W}$ ).

**Organizing Committee 1997-2000**

The President explained the rules and criteria for the nomination for the positions of President, Vice President and Organising Committee for the next triennium. The current Vice President, Roberto Pallavicini, was

elected as President, and Dainis Dravins was elected as Vice President, unanimously. The Organising Committee was unanimously adopted to be the following list:

B. Barbuy	D. Sasselov
I. Hubeny	M. Spite
S. Owocki	K. Stepien
H. Saio	R. Wehrse

There being no further business, the President thanked Commission members for their attendance and closed the meeting.



**COMMISSION 45:                    STELLAR CLASSIFICATION/CLASSIFICATION STELLAIRE**

**PRESIDENT: HUGO LEVATO**

*Complejo Astronomico, El Leoncito, CC 467, 5400 San Juan, Argentina, e-mail: levato@castec.edu.ar*

**Officers triennium 1997-2000**

**PRESIDENT**                    Michèle Gerbaldi  
*Université de Paris-Sud XI, Centre National de la Recherche Scientifique  
Institut d'Astrophysique, 98bis Bd. Arago, F75014 PARIS, France  
e-mail: gerbaldi@iap.fr*

**VICE-PRESIDENT**            T. Thomas Lloyd Evans  
*S A A O, P O BOX 9, OBSERVATORY 7935, South Africa  
e-mail: tle@sao.ac.za*

**ORGANIZING COMMITTEE**

	Juan Claria	Argentina	claria@oac.uncor.edu
	S J Christopher Corbally	Vatican	corbally@as.arizona.edu
	John Drilling	USA	drilling@rouge.phys.lsu.edu
	Catherine Garmany	USA	garmany@jila.colorado.edu
	Richard O. Gray	USA	grayro@appstate.edu
	Donald Wayne Kurtz	South Africa	dkurtz@physci.uct.ac.za
ex-officio	Orlando Hugo Levato	Argentina	levato@castec.edu.ar
	Pierre North	Switzerland	north@obs.unige.ch
	Kazimeras Zdanavicius	Lithuania	astro@itpa.lp

**Membership**

During the triennium the Commission lost a very active member by the death of Dr. Mercedes Jaschek.

An update list of the members of the Commission has been prepared . It is accurate as far as each member with e-mail address and phone number has been contacted and replied to the request. The membership of Commission 45 is 121.

**Meetings**

During the last three years the commission has lent its support to the following scientific meetings:

The MK Process at 50 Years: A Powerfull Tool for Astrophysical Insight  
held in Tucson, USA, in September 1993

IAU Symposium 162: Pulsation, Rotation & Mass Loss in Early Type Stars  
Juan-les-Pins, October 1993

IAU Colloquium 148: Future Utilization of Schmidt Telescopes  
Bandung in March 1994

IAU Symposium 166: Astronomical & Astrophysical Objectives of Sub-milliarcsecond Optical Astrometry held in Le Hague in August 1994

IAU Symposium 167: New Developments in Array Technology & Applications held in Le Hague in August 1994

IAU Symposium 177: The Carbon Star Phenomenon Antalya in May 1996

### Meeting on Automatic Spectral Classification

Report by Christopher J. Corbally, Vatican Observatory

This meeting has been held during the General Assembly in Kyoto.

### IMPRESSIONS

"Automated spectral classification techniques are mature," began Ted von Hippel in the opening talk of the session. *This remains my dominant impression.*

For details, particularly on how both stellar spectral and luminosity types can now be derived by artificial neural networks (ANNs) and weighted metric-distance methods (MDMs) with the same accuracy as that obtained by the human expert, I would refer you to the papers by von Hippel, Gulati, and Weaver. From Weaver's paper we learnt how this accuracy is achieved even for relatively low-resolution, near-infrared (NIR) spectra. In this NIR spectral region, Wing showed that TiO types correlate very well with Keenan types. These presenters joined in making the point that such heavy-duty techniques as ANNs and MDMs are needed because *pattern recognition in spectra is a highly non-linear problem, but one for which humans can be readily trained to find a solution.*

### SHOPPING LIST

The complete training of automated systems now needs more input: i.e., a large, high-quality, homogeneous library of digital spectra that span the MK System's standard stars. This library would firmly anchor an *automated classification package in the well-proven and productive MK System.* Richard Gray et al. can foresee such a package lodged at telescopes in the output stream of data-acquisition computers. These computers would instantly translate spectra into rough MK classifications and so signal anything of immediate interest. Back at home would be a more sophisticated package that should include, at least via Internet, a human classifier to cream off the most peculiar spectra.

Could the automated classification techniques be trained on synthesized spectra? Yes, for an automated system has already been so trained (see von Hippel) and even yielded metallicities, besides effective temperatures and surface gravities. But these data depend on current atmospheric models, and here Kurucz cautioned that at present "observations have nothing to do with stars," (and laughter greeted this expression of his call for more atomic and molecular data and more physically precise models). For durability amid changing theory, it is much better to follow the wisdom of "M" and "K" and anchor spectral classifications in an autonomous system of standards through the proposed comprehensive library. This library should also please our galaxy-oriented colleagues who want the best possible input to synthesize stellar populations.

While the comprehensive spectral library and more line data were the main items on the session's shopping list, other needs surfaced: "red flags" on auto-classified spectra to indicate special difficulty with the classification and so special peculiarities (actually, this appeared to be a call to calibrate goodness-of-fit further); a more fully developed, metal-weak dimension to parallel the MK System; an investigation why Houk's luminosity class IV stars were not well-distinguished from class V and class III by ANNs; and an understanding of the best training strategies for ANNs and MDMs. There was general agreement that the best way to fulfil these needs would first be at the local level and only then to think of global implementation.

## THE FUTURE

The session ended with a sense of optimism. The mega-spectral outputs of surveys such as the Sloan Digital Sky Survey, described in the paper by Andy Connolly, could be coped with and the potential galactic-structure and stellar-atmospheres insights retrieved. Automated spectral classification has come of age and is ready -- with sufficient funding -- to enter this new era of data acquisition. The meeting was concluded by Ch. Corbally with a certain optimistic view about the possibility of coping with the outputs of the big surveys such as Sloan Digital Sky survey. The procedures for automated spectral classification can be applied and useful results for galactic structure studies may be obtained.

## Working Groups

### WG ON STANDARD STARS

Chairperson: Robert Garrison

### WG ON AP AND RELATED STARS

Chairperson: M. Takada-Hidai (Japan)

Ed. Newsletter: P. North (Switzerland)

### WG ON PECULIAR RED GIANTS

Chairperson: Robert F. Wing

### WG ON ACTIVE B STARS

Chairperson: D. Baade

**DIVISION V**  
**VARIABLE STARS**

Division V provides a joint forum for the study of stellar variability in all its manifestations, whether due to pulsations, surface inhomogeneities, evolutionary changes, or to eclipses and other phenomena specifically related to double or multiple stars.

**PRESIDENT**                      Mikolaj Jerzykiewicz                      Past President Commission 27  
*Astronomical Institute, Wroclaw University, Ul. Kopernika 11*  
*PL - 51 622 Wroclaw, Poland*  
*Tel. +48 71 48 2434*  
*Fax. +48 71 48 2434*  
*E-mail: mjerz@astro.uni.wroc.pl*

**BOARD**

D.W. Kurtz	President Commission 27
E. Guinan	President Commission 42
M. Rodonò	Past President Commission 42
Y. Kondo	Past President Division V
L. Balona	Commission 27 Member
J. Sahade	Commission 42 Member

**PARTICIPATING COMMISSIONS**

<b>COMMISSION 27</b>	<b>VARIABLE STARS</b>
<b>COMMISSION 42</b>	<b>CLOSE BINARY STARS</b>

**COMMISSION 27:**

**VARIABLE STARS/ETOILES VARIABLES**

**PRESIDENT:** Mikolaj Jerzykiewicz  
**VICE-PRESIDENT:** Donald W. Kurtz

Report by D.W. Kurtz

**Officers Triennium 1997-2000**

<b>PRESIDENT:</b>	D.W. Kurtz	South Africa	dkurtz@physci.uct.ac.za
<b>VICE-PRESIDENT:</b>	J. Christensen-Dalsgaard	Denmark	
<b>ORGANIZING COMMITTEE MEMBERS:</b>			
	C. Cacciari	Italy	
	P. Cottrell	New Zealand	
	P. Harmanec	Czech republic	
<b>Ex officio</b>	M. Jerzykiewicz	Poland	
	J. Matthews	Canada	
	P. Moskalik	Poland	
	D. Sasselov	USA	
	D. Welch	Canada	
	P. Whitelock	South-Africa	

**Membership**

**NEW MEMBERS OF THE COMMISSION**

Kem Cook, Peter Cottrell, Katy Tsvetkova, Stanislaw Zola, John Caldwell, Denis Gillet, Steven Kawaler, Howard H. Lanning, Albert Bruch, Shinichi Tamura, Eric Gosset, J. Robert Buchler, F. Kerschbaum, C. Aerts

**RESIGNATION**

K.K. Kwee

**NEW IAU MEMBERS**

The commission has supported the application of: Alisher Hojaev, Astronomical Institute, Uzbek Academy of Sciences, Tashkent, Uzbekistan, for the membership of the IAU.

**Communication**

The home page of Commission 27 (made by Andras Holl, Konkoly Observatory) is available from the home page of Konkoly Observatory:

<http://www.konkoly.hu/IAUC27/index.html>

The most important news (deadlines etc) are promised to be circulated by normal mail.

### Support of Working Groups

Commission 27 is going to continue the support of the running working groups on Active B stars, Ap and related stars and Peculiar Red Giants. More suggestion is welcome.

### Professional - amateur connection

J. Percy emphasized that the role of amateurs is increasing in variable star research since not only visual but photoelectric and CCD observations are obtained by them. J. Mattei reported on the activity of AAVSO. The scientific meetings (May 1997, Switzerland and AAS meeting in June, 1997) proved the increasing connection of professional and amateur astronomers (50% - 50%). Amateur-professional common publications are submitted. More and more photoelectric networks (presently Japan+AAVSO) are established. Any other country is welcome, data are free for everybody. Suggestion: the small telescopes, getting to be closed, could be used by amateurs and professionals.

An idea of an IAU Coll organized in Canada on amateurs, teaching and connection between amateurs and professionals was mentioned by J. Percy for getting support. T. Oswald outlined the difference in the activity of AAVSO and IAPPP.

IAPPP does not have as long tradition as AAVSO but, since small observatories with more serious equipments are also involved, it could be regarded as a deeper organization.

### Future meetings

According to the election in Los Alamos the next pulsation conference will be held in Hungary, 1999. Tentative proposal was presented by L. Szabados as follows:

Title: The Impact of Large-Scale Photometry on the Research of Pulsating Stars Date: August 9-13, 1999, Budapest (Total solar eclipse in Hungary on August 11, 1999).

Highlights: massive photometries, structure of the instability strip, precise light curve analyses, double-mode variables, Blazhko-variables, local reddening and stellar distribution, distance scale, etc.

### Division

NEW PRESIDENT: M. Jerzykiewicz (Poland).

Mike Jerzykiewicz is the new president of division V which includes us (C27) and binary stars (C42). Division V now has a board which consists of:

The presidents of C27 and C42, D. Kurtz and E. Guinan, the past-presidents of C27 and C42, M. Jerzykiewicz and M. Rodonò, the past-president of Division V, Y. Kondo and one member each from C27 and C42, L. Balona (C27) and J. Sahada (C42).

The EC will now deal primarily with the Divisions, rather than with the commissions directly. Thus our support of Symposia and Colloquia will be channelled through our division to the EC.

### Miscellaneous

#### IBVS

There was a report on the operation of IBVS by Katalin Olah. IBVS is a privately operated and funded journal. The editors are Katalin Olah and Laszlo Szabados; Andras Holl is the technical editor, and Zoltan Kovari is the administrative editor. The journal has an editorial/advisory board to assist the editors in scientific aspects of the editing process advise the editors in the management of the journal.

Chris Sterken has just concluded 6 years as chair of the advisory board. The new chair of the board is Petr Harnanec.

IBVS published about 150 issues a year. Rejection rates are now about 25%, and language is often a problem.

The announcement of new variables can be problematic, especially where the type of variability is not well characterised.

New ground rules for such announcements are being discussed by the advisory board now. This subject generated a lot of excitement at the business meeting - obviously many people felt threatened that they would not be able to announce their own new variables, and found this distressing. That is probably not what is going to happen to the professionals, although some types of announcements may be shortened and/or gathered into a few announcement issues per year. Note the "some" - not all by any means, so don't panic.

IBVS is now listed on ADS and the visitors to the Website increased by a factor of 5 with that.

## GCVS

Nicolai Samus talked about the GCVS and their problems. They have minimal salaries and NO funds for anything else. Nevertheless, progress has been made in going electronic - ultimately full connection on the internet plus cross referencing with other data bases and services is desired.

There are scientific problems which are being addressed:

Massive surveys are discovering new variables by the tens of thousands. This is very exciting, but does generate a huge amount of work for the GCVS. Should the new survey variables be incorporated in the GCVS? Opinions vary. HIPPARCOS liased with the GCVS before publication to give traditional variable star names to the new variables. Should and will the massive photometric surveys do the same? Feelings on this subject are likely to be strong and cover a wide range.

The entire institute is under threat of closure because of the funding crisis in Russia.

They would obviously like to put the entire GCVS on-line. If you know of any funding possibilities, please help. You can check out "Astronet" at the SternbergAstronomical Institute at

[/www.sai.msu.su/](http://www.sai.msu.su/)

although, because of the severe funding crisis you will not get into GCVS yet.

## Scientific meetings

Finally, E. Guinan proposed that we (C27 and C42) consider a joint meeting of our two commissions in either 1999 or 2000. We are already well along the way to the next pulsation meeting in August 1999 in Budapest; Geza Kovac and Laszlo Szabados have produced an impressive first draft proposal

There are also binary star meetings in 1999, including one in honor of Brian Warner for his 60th birthday. So 1999 is out.

## Next General Assembly

2000 is the next GA in Manchester. If we are to follow up on Ed's suggestion, then we will probably be proposing a Symposium at the time of the GA. There will need to be some stellar Symposium, so we may have a chance if we produce a good proposal.

**Report of Business Meeting: August 27, 1997**

PRESIDENT: Marcello Rodonò

ORGANIZING COMMITTEE: E.F. Guinan (Vice-President), Y. Kondo (Past-President), J.V. Clausen, H. rechsel, P.P. Eggleton, B.J. Geldzahler, G. Hill, S.L. Kenyon, F. Szkody, R.E. Taam, A.V. Tutukov, O. Vilhu, J.C. Wheeler, A. Yamasaki, Di-Sheng Zhai.

**Organizing Committee (1997-2000)**

The following composition of the OC for the triennium 1997-2000, consisting of newly elected and ex-officio members, was approved:

PRESIDENT:	Edward F. Guinan	USA
VICE PRESIDENT:	Paula Szkody	USA
ORGANIZING COMMITTEE:	Luciana Bianchi	Italy
	Jens Viggo Clausen	Denmark
	Horst Drechsel	Germany
	Graham Hill	UK
	Scott J Kenyon	USA
	Virpi S Niemela	Argentina
	Yoji Osaki	Japan
	Marcello Rodonò	Italy
	Christiaan L Sterken	Belgium
	Ronald E Taam	USA
	Osmi Vilhu	Finland
	J Craig Wheeler	USA
	Janet H Wood	UK

**Commission membership and new members**

During the course of the past triennium the following distinguished and active members of Commission No. 42 passed away: Mario G. Fracastoro, John B. Irwin, Jürgen Rahe, Walter F. Wargau, William H. Wehlau, Igor Yurkevich & Di-Sheng Zhai.

The Commission members were standing in silence for a minute to acknowledge their valuable and outstanding contributions to the Commission activities.

The total number of Commission members in the past triennium was 348.

NEW MEMBERS named by the OC: Ho-II Kim (Korea), Chun-Hwey Kim (Korea), Andrew R. King (U.K.), Jeffrey L. Linsky (U.S.A.), Mario Livio (Israel), Lawrence W. Ramsey (U.S.A.), P. Vivekananda Rao (India), already proposed at the previous GA, and Luciana Bianchi (Italy), Albert Bruch (Germany), Giuseppe Cutispoto (Italy), Andrea K. Dupree (U.S.A.), Alister B. Hojaev (Uzbekistan), Howard H. Lanning (U.S.A.), Antonino F. Lanza (Italy), James E. Neff (U.S.A.), Christiaan L. Sterken (Belgium).

CONSULTANTS: Luigi Stella (Italy), Corrado Trigilio (Italy), Grazia Umana (Italy)



**MEMBERS PROPOSED BY NATIONAL COMMITTEES:** G. Anupama (India), Hrvoje Bozic (Croatia), Joao Canalle (Brazil), Rudolf Duemmler (Finland), Mohammad Edalati Sharbaf (Iran), Nickolas Elias (USA), Sergei Fabrika (Russia), Carole Haswell (UK), Coel Hellier (UK), Harold Kenny (Canada), Ulrich Kolb (UK), Urs Muerset (Switzerland), Grzegorz Pojmanski (Poland), Konstantjn Postnov (Russia), Frederic Rasio (USA), Frederick Ringwald (USA), Maximilian Ruffert (Germany), Roberto Turolla (Italy), Rolf Walder (Switzerland), Tae Yoon (Korea R).

The Commission members unanimously approved the above listed candidates and reiterates the traditional conditions to be met by each candidate for admission, i.e., a) Ph.D. in Astronomy or Physics, b) at least three substantive papers published in refereed internationally reckoned journals, with the candidate as first author or among the first three authors. The President is required to check that these two criteria are met before passing the list of the new Commission members to the IAU secretariat.

### IAU Division structure

Commissions No. 42 and No. 27 have agreed to merge into **DIVISION V: Variable Stars**. This merging was unanimously welcomed, as well as the proposed restructuring of IAU into Divisions. The Board of Directors set up by Yoji Kondo, Division President for the triennium just ending, is composed of Y. Kondo (ex officio), M. Jerzykiewicz and M. Rodonò (Commissions' Presidents), D. Kurtz and E. Guinan (Commissions' Vice-Presidents), L. Balona and J. Sahade, as distinguished members of the two Commissions. The Board of Directors meet on August 25 in Kyoto and elected M. Jerzykiewicz as new Division President for the 1997-2000 term. The election was unanimously approved. Final IAU approval will occur during the course of the upcoming GA.

### Working Groups

The request of the Chairman of the *Working Group on Active B Stars*, Myron Smith, that this WG be affiliated to Comm. 42, has been preliminarily accepted by the Commission President, after consultation with SOC members. The new IAU rules, however, imply that WGs approved within Commissions or Divisions should be regarded as internal organization structures. IAU WGs are promoted and are subject to the approval of the Executive Committee.

### Sponsored Meetings

Following consultations of the OC members by the President, Commission sponsorship or co-sponsorship was granted to the following meetings and Joint Discussions (proposer names are given between brackets):

- Progress of Observational Accuracy and Modelling Variable Stars (Mine Takeuti), IAU Kyoto
- *Flares and Jets in Astrophysics* (Kazunari Shibata), IAU Kyoto
- *Stellar Evolution in Real Time* (Robert Koch and Edward Guinan), IAU Kyoto
- The Hot Luminous Corner of the H-R Diagram (Mariko Kato), IAU Kyoto
- *The Hot Universe* (Katsuji Koyama), IAU Kyoto
- *Hipparcos and Tycho Results* (Catherine Turon), IAU Kyoto
- Electronic Publishing: now and the future (Antony G. Hearn), IAU Kyoto
- Population Synthesis: from Planets to Black Holes and from Black Holes to the Universe (E.P.J. van den Heuvel, V.M. Lipunov), September 1997 (Moscow)
- *Accretion Phenomena and Associated Outflows* (D. Wickmasinghe), June-July 1998 (Port Douglas, Queensland, Australia)
- *Precise Radial Velocities* (J. Hearnshaw), June 1998 (Victoria BC, Canada)

### Julian Date vs MJD (JD - 2 400 000.5)

IAU Commissions 4, 19, and 31 objected the *Resolution C3* passed at the IAU GA in The Hague banning the use of MJD, introduced in 1973 by *Resolution 4*.

A Working Group, chaired by Jorge Sahade and consisting of representatives of Commission 4, 19, 27, 30, 31, and 42 (H. Fiegel, T. Fukushima, M. Jerzykiewicz, Y. Kondo, D. McCarthy, M. Rodonò, C. Sharfe, and P.K. Seidelmann), was formed by the IAU General Secretary to consider the issue. The WG proposed the following resolution, that was illustrated by the WG Chairman:

***The International Astronomical Union,***

*recognizing*

the need for a system of continuous dating for the purpose of analyzing time-varying astronomical data, and that both JD and MJD have been employed for this purpose in astronomy, geodesy, and geophysics,

*recommends*

that JD is used to record the instants of the occurrences of astronomical phenomena,

that for those cases where it is convenient to employ a day beginning at midnight, the MJD (equivalent to JD - 2 400 000.5) be used, and

that, where there is any possibility of doubt regarding the usage of MJD, care be exercised to state specifically its definition.

From the floor the question was raised whether it was an appropriate procedure to discuss and approve this resolution during the first GA, before having submitted it to the appropriate commissions for approval. Commission No. 42 expresses strong concern for the unusual and possibly improper procedure adopted in this circumstance.

### Commission Report (1993-96)

The report of the Commission President on the scientific activity in the last triennium was published in the IAU Transaction. A number of people did actively collaborated in the effort. Their substantial contribution was warmly acknowledged by the President. Offprints of the Commission Report were distributed to all participants.

### Information Bulletin on Variable Stars

*(Discussion deferred to the business meeting to be held jointly with Commission No. 27)*

### Bibliography and Program Notes on Close Binaries

Following the resignation of Atsuma Yamasaki, to whom the warmest thanks of the Commission were presented for the wonderful job done, a new *Editor-in-chief* (Horst Drechsel) was nominated by the Commission President. The editorial board includes: J. Carrigan, O. Demircan, R. Haefner, T.J. Herczeg, V.G. Karetnikov, C. Maceroni, P. Mayer, R.G. Samec, D. Scarfe, M. Vetesnik, and A. Yamasaki.

The editorial board proposed to *dismiss the "Current Programs" section* because it appears strongly biased due to the small number of contributors (usually within the editorial board, only), and therefore rather incomplete and unrepresentative of the actual programs being done. The Commission members agree.

Accordingly, following the Editor-in-chief proposal, it was unanimously agreed to rename the "*Bibliography and Program Notes on Close Binaries*" into "*Bibliography on Close Binaries (BCB)*".

### Other business and science session

It was decided to held the second business meeting jointly with Commission No. 27 to discuss matters of common interest, such as the publication policy of the "*Information Bulletin of Variable Stars*", and dedicate the last thirty minutes of this meeting to the presentation of a survey paper by S. Slee, K. Jones and E. Budding on "*Binary star radio survey data*".

**DIVISION VI**  
**INTERSTELLAR MATTER**

Division VI gathers astronomers studying the diffuse matter in space between the stars, ranging from primordial intergalactic clouds via dust and neutral and ionised gas in galaxies to the densest molecular clouds and the processes by which stars are formed.

**PRESIDENT:** Michael A. Dopita  
*Mount Stromlo & Siding Spring Observatories, Private Bag, Weston Creek PO,  
Canberra, ACT 2611, Australia*  
*Tel. +61 2 6249 0212*  
*Fax. +61 2 6249 0233*  
*E-mail: michael.dopita@anu.edu.au*

**BOARD**

See following page

**PARTICIPATING COMMISSION:**

**COMMISSION 34                    INTERSTELLAR MATTER**

**COMMISSION 34:****INTERSTELLAR MATTER/MATIERE INTERSTELLAIRE**

Division VI of the International Astronomical Union deals with Interstellar Matter, and incorporates Commission 34. It gathers astronomers studying the diffuse matter in space between the stars, ranging from primordial intergalactic clouds via dust and neutral and ionised gas in galaxies to the densest molecular clouds and the processes by which stars are formed. Following the 23rd General Assembly held at Kyoto, in August 1997, there are now ~730 Division/Commission members.

**Officers 1997-2000****PRESIDENT:**

Michael A. Dopita, Australia  
*Mount Stromlo & Siding Spring Observatories, Private Bag, Weston Creek PO. Canberra, ACT 2611, Australia*  
*Tel. 61 6 249 0212*  
*Fax. 61 6 249 0233*  
*E-mail : michael.dopita@anu.edu.au*

**VICE-PRESIDENT:**

Bo Reipurth, Chile  
*ESO*  
*E-mail: breipurth@eso.org*

**ORGANIZING COMMITTEE:**

Rafael Bachiller, Spain, 1997 <bachiller@oan.es>

Molecular clouds. Star formation. Protostars. Bipolar molecular outflows. Neutral matter in planetary, proto-planetary nebulae. Interstellar molecular lines. Interstellar chemistry. Millimeter-wave radioastronomy.

Michael Burton, Australia, 1994 <mgb@newt.phys.unsw.edu.au>

Infrared and Antarctic astronomy, star formation, excitation of molecular clouds, molecular shock waves and photodissociation regions, the Orion nebula.

Michael Dopita, (President), Australia, 1997-2000 <Michael.Dopita@anu.edu.au>

Active Galactic Nuclei, Shock Theory, Photoionisation Modelling, Planetary Nebulae, Supernova Remnants, Star Formation & Chemical Evolution.

John Dyson, UK, 1997, <ed@ast.leeds.ac.uk>

The theory of the interstellar medium, gas dynamics, Active Galactic Nuclei, ionisation and recombination fronts.

Debra Elmegreen, USA, 1994 <elmegreen@vaxsar.vassar.edu>

Star formation and spiral structure in galaxies at optical, near-infrared, millimeter, and centimeter wavelengths.

Thomas Henning, Germany, 1997, <henning@astro.uni-jena.de>

Interstellar dust, Laboratory astrophysics, Star formation, Line spectroscopy & Radiation hydrodynamics.

Sun Kwok, Canada, 1997, <kwok@iras.ualgary.ca>

Evolution of planetary nebulae interstellar dust, and circumstellar envelopes of AGB stars. Chair Planetary Nebula Working Group.

Haruyudi Okuda, Japan, 1994, <kuda@astro.isas.ac.jp>

Infrared studies of interstellar matter. Infrared surveys by balloon and satellite.

Guillaume Pineau des Forets, France, 1997, <forets@obspm.fr>

Molecules and interstellar chemistry, gas dynamics and MHD shocks, photodominated regions.

John Raymond, USA, 1997, <jraymond@cfa.harvard.edu>

The theory and observation of optical, UV and X-ray emission from interstellar shock waves.

Bo Reipurth, (Vice Pres.), Chile/ESO, 1997- 2000, <breipurt@eso.org>

Pre-main sequence objects, Herbig-Haro jets and outflows.

Guillermo Tenorio-Tagle, Spain, 1997, <gtt@ast.cam.ac.uk>

Theoretical multi-dimensional hydrodynamics of HII regions and galactic outflows.

Sylvia Torres-Peimbert, Mexico, 1997, <silvia@astrocu.unam.mx>

Spectroscopy and Chemical abundances of Planetary Nebulae and HII regions.

Ewine van Dishoeck, NL, 1994, <ewine@strw.leidenuniv.nl>

Interstellar molecules; Star-formation, Basic molecular processes; Laboratory astrophysics. Secretary: Astrochemistry WG.

Sueli Viegas-Aldrovandi, Brazil, 1994, <viegas@vax.iagusp.usp.br>

Thomas Wilson, Germany, 1994, <p073twi@mpifr-bonn.mpg.de>

Sub-mm Astronomy.

### Working Groups of Commission Number 34

#### PLANETARY NEBULA WORKING GROUP MEMBERS

Chair:	Sun Kwok	USA	kwok@iras.ucalgary.ca
	Agnes Acker	France	acker@cds6.u-strasbg.fr
	Michael J. Barlow	UK	mjb@star.ucl.ac.uk
	George Jacoby	USA	jacoby@noao.edu
	Jim Kaler	USA	kaler@astro.uiuc.edu
	Walter Maciel	Brazil	maciel@orion.iagusp.usp.br
	Dipankar C.V. Malick	India	dcvmlk@iiap.ernet.in
	Mario Perinotto	Italy	mariop@arcetri.astro.it
	Stuart Pottasch	Netherlands	s.r.pottasch@astro.rug.nl
	Luis Rodriguez	Mexico	luisfr@astrocu.unam.mx
	Detlef Schönberner	Germany	deschoenberner@aip.de
	Yervant Terzian	USA	terzian@astrosun.tn.cornell.edu
	Roumald Tylenda	Poland	tylenda@ncac.torun.pl
	Peter Wood	Australia	<wood@mso.anu.edu.au>

#### ASTROCHEMISTRY WORKING GROUP MEMBERS

Chair: D.A. Williams, Dept. of Physics & Astronomy, University College London, Gower Street, London WC1E 6BT, U.K., e-mail: daw@star.ucl.ac.uk, FAX: 44 171 380 7145, Tel: 44 171 391 1355

Secretary: E.F. van Dishoeck, Leiden Observatory, University of Leiden, P.O. Box 9513, 2300 RA Leiden, The Netherlands, e-mail: ewine@strw.leidenuniv.nl, FAX: 31 71 5275819, Tel: 31 71 5275814

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### Divisions VI Working Group Proposals

The Organising Committee of Division VI is in the process of forming two new ISM working groups to monitor progress in their fields and to help develop proposals for future IAU Symposia/Colloquia.

There already exist the Planetary Nebula Working Group and the Astrochemistry Working Group and these have served us well in organising periodic seminars in these subject areas. However, our wish to form new groups is motivated by the realisation that other areas of the ISM are not properly represented in the current organisation.

These working groups would be:

1. Working Group on the Hot and Extragalactic ISM
2. Working Group on Star Forming Regions

We propose that these each take in ex-officio members being either the Division Presidents, or else proposed by the liaising Divisions.

## WORKING GROUP ON STAR FORMING REGIONS

At this time we have a list of nominations (all have been approached and are willing to serve) for, which Rafael Bachiller would chair. These are as follows:

R. Bachiller (Chair)	Spain	34	Radio (mm), low-mass SFR
M. Burton	Australia	34	Infrared, shocks
L. Cram	Australia	Pt Div. IV	
Y. Fukui	Japan	34	Radio (mm), clouds, outflows
G. Garay	Chile	40	Radio (cm), high-mass SFR
T. Henning	Germany	34	Dust, mm continuum
S. Lizano	Mexico	34	Theory
F. Palla	Italy	34	Theory, IR, intermed-mass SFR
J. Palous	Czech Rep.	33	Nominated: Div VII
B. Reipurth	USA	34 (VPt)	HH objects, optical
A. Sargent	USA	34	Radio(mm), disks, low/interm. mass
S. Strom	USA	36,27	Optical/IR

The Executive Committee is expected to formally constitute this Working Group by the end of January 1997, and to give agreement in principle to the setting up of the Working Group on the Hot and Extragalactic ISM. Anyone who wishes to seek nomination in the latter WG should contact the President of Div VI:

**Meetings supported by Division VI/Commission 34**

IAU Symposium on Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies  
Puerto Vallarta, 3-7 November 1998

Contact: Prof. Karel A. van der Hucht <K.vanderHucht@sron.ruu.nl>

IAU Symposium on "New Views of the Magellanic Clouds"  
13-19 July 1998, Victoria, Canada

Contact: Prof. You Hua Chu <chu@astro.uiuc.edu>

**Condolences**

It is with deep regret that we report that Dr. Tarafdar passed away on September 7, 1996.

**DIVISION VII**  
**GALACTIC SYSTEM**

Division VII provides a forum for astronomers studying our home galaxy, the Milky Way, which offers a unique laboratory for exploring the detailed structure of the stellar and gaseous components of galaxies and the processes by which they form and evolve.

**PRESIDENT:**                    Kenneth C. Freeman  
*Mount Stromlo & Siding Spring Observatories, Private Bag,  
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**BOARD**

G.S. Da Costa	Vice President Commission 37
J.J. Binney	Past President Division VII
L. Blitz	
F. Matteucci	
D. Spergel	Vice President Commission 33

**PARTICIPATING COMMISSIONS:**

<b>COMMISSION 33</b>	<b>STRUCTURE AND DYNAMICS OF THE GALACTIC SYSTEM</b>
<b>COMMISSION 37</b>	<b>STAR CLUSTERS AND ASSOCIATIONS</b>



**COMMISSION 33:**

**STRUCTURE & DYNAMICS OF THE GALACTIC SYSTEM  
STRUCTURE & DYNAMIQUE DU SYSTEME GALACTIQUE**

**Report not received**

**COMMISSION 37:****STAR CLUSTERS & ASSOCIATIONS  
AMAS STELLAIRES & ASSOCIATIONS****Officers 1997-2000**

**PRESIDENT:** Dr. Gary S. Da Costa  
*Mount Stromlo Observatory, Private Bag Western Creek PO Canberra, ACT  
 2611, Australia  
 Phone: 61 2 6249 0236, Fax: 61 2 6249 0233, E-mail: gdc@mso.anu.edu.au*

**VICE-PRESIDENT:** Georges Meylan  
*ESO, Karl Schwarzschild-Str 2, D 85748 Garching bei München,  
 Germany, Phone: 49 89 320 06 293, Fax: 49 89 320 23 62, E-mail:  
 gmeylan@eso.org*

**ORGANIZING COMMITTEE:**

	Dr. Sverre Aarseth	UK
	Dr. Roberto Buonanno	Italy
	Dr. Russell Cannon	Australia
	Dr. Vittorio Castellani	Italy
	Dr. Kyle Cudworth	USA
ex officio	Alessandro Feinstein	Argentina
	Dr. Charles Lada	USA
	Dr. Ata Sarajedini	USA

Drs Cannon and Sarajedini were added to the OC in Kyoto succeeding Dr. Mermilliod and Dr. Zhao.

**Membership**

The following new members have been co-opted during the General Assembly: Alberto Buzzoni (Italy), Michael Chryssovergis (Greece), Elvira Covino (Italy), Kathleen DeGioia-Eastwood (USA), Mohammad Hossein Dehghani (Iran), Laurent Drissen (Canada), Miroslaw Giersz (Poland), Pavel Kroupa (Germany), Peter James T. Leonard (USA), Rosemary Mardling (Australia), Randy L. Phelps (USA), Andres Eduardo Piatti (Argentina), Charles Franklin Prosser Jr. (USA), Ata Sarajedini (USA), Evgeni Semkov (Bulgaria), Koji Takahashi (Japan), Luciano Terranegra (Italy), Polina E. Zakharova (Russia).

The total number of the members is then ~230.

**Activity during the General Assembly**

At Kyoto Commission 37 was a Supporting Commission for:

JD 15, The Combination of Theory, Observation, and Simulation for the Dynamics of Stars and Star Clusters in the Galaxy,

and a Co-Supporting Commission for:

Symposium 186	Galaxy Interactions at Low and High Redshift
JD 1	Abundance Ratios in the oldest Stars: Bulge and extreme Halo
JD 10	Low-Luminosity Stars
JD 14	The first Results of Hipparcos and Tycho.

**DIVISION VIII**  
**GALAXIES AND THE UNIVERSE**

Division VIII gathers astronomers engaged in the study of the visible and invisible matter in the Universe at large, from Local Group galaxies via distant galaxies and galaxy clusters to the large-scale structure of the Universe and the cosmic background radiation.

**PRESIDENT:** Peter A. Shaver  
*European Southern Observatory, Karl Schwarzschildstrasse 2  
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Fax. +49 89 320 06480  
E-mail: pshaver@eso.org*

**BOARD:**

F. Bertola	present President Commission 28
J. Narlikar	past President Commission 49
S. Okamura	present Vice-President Commission 28
J. Peacock	present President Commission 49
A. Szalay	Vice-President Commission 49
V. Trimble	past President Commission 28

**PARTICIPATING COMMISSIONS:**

<b>COMMISSION 28</b>	<b>GALAXIES</b>
<b>COMMISSION 47</b>	<b>COSMOLOGY</b>

As elaborated in the January 1995 issue of the IAU Information Bulletin, the Division coordinates the activities of the affiliated Commissions, including proposals for new Commissions, Working Groups, IAU Symposia and Colloquia, and Joint Discussions at General Assemblies.

The possibility of creating further Commissions within Division VIII has been discussed over the last three years. Specifically, it was suggested that there could be four Commissions within the Division : Cosmology (or Formal Cosmology), Large Scale Structure, Active Galaxies, and Normal Galaxies & Clusters. It was finally decided to keep to the original two Commissions for the time being, but this issue will be re-visited in the future, and Suggestions are always welcome.

**COMMISSION 28****GALAXIES****Officers 1997-2000**

PRESIDENT:	Francesco Bertola	Italy	bertola@astrpd.pd.astro.it
VICE PRESIDENT:	Sadanori Okamura	Japan	okamura@astron.s.u-tokyo.jp
ORGANIZING COMMITTEE:	Chantal Balkowski	France	balkowsky@obspm.fr
	David Burstein	USA	burstein@samuri.la.asu.edu
ex-officio, past president	Sandip Chakrabarti	India	chakraba@tifrvax.tifr.res.in
	Pieter de Zeeuw	Netherlands	tim@strw.leidenuniv.nl
	Michael Feast	South Africa	mwf@uctvms.uct.ac.za
	John Huchra	USA	huchra@cfa.harvard.edu
	Virginia Trimble	USA	vtrimble@uci.edu/ vtrimble@astro.umd.edu
	Richard Wielebinski	Germany	p022rwi@mpifr-bonn.mpg.de
	Anatole Zasov	Russia	zasov@sai.msu.su
	Zhen-Long Zou	China	zouzl@sun.ihep.ac.cn

Report prepared by V. Trimble.

**During the triennium**

The Commission sponsored or co-sponsored several symposia and colloquia, which were prioritized by the members of the Committee annually. A single mailing went to the entire membership in January, 1996 soliciting volunteers and nominations of people to help with the triennial report, serve on the Committee, and otherwise participate in the activities of the Commission. Of the 30 or so people who responded or were nominated, several indeed helped write the report, several; are among the new Committee members, and a couple were among the suggestions from Division VIII for the special Nominating Committee.

**At the General Assembly**

The Commission sponsored Symposium 187 and Joint Discussions 2 and 11. It was a co-sponsor of S183, 184 and 188 and of JD 1,18,21 and 22. During the business meeting, the new slate of officers was elected and 25 current IAU members who had asked to join the commission were elected to membership. In addition, about 11 newly elected IAU members had Commission 28 as their first choice. All were, in principle, accepted, although in a couple of cases it was clear that they really wanted to join 29 or some other Commission. No enthusiasm was expressed for preserving any of the working groups that have existed in the past, including redshifts, Photometry and Internal Structure, Magellanic Clouds, and Supernovae; and all of these have now lapsed.

The possibility of splitting the commission into two, devoted to active and normal galaxies respectively was discussed briefly (as it had also been at the earlier meeting of Division VIII). No strong desire to do this was expressed; several members disagreed on the distinction between normal and active galaxies; and in the light of the current development of the Divisional structure, the decision was made to leave things as they are. The Commission thus currently has about 700 members.

## COMMISSION 47: COSMOLOGY/COSMOLOGIE

J.V. NARLIKAR

*Inter-University Center for Astronomy & Astrophysics, Post Bag 4, Pune 411 077, India*  
*e-mail: jvn@iucaa.ernet.in*

Commission 47 held its Business Meeting on August 26, 1997, 09:00 hours, Room D

### Attendance

J.V. Narlikar (President in the Chair), P. Shaver (Vice-President), B. Partridge (Past-President and President, Division VIII), Y. Chu (O.C. Member), J. Einasto (O.C. Member), D. Jauncey (O.C. Member), P. Crane, A. Fairall, B. Tully, M. Wanas

### Condolences

The President welcomed all those present and began the proceedings by recording sorrow at the passing away of the Commission 47 members during 1994-97. He informed that as per the information supplied by the IAU Secretariat, the Commission had lost the following members:

Professor Hannes Alfvén  
Dr. Nicole J. Bel  
Professor Gérard de Vancouleurs  
Professor Robert H. Dicke  
Professor Odon Godart  
Professor Roger J. Tayler  
Dr. B.C. Xanthopoulos  
Dr. A.L. Zel'manov

All members present stood in silence as a mark of respect to the departed.

### New Members

The President presented a list of those IAU members who were admitted to the membership of Commission 47 during the triennium 1994-97. They had fulfilled the IAU criteria for commission membership.

The President further presented another list of new members admitted to the IAU at the Kyoto GA, who had expressed desire to be members of Commission 47. These were duly admitted with the proviso that if C. Kaul (India) and D. Kompaneets (Russia) wished to join C 44 (Space and High Energy Astrophysics) instead, they may be offered that option as their interest and field of expertise might lie closer with that commission.

### Division VIII Decisions

At the President's request Bruce Partridge, President, Division VIII summarized the decisions taken at the Business Meeting of Division VIII on August 23:

A decision was taken to keep the other commission within the Division (C 28, Galaxies) as it is, so that Division VIII would continue to have only two commissions.

P. Shaver would serve as President of Division VIII for the triennium 1997-2000.

During 1994-97 the Division structure was 'on probation'. At this GA it had now been formalized and so, the Division President will have closer liaison with the Executive Committee on matters relating to IAU meetings and other matters.

### Officers triennium 1997-2000

#### PRESIDENT

As per the procedure arrived at during the last Business Meeting at the Hague IAU-GA (1994) the Vice-President takes over as President of the Commission at the end of the triennium. In 1994, Commission 47 had two Vice-Presidents, P. Shaver and A. Szalay, who decided by mutual agreement, that A. Szalay would take over as Commission President at this Business Meeting.

Accordingly A. Szalay will serve as the President of Commission 47 for the period 1997-2000.

#### VICE-PRESIDENT

Following the guidelines of the last Business Meeting, nominations for the Vice-President were invited from the OC members. Of the two names proposed, one withdrew and so only one name, that of J. Peacock was put up on the slate for a poll by the general membership of the Commission.

Accordingly J. Peacock was declared elected Vice-President of Commission 47 for the period 1997-2000.

#### ORGANIZING COMMITTEE

The 1994 Business Meeting had stipulated that the Organizing Committee should include about 12 members, including the President, Vice-President, Past President and President Division VIII as ex-officio members. Other OC-members should have two terms, unless a member is elected Vice-President or Division President.

As Y. Chu, J. Einasto, J. Peacock and A. Wolfe were elected in 1994, they would continue for another term. The guidelines of the 1994 Business Meeting further stipulated that nominations for OC should be invited from the general membership of the Commission 47 and that a ballot be taken of the membership to choose the required number from the slate, after ensuring that at least one OC member is taken from each of the following regions : (i) Asia-Pacific (ii) Europe-Africa (iii) Latin America and (iv) North America.

Accordingly a poll was conducted by the President and the following new members were declared elected to the OC of the Commission.

The entire OC of Commission 47 for 1997-2000 is as follows

PRESIDENT	A. Szalay	Hungary
VICE-PRESIDENT	J. Peacock	UK
	Y. Chu	China PR
*	L. da Costa	Brazil
	J. Einasto	Estonia
*	G.F.R. Ellis	USA
*	D. Koo	USA
*	S.J. Lilly	Canada
Past-President	J.V. Narlikar	India
President, Division VIII	P. Shaver	Germany
*	R. Webster	Australia
	S. White	UK
	A. Wolfe	USA

\* Incoming members

### **Recommended Meetings**

The President informed that the following symposia had been recommended to the Executive Committee by the Organizing Committee for sponsorship of Commission 47:

Symposium entitled "The Light Elements and their Evolution" to be held in Natal, Brazil in 1998.

Symposium entitled "The Low Surface Brightness Universe" to be held in Cardiff in July 1998.

Symposium entitled "The Evolution of Galaxies on Cosmological Time Scales" to be held in Tenerife in July 1998.

Symposium entitled "Activity in Galaxies and Related Phenomena" to be held in Byurakan Astrophysical Observatory, Armenia from August 17-21, 1998.

B. Partridge, in his capacity as President, Division VIII, informed that the first symposium had been postponed by the organizers while the other three were under consideration of the IAU Executive Committee.

The President informed that at the meeting of Commission Presidents with the IAU officials on August 25, the incoming General Secretary had discussed revised guidelines that were being drafted for submitting proposals for new symposia. As per the new guidelines, a proposal would be first vetted by the concerned commission and forwarded to the division president, if found suitable for sponsorship. Based on the information supplied by the commission president(s) the division president would prioritize the symposia with appropriate gradings for final decision by the Executive Committee. The new guidelines will stipulate the time table for all these intermediate steps.

### **Other Matters**

Amongst any other matters, the President sought the members' feedback on the triennial scientific reports of the Commission, which appear in the IAU Transactions. He mentioned that based on the feedbacks received from the various commission presidents, the incoming General Secretary was preparing new guidelines for IAU Commission Reports. The commissions would have the option of preparing a short 2-3 page report listing highlights with source material (reviews, conferences, etc.) topicwise, rather than writing more detailed accounts. Some commissions may prefer the concise option while others may opt for the detailed ones as before.

There was some discussion on this issue where members highlighted advantages of both options. It was expected that the OC will take the decision for Commission 47 in the coming year.

### **Concluding Remarks**

The President thanked the Vice-Presidents and his other colleagues on the OC for the cooperation extended to him. He welcomed Alex Szalay as his successor and hoped that the existing and new members of the OC will continue to provide him with similar support. He specially thanked all those who wrote parts of the Triennial Report of Commission 47, some at relatively short notice. He complimented B. Partridge for his interactive guidance to the commission as Division President, and the IAU Secretariat for help on administrative issues.

On behalf of the Commission, Bruce Partridge proposed a vote of thanks and appreciation to the outgoing President for his leadership of the Commission.

**DIVISION IX**  
**OPTICAL TECHNIQUES**

Division IX provides a forum for astronomers engaged in the innovation, development, and calibration of optical instrumentation and observational procedures, including data processing.

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**BOARD**

I.S. McLean	President Commission 9
G. Lelièvre	Past President Commission 9
J.D. Landstreet	Past President Commission 25
J.B. Hearnshaw	President Commission 30
C.D. Scarfe	Past President Division IX
	Past President Commission 30

**PARTICIPATING COMMISSIONS:**

<b>COMMISSION 9</b>	<b>INSTRUMENTS</b>
<b>COMMISSION 25</b>	<b>STELLAR PHOTOMETRY AND POLARIMETRY</b>
<b>COMMISSION 30</b>	<b>RADIAL VELOCITIES</b>



## COMMISSION 9:

## INSTRUMENTS/INSTRUMENTS & TECHNIQUES

### Organizing Committee triennium 1997-2000

PRESIDENT:	Ian S. McLean	UK
VICE-PRESIDENT:	Ding-qiang Su	China PR
ORGANIZING COMMITTEE:	Martin Cullum	Germany
	Michel Dennefeld	France
	George H. Jacoby	USA
	Gérard Lelièvre	France
	Shiro Emer Nishimura	Japan
	William J. Tango	Australia
	Milcho K. Tsvetkov	Bulgaria
	A.K. Saxena	India

The President thanked the out-going Members for their work inside the Committee: J.C. Bhattacharyya (India), David F. Malin (Australia), Fritz Merkle (Germany) and Richard M. West (Germany).

### Membership

The following members were co-opted:

Ahmad Zaharim Abdul Aziz (Malaysia), Zeljko Andreic (Croatia), Samuel Charles Barden (USA), Giovanni Bonanno (Italy), Jin Chang (China PR), Oberto Citterio (Italy), Yurii Denishchik (Ukraine), Lionid Didkovsky (Ukraine), Gerard Gillanders (Ireland), Shuichi Gunji (Japan), Donald John Hutter (USA), Abdanour Irbah (Algeria), Thomas Kentischer (Germany), Laurent Koechlin (France), Piero Madau (USA), Tadashi Nakajima (USA), Junichi Noumaru (Japan), John O'Byrne (Australia), Creidhe O'Sullivan (Ireland), Neil Parker (UK), Didier Queloz Switzerland, Walter Seifert Germany, Shengcai Shi (China PR), Dirk Soltau Germany), Alan Morton Title (USA), Munetaka Ueno (Japan), Xinghai Yin (China PR), Zhaowang Zhao (China PR).

The total number of Commission Members is thus 309.

### Working Groups

Working Group on Detectors (Chairman: Martin Cullum)

Working Group on High Angular Resolution Interferometry (Chairman: J.T. Armstrong)

Working Group on Wide Field Imaging Surveys (Chairman: Noah Brosch)

### Activities during the General Assembly

Commission 9 has co-supported the following events:

- JD 8 Stellar Evolution in Real Time
- JD 9 Future Large Scale Facilities in Astronomy
- JD 12 Electronic Publishing: Now and the Future
- JD 13 Detection and Study of Planets outside the Solar System

**Activities during the Triennium**

The Commission has sponsored or co-sponsored the following Symposia:

- 166    **Astronomical & Astrophysical Objectives of Sub-Milliarcsecond Optical Astrometry**  
The Hague, The Netherlands, August 15-19, 1994  
Eds. Erik Høg & Kenneth Seidelmann  
Kluwer Academic Publishers, 1995, ISBN 0-7923-3442-6
- 167    **New Developments in Array Technology & Applications**  
The Hague, The Netherlands, August 23-27, 1994  
Eds. A.G. Davis Philip, Kenneth A. Janes & Arthur R. Upgren  
Kluwer Academic Publishers, 1995, ISBN 0-7923-3639-9
- 179    **New Horizons from Multi-Wavelength Sky Surveys**  
Baltimore, USA, August 26-30, 1996  
Eds. Brian J. McLean, Daniel A. Golombek, Jeffrey J.E. Hayes & Harry E. Payne  
Kluwer Academic Publishers, 1998, ISBN 0-7923-4802-8/ ISBN 0-7923-4802-6

## COMMISSION 25: STELLAR PHOTOMETRY AND POLARIMETRY PHOTOMÉTRIE ET POLARIMÉTRIE STELLAIRE

PRESIDENT: John D. LANDSTREET

VICE-PRESIDENT: Chris L. STERKEN

### 1. Introduction

Much Commission business was transacted between General Assemblies by the Organizing Committee, which is able to meet effectively by e-mail as needed, and make recommendations to the Executive Committee, for example, about what Symposia to accept for the most recent General Assembly.

During the Kyoto meeting, two meetings of the Commission were held. About a dozen people came to each; perhaps this small attendance is a reflection of the extent to which the Symposia and Joint Discussion dominate the format of the IAU now. Below is a report on the business transacted.

### 2. Business meetings

#### 2.1. MEMBERSHIP

The commission at present has a membership of slightly more than 200 members. New members who joined during the triennium include Drs S. HUBRIG, J.-L. LEROY, G. MATHYS, D. MOURARD, and J. SUDZIUS. In addition, eight new members of the IAU also joined the Commission during the 1997 General Assembly: B. CARTER, N. CRAMER, Y. EFIMOV, M. LEMKE, A. MANDAYAM, K. MASLENNIKOV, B. POKRZWKA, and M. SZYMAŃSKI.

#### 2.2. OFFICERS

The members present (about 10 persons) unanimously elected Chris STERKEN (Vrije Universiteit Brussels, Pleinlaan 2, B-1050 Brussels, Belgium) as President, and Arlo LANDOLT (USA) as Vice-President. We wish them well during the coming triennium.

Seven members of the OC reached the ends of their terms: J. KNUDE, J. LUB, I. MCLEAN, J. MENZIES, F. VRBA, V. STRAISZYS, and A. YOUNG. Five others are continuing: S. ADELMAN, M. BREGER, D. KURTZ, E. MILONE, and T. MOFFETT. We thank the retiring OC members, and the continuing ones, for their work during the past triennium. New OC members elected are: M. BESSELL, I. GLASS, J. GRAHAM, H. HENSBERGE, K. SEKIGUCHI, J. TINBERGEN, and W. WARREN.

It was agreed by the Commission members present that before the next IAU General Assembly, we will try to have an e-mail election of Commission Officers to increase the participation of Commission members in this important activity.

#### 2.3. REORGANIZATION

Reorganization of the IAU following decisions made at the Hague General Assembly and confirmed at the Kyoto meeting has been proceeding. The new structure of Divisions which group together Commissions of similar interests, and which have more contact with the Executive Committee than the Commissions have had in the past, is beginning to get established. Our Commission is part of Division IX, Optical Techniques, together with Commission 9 (Detectors and techniques) and Commission 30 (Radial Velocities). During the past triennium, the Division Board consisted of the three Presidents and the three Vice-Presidents of these Commissions, with Colin SCARFE of Commission 30 as Division President. A number of issues have come to the Division Board, among which are questions as to which proposed IAU Symposia and Colloquia should be selected. In addition, Division Presidents were invited to participate in most of the Executive Committee meetings during the General Assembly in Kyoto. I expect that Divisions will be more and more used in future to furnish advice to the Executive Committee.

The new Division IX Board will again be made up of the Presidents and Vice-Presidents of the Commissions. The new Division President will be the President of our Commission, Chris STERKEN.

The other aspect of reorganization which has greatly changed the nature of the IAU is the decision to hold six Symposia together with the General Assembly, and to replace to a significant extent the Commission scientific meetings with Joint Discussions. In this context, our Commission supported Symposium 184, "New eyes to see inside the sun and stars", and Joint Discussions 8 "Stellar evolution in real time" and 14 "First results from Hipparchos and Tycho" during the Kyoto meeting. These scientific meetings attracted large numbers of participants, and clearly were of wide interest.

It should be noted that with the increasing importance of Joint Discussion for the scientific life of the Union, members of our Commission should start thinking about JD's that could be of general interest during the next General Assembly in Manchester. Suggestions should be sent to the new President of the Commission.

#### 2.4. REPORTS ON ASTRONOMY

Every three years a small group (usually Commission Officers or past Officers, with help from some others) prepare a report on the state of our field for publication in Reports on Astronomy, Part A. The Executive Committee has been asking Commissions and Divisions for their opinions on the usefulness of these documents. After a discussion between most of the Commission Officers and the Officers of the Union, it seems clear that the EC will decide to keep these reports, while accepting a greater diversity of style and substance from one Commission to another, depending on the needs of each Commission. A discussion at the Commission business meeting of this question produced a similar consensus; most people present agreed that the report for Commission 25 is useful and should certainly be retained, but without being overly concerned about the exact format of the report. It was widely agreed that the report would be much more useful if it were distributed immediately upon completion to all the members of the Commission, rather than having everyone wait until it is published. The current report was in fact distributed in September 1997 by e-mail as a postscript document to the present list of members for whom e-mail addresses are available. It seems clear that this will become increasingly practical as the list of e-mail addresses becomes more complete.

#### 2.5. E-MAIL DISTRIBUTION OF INFORMATION

Commission members who have not received any e-mail from the Officers during the summer of 1997 are urged to send their e-mail addresses to the new President, Chris STERKEN (at csterken@vub.ac.be), to be sure that our list of addresses is as complete and correct as possible.

#### 2.6. PROPOSAL FOR DEFINITION OF BOLOMETRIC MAGNITUDE

The following resolution, proposed to the Commission by Roger CAYREL, was approved by the Commission in principle. (The present form has evolved somewhat from that which was presented at the Commission business meeting, but the substance is the same.)

**Noting** the absence of a strict definition for the zero point of bolometric magnitudes, and the resulting proliferation of different zero points in the literature, the Commission

**Recommends** to define the zero point by specifying that the absolute radiative luminosity,  $L$ , of a star of absolute bolometric magnitude  $M_{bol} = 0$  has the value  $L = 3.055 \times 10^{28}$  W. This choice is intended to be close to the most common practice, and is equivalent to taking the value  $M_{bol} = 4.75$  (Allen, *Astrophysical Quantities*) for the nominal bolometric luminosity adopted for the Sun by the international GONG Project, ( $L_{\odot} = 3.846 \times 10^{26}$  W).

#### 2.7. CLOSURE OF SMALL TELESCOPES

A short discussion was held during the business meeting about whether photometrists could do anything useful to slow the pace of closure of small telescopes (see Reports on Astronomy, Part A, Report of Commission 25). Several suggestions were discussed; the only one which survived group criticism was that people should apply for time regularly on small telescopes in the best sites, to make it clear to time allocation committees and funding agencies that these telescopes are really still valuable to the community.

## 2.8. REPORTS OF WORKING GROUPS

The meeting heard short oral reports from three of its Working Groups (a fourth group, on Infrared Filters, made its report in written form in the Commission Report in Reports on Astronomy, Part A).

Business from the Working Group on Ap and Related Stars was reported by G. MATHYS. The WG organized Joint Discussion 16, on "Spectroscopy with large telescopes of chemically peculiar stars", during the Kyoto meeting; this meeting was very successful. The new Chair of the WG is Masahide TAKADA-HIDAI. The Editor of *A Peculiar Newsletter* continues to be Pierre NORTH. Members of the Commission interested in the field of this WG are reminded of the meeting of the European Working Group on CP Stars which will be held October 27 – 29, 1997 at the Vienna Observatory. Contact Pierre NORTH (Pierre.North@obs.unige.ch) for details.

The activities of the Working Group on Standard Stars were reported by Bob GARRISON. This WG is supported by Commissions 25, 29, 30, and 45. Its function is to maintain, develop, and communicate lists of suitable standard stars. This is done through physical meetings during IAU General Assemblies, and via its newsletter at <http://clavius.as.arizona.edu/ssn>. Membership is open to all interested astronomers.

Arlo LANDOLT reported for the Working Group on Filter Standardization. He has been working on a comparison of photoelectric and CCD photometry. He finds that CCD  $U$  magnitudes are very poorly related to photoelectric values, with a scatter of order 0.2 magnitude! However,  $B$ ,  $V$ ,  $R$  and  $I$  magnitudes from the two types of detectors are very similar; the scatter in colours measured with the two detectors is of order 0.015 magnitude. LANDOLT is also working on a set of photometric standards at  $+45^\circ$  in addition to those already available at  $0^\circ$ .

**COMMISSION 30:****RADIAL VELOCITIES/VITESSES RADIALES**

PRESIDENT:	C.D. Scarfe	Canada
VICE-PRESIDENT:	J.B. Hearnshaw	New Zealand
ORGANIZING COMMITTEE:	W.D. Cochran	USA
	L.N. da Costa	Brazil
	A.P. Fairall	South Africa
	F.C. Fekel	USA
	K.C. Freeman	Australia
	M. Mayor	Switzerland
	B. Nordström	Denmark
	R.P. Stefanik	USA
	A.A. Tokovinin	Russia

The commission's business meeting began on August 21 at 14:00. The following items were on the agenda.

**1. Report of the President****1.1. MEMBERSHIP**

The commission has lost a senior member by the death of F.C. Bertiau on 1995 December 27. In addition the following have resigned their membership: M. Azzopardi, L. Balona, H. Eelsalu, N. Martin and L. Oetken. However, the commission welcomed the following new members: B. Garcia (Argentina), Y. Gnedin (Russia), S. Hubrig (Germany), D. Queloz (Switzerland), A. Rastorguev (Russia), G. Scholz (Germany) and S. Udry (Switzerland). And it has proposed that the following non-members of the IAU be named as consultants to the commission: P. Butler (U.S.A.), N. Gorynya (Russia) and G. Marcy (U.S.A.).

**1.2. MEETINGS**

During the last three years the commission has lent its support to a variety of scientific meetings, including I.A.U. Symposium 179 on "New Horizons from Multi-Wavelength Digital Sky Surveys", held in Baltimore in August 1996, and the meeting in Calgary in June 1995 on the "Origins, Evolution and Destinies of Binary Stars in Clusters", which regrettably the Executive Committee was unable to support. We have also supported the following Joint Discussions at the 1997 General Assembly: (i) JD 8, "Stellar Evolution in Real Time", (ii) JD 11, "Redshift Surveys in the Twenty-First Century", and (iii) JD 12, "Electronic Publishing, Now and in the Future". Indeed the proposal for JD 11 originated in Commission 30, despite the fact that Commission 28 is listed as its principal sponsor, and most of the work of proposing and arranging that JD was done by Drs. Fairall and Huchra, to whom the president expressed gratitude.

**1.3. INTERNAL OPERATION OF THE COMMISSION**

- i) Members' list. In order to facilitate communication between members, it was decided early in the triennium to prepare, and distribute to all, a list of members, with postal addresses, telephone and fax numbers, and electronic mail addresses for as many as possible. Unfortunately there remain about 15 members for whom we have no electronic address. At the suggestion of the vice-president, John Hearnshaw, a code for areas of research interests, developed largely by him, was added to the information for each member, and has proved very useful.

- ii) The commission has also initiated a procedure for choosing its new officers and organizing committee members that is more democratic than that previously in effect, so as to give members a more obviously direct say in the activities of the commission. Any two members of the commission may nominate candidates, and if an election is needed all members are entitled to vote.
- iii) Finally the president thanked all those who participated in the activities of the commission over the past three years, including in particular the members of the organizing committee, whose advice and help has been greatly appreciated, and above all John Hearnshaw, who he said had been a superb vice-president, and could be expected to be an outstanding president in the next triennium.

## 2. Election

Exactly four candidates were nominated to fill the four vacancies on the Organizing Committee, so no election was necessary. However two members were nominated for the post of vice-president, necessitating an election. The president announced the result of that election:

A.A. Tokovinin	19 votes
A.P. Fairall	18 votes

Thus the new officers and organizing committee for 1997 to 2000 will be:

PRESIDENT:	J.B. Hearnshaw	New Zealand
VICE-PRESIDENT:	A.A. Tokovinin	Russia
ORGANIZING COMMITTEE:		
A. Continuing Members:	W.D. Cochran	USA
	F.C. Fekel	USA
	B. Nordström	Denmark
	R.P. Stefanik	USA
B. New Members:	T. Mazeh	Israel
	N. Morell	Argentina
	H. Quintana	Chile
	S. Udry	Switzerland

The president thanked all candidates for their willingness to serve.

## 3. Galaxy radial-velocity catalogues

A.P. Fairall summarized the current situation, noting the existence of the following five major data bases.

- NASA/IPAC Extragalactic Database (NED), maintained by H. Corwin, B. Madore et al., which currently includes about 770,000 extragalactic objects, of which over 100,000 have referenced redshifts. About 50,000 redshifts include detailed information on instrumentation, measurement and reduction. Conversion is available between geocentric, heliocentric and 3K background reference frames or between user-defined reference frames.
- Lyon Extragalactic Database (LEDA), maintained by G. Paturel et al., for which no current details were available.
- Strasbourg Data Centre (SIMBAD).
- Harvard-Smithsonian Center for Astrophysics Catalog (ZCAT), maintained by J. Huchra et al., which currently includes 91022 entries, including 87904 galaxies with velocities, 74255 of which are published.
- Southern Redshift Catalogue (SRC), maintained by A. Fairall, which includes all measures published for each galaxy, noting any large differences.

Dr. Fairall recommended that the commission include in its report a reminder to those publishing redshift data to provide information necessary for users of those data, and the commission agreed to do so, with the following statement: "Commission 30 urges all those who publish radial velocities of galaxies to publish 'heliocentric' velocities; if another frame of reference is used, this should be clearly indicated. The velocities should be expressed as  $cz$  (i.e. without relativistic correction). Accurate co-ordinates should also be provided."

#### 4. Stellar radial velocity catalogues

H. Levato is the leader of a group in Argentina who have taken over responsibility for maintaining a record of, and publishing information on, work on stellar radial velocities, as successors to the group at Marseille led for twenty years by M. Barbier, who has recently retired. Dr. Levato presented the following progress report.

The Argentine group have continued with the compilation of a bibliography for papers that contain radial velocities of stars. Up to 1970 the compilation was made by Abt and Biggs and from 1970 to 1990 by M. Barbier. The work has been continued, looking for papers with radial velocity measures since January 1st, 1991. The period 1991-1994 is already complete, with more than 13,000 new objects added, and the catalogue has been deposited at the CDS. The CDS will add other data for the stars, such as magnitudes, spectral types, positions, etc. The period 1995-1996 is 80% complete and the first semester of 1997 is 40% complete.

Papers with radial velocity data have been sought in all the major journals: ApJ, ApJS, A&A, A&AS, PASP, MNRAS, AJ, Rev. Mex. Astron. Astrofis., The Observatory, and around a dozen more. The catalogue shows the radial velocity published by the authors in the case of one measure per star or the average for several measurements if the authors published it. Also indicated are the cases of relative velocities or Coravel velocities, and other unusual details of some kinds of measurements. It is hoped that the catalogue will be available to all users at the CDS as soon as possible. The data for 1995-1996 will be ready by the end of 1997. In the future it is planned to send new material to the CDS about every six months.

#### 5. Standard-velocity stars

R. Stefanik, who chairs the commission's Working Group on Radial Velocity Standards gave a review and progress report on the efforts of that Working Group. For some time it has been known that the official list of IAU radial velocity standards (J. Pearce, Trans. IAU, 9, 441, 1955; R. Bouigue, Trans. IAU, 15A, 409, 1973.) included velocity variables, and that the velocities were not on an absolute or even common velocity system. An observational campaign involving the Dominion Astrophysical Observatory, the Geneva Observatory and the Harvard-Smithsonian Center for Astrophysics was initiated to address this problem. The objective was to establish a new set of late-type IAU radial velocity standard stars with individual mean velocities and an absolute zero point of the system good to 100 m/s. The initial results of this campaign were presented in Trans. IAU, 21B, 269, 1991. Nine stars were eliminated from the IAU list because they showed significant velocity variations of over 1 km/s. However, there was a color dependence of the zero point comparison between the observatories. Work has continued at the three observatories to refine the sample further, and to address the color dependence problem. More than 10,000 observations covering a time span approaching two decades, and in a few cases longer, have been obtained.

- a. This monitoring shows that the following stars should be eliminated as velocity standards: HD 29587 (SB1, P=1483d, K=1.00 km/s); HD 42397 (a double-line spectroscopic binary of long but unknown period); HD 114762 (SB1, P=84d, K=0.60 km/s); HD 123782 (Pulsation variable, P=494d, K=0.95 km/s); HD 140913 (SB1, P=148d, K=1.83 km/s) and HD 171232 (Long period SB1 with a 4 km/s velocity decrease during the past 14 years).
- b. As a step toward establishing an absolute zero point to the velocity system the Center for Astrophysics has been monitoring the velocities of minor planets. An absolute system is defined by minor planet velocities, computed from astrometric orbits by the Minor Planet Center and good to several tens of mm/s. The offset of the CfA system from this absolute system is -95 +/- 18 m/s with no trends in the residuals with time, declination, hour angle, air mass, or signal-to-noise. This comparison covers eight years with over 800 observations of 25 minor planets.
- c. The color dependence in the comparison of velocities from the three observatories continues to be an unresolved problem. There does not appear to be a color dependence for solar type stars with B-V between 0.5 and 0.8. The combined mean data from CfA and DAO do not show any color dependence or a difference in zero-point between the bright and faint groups of standards. However, the differences between CfA+DAO and the mean velocities from CORAVEL are correlated with the color indices of the stars, becoming increasingly negative for redder stars. Toward resolving this problem the standard stars are being reobserved by the Geneva team using ELODIE for comparison with the CORAVEL results.



- d. Little additional progress has been made in establishing a list of early spectral type standard velocity stars from that reported in *Trans. IAU*, 21B, 269, 1991. Fekel continues to monitor the early type standard candidates at KPNO. He reports that the following stars are variable or probably variable and should be removed from the candidate list: HD 145570 (HR 6031), HD 147394 (HR6092), HD 179761 (HR 7287) and HD 196426 (HR 7878).

In response to a question by J.B. Hearnshaw, Dr. Stefanik indicated that the absolute accuracy of the standard star system is probably about 100 m/s.

#### **6. Meeting proposal**

J.B. Hearnshaw reported on the proposal for an IAU Symposium on Precise Stellar Radial Velocities, that he had sent to the Assistant General Secretary in November 1996. The proposal is for a meeting in Victoria, Canada, from June 21 to June 26, 1998. The major purpose of the meeting is to explore the various applications of highly precise velocity data. The scope will therefore be broad, and will include such topics as stellar pulsation and line asymmetry, as well as the search for extrasolar planets. The Scientific Organizing Committee (SOC) will be chaired by J.B. Hearnshaw, and the Local Organizing Committee (LOC) by C.D. Scarfe. Further information can be found at the World Wide Web site:

<http://astrowww.phys.uvic.ca/prvs/prvs.html>

that has been set up by the LOC.

(Subsequent to this meeting, the proposal was accepted by the Executive Committee not as a Symposium, but a Colloquium, numbered 170 in the IAU's series.)

#### **7. End of meeting**

There being no further business, the meeting adjourned at 15:45.

**DIVISION X**  
**RADIO ASTRONOMY**

Division X provides a common theme for astronomers using radio techniques to study a vast range of phenomena in the Universe, from exploring the Earth's ionosphere or making radar measurements in the solar system, via mapping the distribution of gas and molecules in our own and other galaxies, to the study of previous vast explosive processes in radio galaxies and QSOs and the faint afterglow of the Big Bang itself.

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**BOARD**

See following pages

**PARTICIPATING COMMISSION**

**COMMISSION 40**      **RADIO ASTRONOMY**

## REPORT ON COMMISSION 40 BUSINESS MEETINGS

JOHN WHITEOAK  
*Australia Telescope National Facility CSIRO*  
*PO Box 76*  
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The 23rd IAU General Assembly was extremely busy, with many unfortunate overlaps of interesting meetings. Because Commission 40 has its own Division (Div. X), as its President I was further disadvantaged, because for the first time, Division Presidents were invited to the meetings of the IAU Executive Committee, and these extended over several days during the General Assembly. However, to our advantage, the participation of Division Presidents provided an information link between the Commissions and the Executive Committee.

Commission 40 held four 'Business Sessions' during the General Assembly, on August 20, 25 (two sessions), and 26. The first two sessions were devoted to strictly business activities, whereas the other two were scientific sessions at which a number of astronomers presented short informal scientific reports. Commission 40 Business Highlights are as follows:

1. Professor Lucia Padrielli of Italy is the new Commission 40 Vice-President. She will become President at the end of the next General Assembly, and in fact the first Italian President of the Commission.

2. I retired as President of the Commission, but as the Past President I will remain a member of the Organizing Committee until the next General Assembly.

3. My tally of Commission members listed in the latest Transactions of the IAU yielded 762 members (probably for epoch 1996 October). A total of 88 new members should have been added to this list after the latest General Assembly.

4. The following retired from the Commission 40 Organizing Committee:

Prof E. Baart (South Africa)  
Dr F. Colomb (Argentina)  
Dr E. Gerard (France)  
Dr J. Gomez Gonzales (Spain)  
Dr I. Gosachinskij (Russia)  
Prof M. Morimoto (Japan)  
Dr T. Velusamy (USA)  
Prof S. Ye (China PR)

The new members of the Commission are:

Dr L. Bronfman (Chile)  
Dr P. Dewdney (Canada)  
Dr L. Litvinenko (Ukraine)  
Dr J-M. Marcaide (Spain)  
Dr R-D. Nan (China PR)  
Dr G. Nicolson (South Africa)  
Dr R. Schilizzi (Netherlands)

To complete the membership, the continuing members are:

- Dr K. Anantharamaiah (India)
- Dr L. Baath (Sweden)
- Dr E. Berkhuijsen (Germany)
- Dr R. Davis (UK)
- Dr H. Dickel (USA)
- Dr K. Johnston (USA)
- Dr J. Moran (USA) - President
- Dr L. Padrielli (Italy) - Vice-President
- Dr J. Whiteoak (Australia) - Immediate Past-President

5. Representation on other committees etc:

- R. Ekers (Australia) to Chair IAU Executive Working Group for Future Large Scale Facilities
- S. Ananthakrishnan (India) and K. Kawaguchi (Japan) to join B. Doubinski (Russia) and A. Thompson as IAU representatives on IUCAF
- J. Moran (USA) as a new IAU representative on URSI
- A. Thompson (USA) and J. Whiteoak (Australia) to represent the IAU at the International Telecommunication Union (Radiocommunication)

6. The Commission 40 Working Group on the astrophysically most important spectral lines has been inactive during the last three years. However, IUCAF now has a Working Group that has taken over the task. At the ITU's World Radiocommunication Conference in 1999 there may be an Agenda item related to a revision of radio astronomy allocations at frequencies above 70 GHz. It is important that the radio astronomy community has a well-prepared position set up by the time of this meeting.

7. After some discussion at both Commission 40 and Executive Committee meetings, the Executive Committee decided to continue with the 3-year Commission reports. However, the Committee may provide a pro-forma to facilitate the task.

8. A meeting of Observatory Directors was Chaired by R. Booth (Sweden). The main aim of the meeting was to formulate a resolution, 'The Kyoto Declaration', to be signed by the Directors. A draft document was set up during the General Assembly, and published in an issue of the daily IAU newspaper ('The Sidereal Times'). Since then it has been distributed around the observatories by email. In the document the Directors resolve to conduct educational activities related to protecting radio astronomy's spectrum requirements, and to study means to mitigate the problem of radio interference. Additional matters include an endorsement of the Radio Astronomy Working Group of the OECD's Megascience Forum, agreement to intensify participation in ITU's frequency regulation processes, and agreement to increase the level of coordination between the world's radio observatories in order to present a common position on issues of radio spectrum management.

9. Six proposals for IAU-sponsored Colloquia or Symposia in 1998 were co-sponsored by Commission 40. At an Executive Meeting towards the end of the General Assembly, the following were supported:

- Symp. 190: New Views of the Magellanic Clouds - Victoria, Canada, 1998 July 13-19.
- Symp. 194: Activity in Galaxies and Related Phenomena - Byurakan, Armenia, 1998 August 17-21.
- Colloq.171: The Low Surface Brightness Universe - Cardiff, UK, 1998 July 6-10.

10. Two possible future meetings sponsored by Commission 40 which are already under discussion are a 1999 meeting (in India) on long-wavelength radio astronomy, and a 2000 meeting (in Manchester) involving astronomy at high angular resolution. Information on these can be obtained from V. Kapahi (vijay@gmrt.ernet.in) and R. Schilizzi (rts@nrao.nl) respectively.

11. The two sessions on short scientific contributions proved quite popular; 23 different presentations were squeezed into the limited time available.

**DIVISION XI**  
**COMMISSION 44**  
**SPACE AND HIGH ENERGY ASTROPHYSICS**

Division XI connects astronomers using space techniques or particle detectors for an extremely large range of investigations, from in-situ studies of bodies in the solar system to orbiting observatories studying the Universe in wavelengths ranging from radio waves to gamma rays, to underground detectors for cosmic neutrino radiation.

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\*\* Vice-President, Commission 44

## **DIVISION XI/COMMISSION 44**

### **SPACE & HIGH ENERGY ASTROPHYSICS/ ASTROPHYSIQUE SPATIALE & DES HAUTES ENERGIES**

**PRESIDENT:** *Giovanni G. Fazio, Harvard Smithsonian Center for Astrophysics, Cambridge, MA 02138, USA (gfazio@cfa.harvard.edu)*

#### **1. Introduction**

The business meeting of Division XI/Commission 44 was held on Saturday 23 August 1997 from 11:00 AM until 12:30 PM in Room H at the XXIII General Assembly of the IAU in Kyoto, Japan. Sixteen members of the Commission were present.

Chair of the meeting was Dr. Giovanni G. Fazio, President, Division XI/Commission 44. Also present were the two Vice-Presidents, Dr. Willem Wamsteker and Dr. Ginesan Srinivasan. The meeting began with introduction of the President and Vice-Chairman, followed by a reading of the proposed agenda. The agenda was accepted.

The President reviewed the history of the merger of Commissions 44 (Space Astronomy) and 48 (High Energy Astrophysics) into the current Commission 44 and also discussed the proposed structure of the Division and the Commission for the coming year. Also presented and discussed was the need for an increased role of the Division Presidents in the deliberations of the IAU Executive Committee.

#### **2. President's report**

The President reported that at the meeting of the XIII General Assembly of the IAU the Commission co-sponsored the following Symposia:

- Symposium 183. Cosmological Parameters and Evolution of the Universe
- Symposium 186. Galaxy Interactions at High Redshift
- Symposium 187. Hot Universe

Supported or co-sponsored the following Joint Discussions:

- JD 8. Stellar Evolution in Real Time
- JD 9. Future Large Scale Facilities in Astronomy
- JD 12. Electronic Publishing
- JD 13. Detection and Study of Planets Outside the Solar System
- JD 18. High-Energy Transients
- JD 19. Astronomy from the Moon

and supported one Special Session: Highlights of the ISO Mission

For 1998 the Commission has agreed to co-sponsor four proposals for Symposia:

- 98-01 Population Synthesis: From Planets to Black Holes, Black Holes to the Universe
- 98-06 Nuclei in the Cosmos
- 98-07 New Views of the Magellanic Clouds
- 98-12 Wolf-Rayet Phenomena in Massive Stars and Starburst Galaxies.

Through the efforts of Dr. Wamsteker the Commission also established a World Wide Web page at <http://www.vilspa.esa.es/IAU-XI/> This page contains a summary of current astronomy space missions as well as a membership list of the Commission.

In the Commission there is one Working Group: Astronomy from the Moon This WG is chaired by Professor Yervant Terzian. The Working Group sponsored a Joint Discussion at the meeting of the General Assembly.

### **3. Membership Status and Issues**

The membership status was reviewed and questions were answered concerning application for membership in the Commission. There are approximately 600 members in the Commission.

### **4. Reports on Astronomy**

Prior to the General Assembly Meeting considerable discussion was held among the Division and Commission Presidents concerning the value of the IAU Reports on Astronomy and whether they should be continued. At this Business Meeting a discussion was held to view the reactions of the Commission. In general there was the reaction that the Reports, in their present form, are not very useful to the membership and are rarely referred to in the scientific literature. It was also noted that almost all of what is now in the Reports can be accessed more rapidly by use of the World Wide Web. Instead, it was proposed the Reports be used as a summary of Commission activity, identifying the direction that space research is heading and noting current trends. Such a summary does not exist anywhere else.

### **5. Report of the Working Group on Astronomy from the Moon**

Professor Yervant Terzian, Chair, reviewed the activity of the Commission's Working Group. The Group sponsored a very successful and well attended Joint Discussion on Astronomy from the Moon at the General Assembly.

Interest in the topic and among the members is still very high. The Group will also support a Resolution to the General Assembly on Protection of the Far Side of the Moon. The Working Group has also received an invitation from COSPAR to sponsor a session at its next meeting (Nagoya, Japan).

Professor Terzian has agreed to remain Chair of the WG for the next three years.

### **6. Concept for a World Space Observatory (WSO)**

Vice-President Wamsteker presented a concept for a World Space Observatory as a challenge for the new millennium. The basic idea behind the WSO is that general facilities in the windows for astronomical observations which require satellite observatories, are better done through a project with a world-wide support, participation and contribution, rather than specific projects defined in a more limited national configuration. Such an observatory would also help increase the participation of developing countries in astronomy and space science by providing front line facilities and tools for their research. The Commission supported the concept and recommended further evaluation of such an observatory. The possibility was raised that the UNISPACE III Conference in Vienna in 1999, might present a good occasion to expand on the implementation of such concepts on a truly world-wide scale.

## 7. Election of Officers

PRESIDENT DIVISION XI:	W. Wamsteker	ww@vilspa.esa.es
PRESIDENT COMMISSION 44:	G. Srinivasan	sriini@rri.ernet.in
VICE-PRESIDENT COMMISSION 44:	H. Okuda	okuda@astro.isas.ac.jp

The Division proposes, that, at the XXIV General Assembly of the IAU, Commission 44 be dissolved and that only Division XI exist, and that Vice-President H. Okuda become President of Division XI.

The proposed new name for the Division would be Space Astronomy.

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## 8. Obituary

With great sadness it was noted that on 29 October 1997, our colleague and friend Dr. Andy Michalitsianos, recently elected as member of the Scientific Organizing Committee of Division XI, passed away, after a prolonged sickbed. Our best wishes accompany his wife and three children.

25 November 1997



**COMMISSIONS OF THE EXECUTIVE COMMITTEE**

<b>COMMISSION 5</b>	<b>DOCUMENTATION &amp; ASTRONOMICAL DATA</b>
<b>COMMISSION 6</b>	<b>ASTRONOMICAL TELEGRAMS</b>
<b>COMMISSION 14</b>	<b>ATOMIC AND MOLECULAR DATA</b>
<b>COMMISSION 38</b>	<b>EXCHANGE OF ASTRONOMERS</b>
<b>COMMISSION 46</b>	<b>TEACHING OF ASTRONOMY</b>
<b>COMMISSION 50</b>	<b>PROTECTION OF EXISTING AND POTENTIAL OBSERVATORY SITES</b>

**COMMISSION 5. DOCUMENTATION AND ASTRONOMICAL DATA  
(DOCUMENTATION ET DONNEES ASTRONOMIQUES)**

**PRESIDENT:** B. Hauck

**VICE-PRESIDENT:** O. Duzhnevskaya

**ORGANIZING COMMITTEE:** H.A. Abt, M.S. Bessel, M. Cr ez e, A.G. Hearn, H. Jenkner, Li Qi-Bin, A. Piskunov, E. Raimond, G.R. Riegler, W.H. Warren, D.C. Wells, R. Wielen, G.A. Wilkins

**SECRETARY:** F. Genova

**1. Business meeting (August 22, 1997, Chairperson B. Hauck)**

**1.1. REPORT OF THE PRESIDENT FOR 1994–1997**

All the Commission members received last Winter the Commission activity report which was published in Newsletter # 13 and which also appeared in IUA Transactions Vol. XXIII/1997.

Meetings of several WG and TG of Commission 5 have been and will be held at this GA (section 2). A Commission 5 meeting about “Ground-based observatories data handling and archiving” was organized by F. Pasian on August 21st (Section 3). Joint Discussion 12 “Electronic Publishing: Now and the Future”, organized by A.G. Hearn, chairperson of the WG on Information Handling, will be held on August 25th.

The conference held in July 1996 in St Petersburg, on “International Cooperation in the Dissemination of Astronomical Data”, was a great success. It allowed for example a special meeting between five representatives of astronomical data centres to take place. The proceedings have been published in *Baltic Astronomy*, Vol 6, Number 2, 1997, and are available on the WWW at URL

<http://www.inasan.rssi.ru/~colloq/>.

Four meetings related to the scope of Commission 5 will soon be held. One, the third edition of “Library Information Services in Astronomy” (LISA III), is sponsored by our Commission. It will be held in Puerto de la Cruz in April 1998. The others are the third edition of “Astronomy with large databases” (ALD III), to be held in Postdam, the 1997 edition of “Astronomical Data Analysis Software and Systems” (ADASS’97), to be held in Sonthofen in September 1997, and the IXth Canary Island Winter School of Astrophysics on “Astrophysics with large databases in the Internet age”, in November 1997 in Tenerife.

The last Business Meeting of Commission 5 in The Hague adopted a new structure for the Working Groups and Task Groups. The main argument for proposing this new structure was the very high number of Working Groups. Furthermore, it was necessary to adapt the scope of the WG to the evolution of the field covered by the Commission, and thus the Working Group on Information handling was created. Since the last General Assembly, Commission 5 has three WGs covering broad fields of interest and several TGs which cover narrower, or more technical fields. This new structure operated well, but the FITS TG insists that they would prefer by far to be a WG. For them, the difference between a WG and a TG seems to have a sociological importance, mainly due to the fact that the FITS community is much larger than the IAU TG. The President suggests that the point be discussed between the new President and Vice-President and the FITS Task Group.

Finally, from the last GA to now, 6 Newsletters have been sent to Commission members and numerous librarians.

B. Hauck thanks all the colleagues, especially the SOC members, who have helped him during his two terms as President of Commission 5.

**1.2. REPORTS FROM THE CHAIRPERSONS OF THE WORKING AND TASKS GROUPS**

Several WG and TG meetings were held in Kyoto. A short summary of the activities and discussions will be given in the next Section of this paper. More detailed reports will be posted on the Commission 5 WWW service if available.

## 1.3. OFFICERS, ORGANIZING COMMITTEE, MEMBERS AND CONSULTANTS FOR 1997-2000

The SOC proposed to the General Assembly is composed of President O. Duzhnevskaya, Vice-President F. Genova, and the members : M.S. Bessel, P.B. Boyce, H.R. Dickel, B. Hauck, A.G. Hearn, H. Jenkner, F. Murtagh, K. Nakajima, F. Ochsenbein, A. Piskunov, E. Raimond, G.R. Riegler, R. Wielen, Zhao Yongheng, D.C. Wells.

The following new members and consultants were proposed to the General Assembly :

- new members : P.B. Boyce (Washington DC), Guo Hongfeng (Beijing), S. Lesteven (Strasbourg), D. Lubovich (AIP), O. Malkov (Moscow), F. Murtagh (Armagh), F. Pasian (Trieste), A.H. Rots (GSFC), R. White (GSFC), Zhao Yongheng (Beijing);
- consultants for 1997-2000 : T. Banks (New Zealand), S. Borde (Paris), E. Bouton (NRAO), C. Cheung (GSFC/ADC), B. Corbin (USNO), M. Cummins (DDO), G. Eichhorn (CfA/ADS), M. Gomez (Tenerife), U. Grothkopf (ESO), M. Hamm (Strasbourg), S. Laloe (Paris), Li De-He (Lintong, Xian), M. Schmitz (IPAC/NED).

Resignations of B. Cogan, A. Heck and C. Jaschek were recorded.

Working groups and Task groups and their chairpersons for 1997-2000 :

WG Astronomical Data : E. Raimond, Vice-chair R.P. Norris  
 WG Information Handling: P.B. Boyce  
 WG Libraries: F. Murtagh/U. Grothkopf  
 TG Data Centres & Networks: F. Genova  
 TG Designations: H.R. Dickel  
 TG FITS: D.C. Wells, Vice-chair E. Raimond  
 TG UDC 52: G.A. Wilkins

## 1.4. RESOLUTIONS

Six resolutions were discussed and proposed to the General Assembly, which adopted three of them on August 27th, dealing with:

- proposal for registering a new acronym;
- support to data archiving and Data Centers;
- FITS evolution to take into account year 2000.

The questions raised by the recent developments about Astronomy and Astrophysics Abstracts, which had been brought to the knowledge of Commission 5 by R. Wielen, were thoroughly discussed, and a resolution about the subject was proposed to the General Assembly. The Commission of Resolutions sent this resolution to the Executive Committee for follow-up. Similar action was taken for another resolution proposed by Commission 5 about the need for data links with a sufficient bandwidth.

Quite generally, the importance of the “de facto” standards used in astronomy as been continuously stressed during the various Commission 5 meetings. In particular, a fifth resolution proposed as a result of discussions during the “Ground-based observatories data handling and archiving” meeting is taken into account at the level of Commission 5 :

*Considering*

*the fast evolution towards fully interlinked astronomy on-line resources which rely heavily on communication standards, and the need to include observatory archives in this framework;*

*considering*

*the current development of ground- and space-based projects aimed at providing the astronomical community with large-scale observing facilities, and the need to harmonize the access to the resulting huge amount of data;*

*the IAU Commission 5 supports the efforts currently being carried out to define a standard protocol to access individual observatory data, and points to the need to define a generalized and unique format to describe individual observations.*

Furthermore, the “bibcode” standard, first defined by the CDS and NED, and now heavily used by the ADS and the electronic journals, was put under the responsibility of the WG on Information Handling.

More work will be carried out in the coming months, on the procedures to maintain the standard, and a recommendation allowing the recognition of the bibcode as an official reference standard of the IAU should be prepared for the next GA, as proposed by G. Eichhorn.

### 1.5. ACTIVITIES FOR THE NEXT TRIENNIUM

O. Dluszhnevskaya presented her views on the Commission activities for the next triennium. She pointed at the growing volume of observational material, and the rapid development of electronic publications. One goal of the Commission will continue to be to encourage the observatories to open their archives. The Newsletter distribution will be actively continued, and contributions and suggestions are welcome. This can be used e.g. as a support to transmit information about standards.

A email distribution mechanism will be implemented, with support from NRAO. A WWW page describing Commission 5 activities will soon be opened at INASAN.

### 2. Working and Task Groups meetings and reports

As explained above, only a brief summary of the Working and Task Groups meetings and and of reports sent by the WG and TG chairpersons is given in this text. More detailed versions will be posted on the Commission 5 WWW service at INASAN when available.

#### 2.1. TG ON DESIGNATIONS (AUGUST 21ST, 1997, CHAIRPERSON H.R. DICKEL)

A joint meeting of the TG on Designations, with members of the FITS TG, Data Centers, Journal editors, librarians, was held on the same day before the TG Business Meeting, to discuss recent developments in TG on Designation and common problems. Three main topics were discussed:

- Description of the new IAU "Registry of new Acronyms" by F. Genova (CDS). She described the "Second Dictionary of Nomenclature of Celestial Objects outside the solar system", which is maintained and updated by the CDS. She then presented examples of its use and of the new Registry of Acronyms which is part of this on-line Dictionary (there is also a Resolution re the Registry).
- Proposal to increase the minimum support length at 8 characters for the FITS keyword OBJECT to 32 characters. Several people spoke in support of this proposal; the main speaker was D.C. Wells of NRAO who is chair of the FITS TG.  
There is no technical reason that this cannot be changed from the original, now out-dated 8 character limit to 32 characters. D.C. Wells had put this proposal on the FITS group news but there was no response - pro or con. The Data Centers and electronic journals realize the need for this change to facilitate the exchange, search and retrieval of data; unique designations are needed for objects and it is no longer possible with 8 or even 16 characters. 24 characters would suffice for many current designations but 32 allows for the immediate future.
- Short presentations were made, including P.B. Boyce (AAS electronic journals), F. Genova (CDS), and D. Lubowich (AIP), regarding how to facilitate the proper complete designations being given in papers, data tables, before the paper is submitted to journal and/or data submitted to an archive.

#### 2.2. WG ON LIBRARIES (AUGUST 21ST, 1997, CHAIRPERSONS B. HAUCK AND U. GROTHKOPF)

U. Grothkopf presented the report she had prepared with B.G. Corbin (to be distributed in the next Commission 5 Newsletter). An impressive list of services maintained by librarians was presented: list of astronomy Newsletters (C. Van Atta, NOAO), astronomy book reviews database (M. Cummins, U. Toronto), list of IAU colloquia and other meetings (S. Stevens-Rayburn, STScI), list of astronomy librarians and libraries (U. Grothkopf, ESO), list of international astronomy meetings (L. Bryson, CFHT), an international clearinghouse for observatory manuals and information on how to access them (L. Bryson, CFHT), the Physics-Astronomy-Mathematics (PAM) Division of the Special Libraries Association (SLA) homepage (D. Stern, Yale). Several projects were also discussed : a Distributed database of Online Astronomy Preprints and Documents (NASA Grant NAG5-3942, PI R.J. Hanisch), a catalogue of individual observatory publications (B. Corbin, USNO), a preservation effort for the series of observatory publications (D. Coletti, CfA, B. Corbin, USNO). Other important resources are the astronomy Thesaurus (R. and R. Shobbrook) and the Union List of Astronomy Serials (J.L. Bausch, Yerkes).

Two distribution lists are available, which are specifically for astronomy librarians, Astrolib, managed by E. Bouton (NRAO) and EGAL (European Group of Astronomy Librariansa, managed by I. Howard, RGO).

The third LISA conference will be hosted by the Instituto Astrofisica de Canarias (IAC), Tenerife, from April 21 through 24, 1998.

Electronic journals licensing issues, and the fate of Astronomy and Astrophysics Abstracts, were also discussed.

### 2.3. TG ON REVISION OF UDC 52 ( AUGUST 21ST, 1997, CHAIRPERSON G.A. WILKINS)

The report presented by G.A. Wilkins (to be found on Commission 5 WWW service) was discussed. It covered the current status of revision, the procedures for review, checking and approval of drafts, the relationship between UDC 52 and the Astronomy Thesaurus, and the procedures for the maintenance of UDC 52 and Astronomy Thesaurus. The need for greater support from the astronomical community was emphasized. Conclusions can be summarized in the following way: it was recognized that UDC was no longer widely used in astronomy, but, nevertheless, it was hoped that the revision would be completed as soon as possible and that the schedule and index for astronomy would be made available on the World Wide Web. It was noted that the Astronomy Thesaurus and UDC 52 are complementary documents and so it was considered that it would be appropriate to maintain them in a cooperative manner so as to insure that they would both be up-to-date and mutually compatible.

### 2.4. TG DATA CENTERS AND NETWORKS (AUGUST 21ST, 1997, CHAIRPERSON F. GENOVA)

Several members of the TG took a very active part in the organization of the St Petersburg Colloquium "International Cooperation in dissemination of Astronomical Data" (July 2-9, 1996, Co-chairs O. Dluzhnevskaya and B. Hauck). The data center activities, the diffusion of data, catalogues, the new possibilities offered by electronic publication, etc were thoroughly presented. This meeting was an excellent occasion to create collaborations, in particular for the participants of Eastern Europe and FSU countries. A TG meeting was held during the Colloquium, with five of the Data Center Directors and key personnel. Collaboration, and the common standard for table description, were discussed. A resolution was proposed, assessing the need for data archiving and the role of the data centers.

A second task group meeting was held in Kyoto. C. Cheung, F. Genova, K. Nakajima, and O. Dluzhnevskaya, Directors of the American (ADC), French (CDS), Japanese (ADAC), and Russian (INASAN) Centers, presented their activities. The data centers share a common data set of catalogues and tables, and a common standard for table description, first proposed by CDS and now shared by the data centers and several major journal editors (A&A, AAS, *Astronomicheskii Zhurnal*). This standard is the key for data checks, exchange and transformation. The presentations illustrated the good collaboration between the Data Centers, and their impact on the dissemination of astronomical information for the world-wide astronomical community. The data centers (also the Chinese and Indian ones) also play an important role at regional level. The Data Center activities are more and more linked to the journals and the ADS, with the rapid evolution towards electronic publication, with in particular tables published in electronic form only. It is very important to have more journals joining the evolution.

### 2.5. TG FITS (AUGUST 21ST, 1997, CHAIRPERSON D.C. WELLS)

D.C. Wells presented a report on the activities of the FITS TG. The activities of the NSSDC FITS support office were also reviewed (report prepared by B.M. Schlesinger and presented by D.C. Wells).

It was recalled that the FITS WG was created by a General assembly resolution at Baltimore (1988); it is the "owner" of the FITS format, and controls the evolution of the FITS standard. There are three regional FITS Committees. The IAU FITS TG only considers proposed changes which have been approved by all regional committees and for which interoperability has been demonstrated, and which get approval by 3/4 majority and no "NO" vote. **BINTABLE** was approved in June 1994. The TG is currently considering year-2000 **DATExxxx** proposal (a Resolution was approved in Kyoto on that topic). Probable activities for the next triennium include the approval of the year-2000 **DATExxxx** agreement, in 1997; approval of the NOST V2.0 FITS standard, probably during 1998 (this will be a comprehensive compilation of the FITS standard); register of FITS with the Internet as a MIME data type, probably in 1998 after approval of the NOST standard; and to continue the progress towards a WCS (World Coordinate System) agreement.

A technical panel of the FITS support office is preparing draft for Version 2, including IMAGE, BINTABLE, blocking agreement, defining keyword value, table entry, data display formats no longer relying on FORTRAN definitions. This will be available for community review in 1–3 months. Version 4.0 of the User's Guide was released in May 1997 (348 accesses on ftp site in a couple of months). The Standard document got 246 accesses on ftp on the first half-year of 1997. WWW pages have been installed, which contains basics and information, and the list of extension types registered with the IAU TG. Expansion of the service is planned.

## 2.6. WG INFORMATION HANDLING (AUGUST 27TH, 1997, CHAIRPERSON A.G. HEARN)

The main WG activity in Kyoto was the organization of Joint Discussion 12, "Electronic Publishing, Now and the Future" (published in the Proceedings). P.B. Boyce will be the WG Chairperson for 1997–2000.

## 2.7. WG ASTRONOMICAL DATA (AUGUST 27TH, 1997, CHAIRPERSON E. RAIMOND)

The membership of the Working Group on Astronomical data comprises a relatively large fraction of the membership of Commission 5. All members have in common that they are actively working with astronomical data in a global way, i.e. more than an average astronomer would do in the course of his/her own research.

The activities of the Working Group as a whole are not so easily listed. During the past triennium a considerable amount of e-mail traffic between members of the WGAD has taken place. Many members contributed actively to compile the two-yearly report of the IAU to the ICSU organisation CODATA. A recently revised and updated version of this report reflecting the activities of the WGAD and other bodies of Commission 5 over the past three years (1994 - 1997), is available now.

The areas of work which are probably most specific to the WGAD are those concerning archiving of observed data, processing data and making the archived data available for later use. Interesting developments in this field have taken place in the last decennium or two. More and more observatories are setting up usable archives. And, although many of them have been plagued by shortage of funds and lack of active interest by the observers, the notion that a proper archive with data that can easily be used by outside users is getting more and more common.

After a learning period during which reasonably usable archives were set up, we've now reached the stage in which the design of the data archive is being made part of the design of a new telescope or a new observatory. The Italian Galileo Telescope, the ESO VLT and the Japanese Subaru telescopes are excellent examples. The special session on archiving at this General Assembly illustrates the growing interest in observatory archives.

R.P. Norris, ATNF, Australia, was elected as a vice-chair in 1997.

## 3. Meeting on "Ground-based observatories data handling and archiving" (August 21st, 1997, Chairperson F. Pasian)

This meeting was organized in coordination with the WG on Astronomical Data, to review the current status of data handling and archiving in active and future ground-based observatories.

In his introduction, Fabio Pasian pointed out that most of the observing facilities of the new generation now include data archiving as one of their basic tasks, and this is a significant change with respect to the past. He reminded that the purpose of archives is twofold, i.e. technical (monitoring the performance of telescope and instruments) and scientific (re-using data for purposes different from the original ones). While the first purpose implies storing all possible data including telemetry, the scientific user should be shielded from this huge amount of data, and should access only calibrated scientific exposures. Data handling and archiving are therefore closely connected with data processing. As a matter of fact, the new projects in the optical domain (ESO, Gemini, TNG) consider the observatory data management as an "end-to-end" mechanism: starting from the observation proposal, the scheduling, observation, calibration, quality control, and archiving steps are performed; through archival research a scientist gathers information useful for proposing for observing time again. Retrofitting existing archives of observatories organized in the "traditional" way to match the new concepts has proven to be impossible in most cases.

Ernst Raimond presented the results of a survey made on the status of radio-observatories archives, made by e-mail and using the Web. Seventeen facilities were screened, ranging from mm to m wavelengths, and including VLBI networks and arrays. In general, major radio-observatories save their data, but only large institutions can afford to keep data readable on modern media. While an observations catalog is

usually searchable by outside users, observations are kept off-line, and when available for external use after a proper period (18 months on average), their retrieval requires staff support to be retrieved. Catalogs are usually searchable by position, and sometimes by other parameters (source name, type of observation, etc.). Results of surveys can usually be retrieved directly, or through a data center. The accessibility ranges from excellent to usable, although it sometimes happens that the archive is not easily traceable in the hierarchy of Web pages of the observatory, and hence could be "advertised" better.

The concepts behind the data handling and archiving in the Subaru telescope project, and a description of the system, were presented by Ryusuke Ogasawara. Purpose of the system, actually a supercomputer network with dedicated hardware for data storage, is to store all observational data (including the technical information on telescope operations), manipulate the data for off-line analysis, provide a single system for database handling and image processing and analysis, and support numerical simulations to be compared to actual observations. The hardware system includes a 50Gflops vector parallel processor, a 27-nodes 98-CPU scalar parallel server, 150 TeraBytes data storage machine, 2.4 TeraBytes on fast disk, 50 workstations and 100 PCs for user activity. The computers are all linked by a fast backbone network (266 Mbps), and the connection to the telescope is guaranteed by an ATM link. The system has been installed in March 1997, and the ATM link is expected to be activated in January 1998. This outstanding hardware setup has been made possible by the close cooperation among the Subaru project and several computer and peripheral manufacturers.

Françoise Genova focussed on a number of different aspects in which data centers can complement, integrate and harmonize the information produced by observatories. Task of the data centers is to hold "metadatabases" rather than observations, and to provide navigation tools among heterogeneous distributed services including observatory archives. By displaying a number of Web pages, the CDS was used as a practical example of the services which are or can be provided. The basic service of a data center is to provide full access to individual on-line catalogs (Astronomer's Bazaar at the CDS); upgrades are the possibility of using selection criteria on a library of catalogs and displaying the results (VizieR), or providing a new service by merging information from a library of different catalogs and integrating with full bibliographic information (Simbad, CDS bibliographic service). The crucial point to link the information available with the observatory archives is to be able to reference the observational data with standard keywords (i.e. an observation identifier): in this way, users can be informed that data are available, and can select and access useful data. A first step in this direction is the definition of a standard Internet-based query language (ASU - Astronomical Server URL), defined by CDS, ESO, IUE, CADC and OAT.

The discussion held at the end of the session evidenced the following items:

- there is an increasing need for the definition of standards allowing to access uniformly on-line observatory information;
- it is necessary to define mechanisms to link metadata and bibliography information to observational data;
- source names and acronyms in observatory catalogs should be standardized: this issue becomes a technical problem if data centers are used as name resolvers through network connections;
- keeping old data readable is a serious problem; staff is also required to allow access to off-line data: the availability of new storage devices and media at affordable prices may help alleviating these problems;
- there is a need for improvements in networking: a high-capacity world-wide scientific backbone will be essential in the near future;
- making calibration software available to remote users is a critical issue for observatory archives: distribution and maintenance of such software require a considerable amount of resources;
- all of the above items imply that proper staffing and funding are to be allocated by the agencies to observatory archives and data centers.

The results of the discussion were reflected in some of the resolutions Commission 5 decided to adopt in its business meeting, on the importance of data archiving, on the need of world-wide efficient data links, and on the need to define a protocol and a unique format to access observatory data.

**COMMISSION 6:                    ASTRONOMICAL TELEGRAMS/TELEGRAMMES/  
    ASTRONOMIQUES**

President:                         R. M. West  
Secretary:                        B. G. Marsden

After the adoption of the agenda for the meeting, President West welcomed the eight other persons present and asked them to stand in memory of three members lost since the last meeting: Michael P. Candy, Antonin Mrkos and Leonida Rosino.

Given the very small number of active members of Commission 6, it was agreed that West and Marsden should serve second terms as President and Vice President, respectively. K. Aksnes, S. Nakano and E. Roemer were elected to the Organizing Committee. In the expectation that he would be elected to IAU membership, Green was transferred from consultant to membership status. C. Kouveliotou and M.K. Tsvetkov were also elected as new members of the commission, and G.R. Kastel and J. Ticha were appointed as consultants.

Remarking that Commission 6 is one of the IAU's earliest and that the rapid dissemination of urgent astronomical information by the Central Bureau for Astronomical Telegrams (CBAT) is one of the oldest and most essential services of the IAU, President West reminded those present that one of his hopes as president had been that it would be possible to disseminate the *IAU Circulars* free of charge: after all, in some countries, the cost of a subscription was a sizeable fraction of an observatory's budget. It was therefore very welcome news to read in the *Sidereal Times* that this had been accomplished that very day! Of course, the production of the *Circulars* is not without cost, and he noted that Vice President Marsden would report on how this arrangement had in fact been made. West pointed out that, since Commission 6 was outside the new IAU divisional structure, there were special demands on members of Commission 6. It was therefore rather deplorable that a certain fraction of the membership seemed to take only little interest in the commission.

Reporting on the CBAT's activity during the triennium, Marsden remarked that the downward trend evident in 1994 and 1995 had subsequently been significantly reversed, thanks to the appearance of two spectacular comets and extensive items on  $\gamma$ -ray bursters; furthermore, the 107 supernovae already announced in 1997 already represented a record for a full year. In discussing the financial arrangements whereby it had been possible to place the *IAU Circulars* freely in the World Wide Web just 160 minutes before the start of the meeting, Marsden noted that, during the preceding year, some 21 percent of the combined income of the CBAT and the Minor Planet Center (MPC) had come from subscribers to the Computer Service. Although there would still be a charge for e-mail delivery of *IAU Circulars* and use of the Computer Service (CS) on their own computers, the CBAT and the MPC could stand to lose this fraction of their combined income, some 65 percent of which goes for salaries and benefits, principally those of CBAT Associate Director D. W. E. Green and MPC Associate Director G. V. Williams, the latter serving also as webmaster and thus responsible for the Web CS dissemination of the *IAU Circulars*. What had made the free distribution possible was the anticipation that Williams' salary for the next four years would instead be paid by a grant from NASA. A recent editorial in *Nature* had condemned the use of the *IAU Circulars* as a forum for the publication of theoretical ideas. Marsden admitted that, although an attempt was made to weed out those sections of the items received that contained theoretical arguments, such publication occasionally happened. Certainly, it seems appropriate to use the *Circulars* to make a timely prediction that observations thereby inspired might confirm or deny (publication in *Nature*, for example, being too slow), and some background reasoning may then be necessary, but he agreed that some contributors went too far. It may not be appreciated that many of the items appearing on the *IAU Circulars* are in fact refereed, but this could always be done more thoroughly. Members of Commission 6 should be, and several of them are an important resource for refereeing activities.



West reported on the Commission 20 vote concerning the uniqueness of comet names. There had in a fact been a tie between those who felt that names should be unique and those for whom it was sufficient that the designations be unique. The *status quo* would therefore be maintained, at least for the next three years. A second vote had caused the reinstatement of the practice that comets might have three names, rather than the two recommended by the committee set up to produce guidelines for comet naming. S. Nakano remarked on the fact that several amateur astronomers had recently made announcements of their discoveries of alleged comets, novae and supernovae over the internet. It was agreed that this was an unwise development that could deprive the rightful discoverers of credit. If would-be discoverers insist on internet announcement in this way, it was strongly recommended that they also inform the Central Bureau of their finds. It would also be useful if those who *do* make reports to the Central Bureau were to alert the Bureau to the fact that they had made an internet report. There was a strong feeling that, given the widespread availability of CCD equipment to amateurs, the latter should take some responsibility for making at least some initial confirmation of their claims. Otherwise, the whole concept of a "discovery" could become very blurred. This was somewhat ironic, given the Commission 20 vote on reinstating the practice that comets should be named for up to three *discoverers*.

The meeting ended with a brief discussion on whether it would be appropriate, in these days of more modern communications, to change the word "telegrams" in the names of both the commission and the Central Bureau. The prevailing view was that there is little wrong with maintaining a harmless tradition. The Bureau in fact still receives telegrams -usually by snail-mail- two or three times a year. In any case, some professional contributors frequently refer to the *Circulars* quite matter-of-factly as "telegrams", a point that surely -and perhaps appropriately- stresses their urgency.

**COMMISSION 14:****ATOMIC & MOLECULAR DATA  
DONNEES ATOMIQUES & MOLECULAIRES**

President: W.H. Parkinson  
Vice President: F. Rostas  
Secretary: P.L. Smith

**Business Meeting**

The business meeting of IAU Commission 14 was called to order by F. Rostas (Vice-President) in the absence of W. H. Parkinson (President) at 14:00 on Thursday, August 21, 1997 in room H of the Kyoto International Conference Hall in Kyoto, Japan.

Present were: F. Rostas (France, Vice-President), W.C. Martin (USA, Outgoing WG 1 chair), (W.F. Huebner (USA) and R. Kurucz (USA)

W.H. Parkinson (President) and P.L. Smith (Secretary) were excused, being unable to attend due to lack of support from their national authorities. Most of the points on the agenda, especially the proposals for new officers and WG chairmen have been presented in a letter circulated by W.H. Parkinson before the meeting.

**APPROVAL OF NEW OFFICERS**

F. Rostas announced that P. L. Smith has agreed to serve as Vice-President and Nicole Feautrier as Secretary for the next triennium. There were no objections.

**ORGANIZING COMMITTEE**

According to the rules set at the 1991 GA in Buenos-Aires, members of the OC appointed in 1991 are leaving (S.J. Adelman, J. Dubau). They are replaced by K.A. Berrington, Nicole Feautrier and W.C. Martin. W.H. Parkinson remains in the OC, as ex-president and P.L. Smith as Vice-President.

The structure of Commission 14 for the triennium, 1997-2000 as it is shown on the table below is approved:

President:	François Rostas, France (1994)
Vice President:	Peter Smith, USA (1991)
Secretary:	Nicole Feautrier, France (1997)
Organizing Committee:	Keith A. Berrington, UK (1997) Nicolas Grevesse, Belgium (1994) Sveneric Johansson, Sweden (1994) W.C. Martin, USA (1997) Uffe Gråe Jørgensen, Denmark (1994) Helen Mason, UK (1994) William H. Parkinson, USA (1985), past President 1994-1997 W.-Û. L. Tchang-Brillet, France, (1994)

**WORKING GROUPS:**

W.C. Martin is retiring as chair of WG1, S. Johansson has agreed to replace him. D.R. Schultz has replaced Jean Gallagher as chair of WG3 since her death in 1995. Nicole Feautrier is becoming secretary of the Commission and has proposed Chantal Stehlé, who accepted, as new chair of WG4.

As suggested by the executive group, vice chairpersons are being looked for by the WG Chairs. Some have already been designated as shown below.

Working Group Chair	Vice	Co- Chair
1. Atomic Spectra & Wavelengths	S. Johansson	TBD
2. Atomic Transition Probabilities	W.L. Wiese	J.R. Fuhr
3. Collision Processes	D.R. Schultz	TBD
4. Line Broadening	C. Stehlé	G. Peach
5. Molecular Structure	E. F. Van Dishoeck	J. H. Black
6. Molecular Reactions on Solid Surfaces	S. Leach	TBD

#### NEW MEMBERS

Nine new IAU members have chosen Commission 14 as their primary interest. These are K. Aggarwal (India), C. Barnbaum (USA), H. Boechat-Roberty (Brazil), F. Launay (France), A. Le Floch (France), H. Ozeki (Japan), C.C. Pei (China P.R.), F. Rogers (USA), J.-Y. Roncin (France).

#### EVOLUTION OF THE COMMISSION REPORTS

At the meeting of commission Presidents, the new General Secretary (J. Andersen) announced that the format of the Commission Reports published in Reports on Astronomy (Transactions A) will be modified: basically they would be reduced to a 2 page outline. Supplementary space would be requested by the Commissions who wish to maintain a detailed scientific report. Most presidents said they would be in that case. It has been agreed that Commission 14 would continue to publish an extensive study based on the Working Group's reports.

#### MEETING ON THE SPECTROSCOPY OF LARGE MOLECULES

The principle of such a meeting initiated and sponsored by Commission 14 is accepted. Collaboration with interested Commissions has to be looked for. The exact format and date will have to be worked out by the organizing committee in consultation with competent members.

## COMMISSION 38: EXCHANGE OF ASTRONOMERS

### Report of Business Meeting at 14:00, 22. August 1997

President: H. E. Jørgensen

Vice-president: M. Roberts

Secretary: R. M. West

Members present: President, Vice-president, J. Sahade, R. M. West, S.-H. Ye

Also present were: M. Yang, J. Zhao

#### Agenda:

1. Report of the President
2. Review of membership of the Commission for the next triennium including President, Vice-president and Organizing Committee
3. Review of the Guidelines for Grants
4. Other proposals from members
5. Any other business

The President opened the meeting welcoming those who attended. The agenda was adopted.

1) The President reported that during the triennium the Commission business was carried out by the Vice-president and himself mainly through E-mail. E-mail has greatly facilitated the application and granting procedure.

The President pointed out that the cooperation with the Vice-president had been excellent and he wished to express his sincere thanks to Dr. Morton Roberts.

During the triennium up to August 12, 1997, 31 grants were given and only very few replies were negative, since the applications did not meet the Guidelines for Grants. The grants that were approved went to astronomers in 14 different countries, namely:

India (6)  
Argentina (4)  
Russia (4)  
USA (3)  
Australia (2)  
China (2)  
Nigeria (2)  
Turkey (2)  
Bulgaria (1)  
Egypt (1)  
Israel (1)  
Japan (1)  
Morocco (1)  
Ukrania (1)

The number in parenthesis being the number of grantees from each particular country. The President pointed out that the program is a general program open to applicants of all nationalities. The host institute to which the grantees went were in the following countries:

USA (12)  
 UK (5)  
 India (4)  
 South Africa (3)  
 Argentina (1)  
 Canada (1)  
 Czech Republic (1)  
 France (1)  
 Germany (1)  
 Spain (1)  
 Sweden (1)

The numbers in parenthesis again being the number of grantees that went to a particular country.

These numbers deviate somewhat from the numbers in the Report of Commission 38 as published in the IAU Report on Astronomy, Vol XXIII A due to the fact that the Report was prepared in August 1996.

The President indicated the amount of money that was available in the IAU budget in the past two triennia and the amount that would be available for the next triennium as

1992 - 1994: 76.000 CHF  
 1995 - 1997: 88.000 CHF  
 1998 - 2000: 75.000 CHF

The decrease in the amount available for the next triennium compared to the past is not due to a lower priority of the granting program of Commission 38. In fact the number of grants have increase considerably during the last triennium compared to previous ones. However, the price of air fares have been reduced considerably during the years.

According to the IAU Information Bulletin No. 80 the expenditures are as follow :

1991 - 1993: 39513 CHF  
 1994 - 1996: 50689 CHF

The budget for the next 3 years thus exceeds the expenditure in the last 3 years by approximately 50% and the President foresees no money problems.

The number of grants assigned in the last triennium is larger than in any recent triennia, namely

1976 - 1979: 18  
 1979 - 1982: 24  
 1982 - 1985: 23  
 1985 - 1988: 23  
 1988 - 1991: 27  
 1991 - 1994: 24  
 1994 - 1997: 31

Finally the President invited questions or remarks to his report. Dr. R. West asked about the negative replies and the trend. The President said that only 2-3 negative replies were given to applications. E.g. travel money was not given to go and take up a new job at another institute. Also grants could not be given to researchers in totally different fields. Furthermore, informal requests by E-mail had to be answered negatively unless the applications were in line with the Guidelines for Grants. Potential applicants were informed of the Guidelines.

Dr. F. Yang asked about the percentage of negative replies. The President mentioned that 31 grants were approved and with negative answers to only a few real applications as mentioned the percentage of negative replies was very low.

The President wished to stress that the Commission does not work as a Research Council. If an application is in agreement with the Guidelines for Grants then a grant is given.

2) The President reported that Dr. Hong-jun Su has asked to cancel his name from the member list of Commission 38 due to heavy work load. The President expressed his gratitude to Dr. Su for his support to our Commission.

The President also reported that he had approached a number of active astronomers from regions presently under-represented in Commission 38 getting advice from the Vice-president and Dr. West. In this connection Dr. Mazlan Othman (Malaysia), Dr. Russell Cannon (Australia), Prof. Vytas Straizys (Lithuania) and Dr. Massimo Capaccioli (Italy) have confirmed that they are prepared to serve as Commission 38 members. The President proposed them as new members. Furthermore Dr. S.-H. Su proposed Prof. J. Zhao (China) as a new member. Commission 38 agreed to those being proposed by the President and Dr. Ye and welcomed them as new members. No additional names were proposed and the final list as presented by the President was agreed.

The President proposed to confirm to the EC the following names for the next triennium :

- Dr. Morton Roberts as the next President

- Dr. Richard M. West as the next Vice-president

and D. M. Chitre, J. R. Ducati, G. Krisna, M. Morimoto, C. R. Tolbert, S.-H. Ye and H. E. Jorgensen as members of O. C. No objections were raised.

3) The President had received no proposals for changes of 'Guidelines for Grants'. He pointed out that the Guidelines work very well and have the necessary flexibility being guidelines and not strict rules. As mentioned once by the Vice-president: There are no standard cases - all seem to be special. The President could fully echo this statement. There were no proposals for changes of the 'Guidelines for Grants' during the meeting.

4) The President had received no proposals from members but considered this moment to be a good opportunity to express opinions about the future work of the Commission. He said that the 'Guidelines for Grants' are now being printed in every issue of the IAU Information Bulletin. It is very important to remind the IAU members of the existence of the program, since the professional astronomers are supervisors for graduate students and can make the students aware of the program. Also the travel grant program has been mentioned in the EAS News.

To a question from Dr. West if UNESCO was informed the President said that he was not aware of that. It would be a good idea to inform UNESCO since it has offices in many countries. However, the granting program is mentioned in a number of commercially available booklets informing about grants.

5) No issues were raised.

The Vice-president thanked the President for having done an outstanding job and expressed his great pleasure to work with the President. Dr. Ye echoed the words by the Vice-president.

The President closed the meeting at 14:38.

## COMMISSION 46 (THE TEACHING OF ASTRONOMY)

*Report of Business Meetings: 21 and 25 August, 1997*

PRESIDENT: John R.Percy

SECRETARY: Jay M. Pasachoff

### 1. Report of the President

Most of the work of the Commission is carried out by the Organizing Committee, and this is outlined in the Commission's Triennial Report. The president concentrated on making contacts with astronomy educators in many countries (including ones not yet adhering to the IAU), visiting as many countries as possible (including Brazil, Central America, China, Paraguay, several countries of Europe, and Canada and the US), and/or attending meetings and writing papers which publicize the work of the Commission. The president has worked to develop and maintain good links with the planetarium and science centre community, the amateur astronomy community, and with the science education community, as well as with major scientific and educational organizations.

### 2. Officers and Organizing Committee

The following officers and Organizing Committee were recommended for the 1997-2000 triennium: Julieta Fierro (President), Syuzo Isobe (Vice-President; Liaison, Asia-Pacific Region), Armando Arellano Ferro (Liaison, Latin America), Alan Batten (Chair, Working Group on the Worldwide Development of Astronomy), Michèle Gerbaldi (Secretary, ISYA), Edward Guinan (Assistant Secretary, ISYA), William Gutsch (Liaison, IPS), Darrel Hoff (Books and Journals Program), Barrie Jones (Newsletter Editor), Peter Martinez (Liaison, Africa), Derek McNally (Chair, TAD), Jayant Narlikar (Liaison, India), Andrew Norton (Webmaster), Jay Pasachoff (Chair, Subcommittee on Eclipses), John Percy (Past President; Coordinator, Travelling Telescope), Donat Wentzel (Secretary, TAD).

### 3. Membership

The Commission 46 membership records at IAU Secretariat have several problems (such as many National Representatives not being recorded as members of the Commission). The president will attend to this problem immediately after the General Assembly.

In the past, all members have received the publications of the Commission by mail, and this has been an expensive proposition. Now that the publications are available by e-mail, and on the WWW (address : <http://physics.open.ac.uk/IAU46/>), they will be mailed only to National Representatives, and to a few other key people who do not have access to the Internet. Members of the IAU may join Commission 46 if they have a special interest in education, above and beyond the routine teaching of courses. This membership does not count as part of the IAU's "three commission limit".

### 4. International Schools for Young Astronomers (ISYA)

ISYA's were held in Egypt (1994), Brazil (1995) and Iran (1997). Reports on these have been published in the Newsletter, which is posted on the WWW. Possible future sites include: Romania (in conjunction with the total solar eclipse in 1999), Southeast Asia, Nigeria, Peru, Ukraine, or Vietnam, depending on what invitations are received. ISYA's are costly, since 20-30 students must be brought to the site and supported for three weeks.

## 5. Teaching for Astronomical Development (TAD)

Secretary Donat Wentzel reported on behalf of Derek McNally, chair of TAD. From 20 applications for the TAD program, four were chosen. Programs are underway in Central America, and Vietnam, and are being considered for Morocco and Sri Lanka, pending the choice of suitable sites and local sponsors. TAD funds are used for a variety of purposes, including visiting lecturers, providing equipment, etc. There is often a problem transporting equipment, and getting it into the country.

In September 1997, Wentzel and a colleague will run a workshop in Vietnam for 15 university instructors, and 15 physics students, to update them in astronomy, and instill a sense of inquiry. There will be practical activities in both astronomy, and astronomy teaching. The lack of audio-visual facilities is partly offset by a generous donation of textbooks by a US publisher. Two Vietnamese students are in PhD programs in Paris, and are expected to return to Vietnam to do research. The TAD program is supported by the highest levels of the government of Vietnam. Wayne Orchiston mentioned a New Zealand astronomer, now working in Vietnam, as a possible source of assistance.

A second TAD program operates in Central America. The IAU supports an annual course in observation, at the observatory in Honduras, and also the annual meeting of Central American astronomers, which is a useful form of professional development. The European Council is providing funds for a series of six MSc courses - possibly one in each of the six participating countries - though this program has some problems. There was a UN/ESA (United Nations/European Space Agency) Workshop on Basic Space Science, in Honduras, in June 1997.

## 6. Travelling Telescope

The travelling telescope consists of a Celestron-8 telescope with accessories and instruments, in four large shipping crates. Because of the size, weight, and delicacy of the telescope, it has been difficult to transport. For the last several years, however, the instruments have been in Paraguay, as a follow-up to the Visiting Lecturers Program. They were returned to Canada in August 1997 for refurbishment. What should be the future of the travelling telescope and its instruments. Should they be given on long-term loan? Should the telescope be sold, to raise money for other instruments which are easier to transport?

## 7. Newsletter (Electronic and Paper) and Web Site

Generally, the electronic version of the Newsletter is produced and sent every three months. The editor is John Percy, and the distributor of the electronic Newsletter is Armando Arellano Ferro. Every six months, two electronic issues are printed and mailed to the National Representatives and other contact people. The issues are also posted on the Commission's web site. These arrangements will continue for the next triennium. Percy will continue as Newsletter editor until April 1998, when Barrie Jones will take over. Norton will continue as webmaster. Rajesh Kochhar noted that many countries, including India, have only limited access to the WWW. The Commission Newsletter, and other such resources, should be distributed as much as possible by the National Representatives.

## 8. Triennial Reports

Triennial Reports on astronomy education in the countries adhering to the IAU, and several other countries, were prepared and distributed by mail to the National Representatives and other contact people. They were also posted on the web site. Several National Representatives did not provide reports, despite many reminders. Percy met with the National Representatives to the IAU General Assembly in August 1997, to urge the appointment of active National Representatives to the Commission. The Triennial Reports will continue in their present format for another triennium. Wayne Orchiston suggested including short bibliographies with the reports.

## 9. Solar Eclipses and Astronomy Education

There is a subcommittee of the Commission - Jay Pasachoff (chair), Julieta Fierro, and Ralph Chou - which promotes safe and successful eclipse viewing to advance astronomy education. Total solar eclipses are especially striking, but partial eclipses occur over a wider area of the Earth, and also provide a good opportunity for public education. In the next triennium, there will be a total eclipse in February 1998 visible in Panama, northern South America, and some of the islands of the Caribbean; the zone of the partial eclipse covers much of North and South America. The August 1999 eclipse will be total in a band



from southern England across Europe, through Turkey, Syria, Iran and Iraq, to India and Bangladesh. It will be partial in a wide band of Europe and Asia. The annular eclipse of 1998 will bring a partial eclipse throughout Southeast Asia, and the annular eclipse of 1999 will bring a partial eclipse throughout Australia and New Zealand. Chou has been testing safe filter materials. There is now an increased availability of solar-filter materials, such as CD's, the inside of floppy discs, and even aluminized Mylar used to pack tea in South Africa and perhaps elsewhere.

## 10. Books and Journals

The Commission has begun a program to find and distribute surplus books and journals to suitable institutions in the developing countries. Darrel Hoff is presently co-ordinating this program, and requests help in finding suitable material. First priority goes to institutions which are taking part in other Commission programs such as ISYA, TAD, and VLP. The IAU sends complimentary copies of its publications to many needy institutions, especially in the former Soviet Union, and several other organizations send copies of their publications to a few developing countries. The problem is to find books and journals which are at a suitable technical level. These might include: *Sky and Telescope*, *Astronomy and Geophysics* (a new publication of the Royal Astronomical Society), and *The Messenger*, a publication of the European Southern Observatory.

## 11. Future Meetings

There was much discussion of an invitation, presented by Wayne Orchiston (New Zealand) and Maria Hunt (Australia), to hold the next proposed IAU colloquium on astronomy education in Australia, specifically in Penrith (50 km from Sydney) in the Blue Mountains, 12-16 July, 1999. This follows by one week, a joint meeting of Australian and New Zealand astronomers. There will be field trips on July 10-11, and a teachers' day on July 11. The theme of the meeting is "astronomy education in the schools, including roles of observatories, planetariums, and astronomical societies". Graeme White (University of Western Sydney) will chair the LOC, and several other members of the LOC have already been appointed. Julieta Fierro will chair the SOC. The invitation was unanimously and enthusiastically accepted by the meeting.

Other forthcoming meetings of possible interest to the Commission include: a colloquium on amateur-professional cooperation in astronomical education and research, in Toronto, July 5-7, 1999; a colloquium on light pollution and related topics, organized by IAU Commission 50 as part of UNISPACE III in Vienna, in late July 1999; a summer school of the European Association of Astronomy Educators, to be held in France in connection with the August 11, 1999 total solar eclipse; and a possible ISYA in Romania at the same time.

The traditional one-day meeting between astronomers and schoolteachers was organized, at the 1997 IAU General Assembly, by Syuzo Isobe and his colleagues. About 150 schoolteachers attended, along with several astronomers. John Percy thanked him, on behalf of the Commission, for organizing such a successful event.

## 12. Regional Activities

Syuzo Isobe reported that he will continue to publish the bulletin *Teaching Astronomy in the Asia-Pacific Region* every half year. Wayne Orchiston suggested that we should have some contact with the Asian-Pacific Economic Group, which is meeting soon.

There is now a Working Group on Basic Space Science in Africa. Peter Martinez is our liaison person with that group. Francois Querci (querci@astro.obs-mip.fr) reported on that group's new publication *African Skies/Cieux Africains*. See also the web site: <http://www.sao.ac.za/wgssa/>

Nikolai Bochkarev (Sternberg Astronomical Institute, Russia) reported on the work of the Euro-Asian Astronomical Society, which includes the countries of the former Soviet Union. They have several branches connected with astronomical education, including planetariums. They have several popular magazines, an association of schoolchildren etc. Professor Bochkarev urged the commission to appoint a liaison person for the countries of the former Soviet Union.

## 13. Liaison with Other Organizations

*Working Group on the Worldwide Development of Astronomy.* Alan Batten reported that there is much overlap between the work of the WGWWDA and of Commission 46, though the WGWWDA is concerned

about the full range of astronomical activity - not just education. Batten, John Percy, and Donat Wentzel have travelled to several astronomically developing countries, and there has been good co-operation between the WG and the Commission - in part, because the president of one is a member of the Organizing Committee of the other. This kind of co-operation should continue. With regard to Morocco: Batten noted that the Atlas Mountains may be one of the last great observing sites in the world which is not already used. Site testing is being done, in collaboration with the Observatoire de Nice.

*International Planetarium Society.* William Gutsch, who is a member of the Organizing Committee of the Commission, was not able to be present, but his report was read. Tens of millions of people visit planetariums each year, so they have a major impact on formal and informal education. Gutsch's report described a project to enlist the help of astronomers as advisors and visiting lecturers in planetariums.

*UN Office for Basic Space Science.* Hans Haubold reported on the series of UN/ESA Workshops on Basic Space Science, held since 1991. Five were held in the five major regions of the developing world. The sixth was held in Germany, to assess the first five, and plan for the future. A seventh workshop was held in Honduras, in June 1997, on the occasion of the official opening of the observatory there. These workshops are part of the activity of the UN Committee on the Peaceful Uses of Outer Space (COPUOS). The UN thus contributes to the development of astronomy.

Donat Wentzel proposed the following resolution: "Considering the practical advances in astronomy that followed the UN/ESA workshops on basic space science, and considering the strong interest of Commission 46 in the countries affected by these workshops, Commission 46 urges that the UN Committee on the Peaceful Uses of Outer Space, and ESA continue the series of workshops." Jean-Claude Pecker, chair of the IAU Resolutions Committee, pointed out that this cannot be an IAU resolution, but should be dealt with by the IAU Executive Committee, especially as it has budgetary implications.

Alan Batten suggested that the IAU should co-sponsor the workshops. In that case, support for at least one speaker would be expected. There are no funds allocated for this in the proposed IAU budget. Wentzel suggested that an IAU-supported speaker could organize a half-day workshop, as well as giving a talk. Jean-Claude Pecker suggested that, when the resolution was transmitted to the IAU Executive Committee, it should have an appendix, saying that the Commission would like the IAU to be a co-sponsor, provided that suitable funds can be allocated to it. The resolution was passed unanimously. The president transmitted it to the IAU Executive Committee.

Haubold noted that his office receives more and more requests, from developing countries, on how to introduce astronomy in the teaching curricula of high schools, colleges, and universities. They would like to be able to provide kits to teachers, free of charge. They might even be able to translate resource material into various languages, especially if the length of any resource document could be kept to 48 pages or less. Wentzel offered to develop a booklet of this approximate length, dealing with the introduction of astronomy in university-level physics courses. The UN may be willing and able to translate it.

Haubold's address is: Program on Space Applications, Office for Outer Space Affairs, United Nations, Room F-0839, Vienna International Centre, P.O. Box 500, A-1400 Vienna, Austria. E-mail: haubold@eunet.c

*ICSU (International Council of Scientific Unions).* The IAU Assistant General Secretary Johannes Andersen has been the official representative to ICSU. There is no longer representation on an ICSU Committee for the Teaching of Science. ICSU now has a Committee on Capacity Building in Science, which is obviously of interest to the IAU and Commission 46. Furthermore, ICSU is our channel to UNESCO. Jean-Claude Pecker recommended that the Commission should make proper contacts with ICSU's General Secretary so that, at the meeting of UNESCO in November, on teaching, the importance of the teaching of astronomy will not be overlooked. Derek McNally agreed that it is very important to develop and maintain this connection with UNESCO. The head of its physics commission is sympathetic to astronomy.

*Committee on Space Research: (COSPAR).* Alan Batten reported on a possible IAU-COSPAR initiative to provide workshops, for astronomers from developing countries, on how to access and use databases from satellite observatories. The IAU WGWWDA has advised the IAU General Secretary that, in its opinion, the idea is a good one, but there would be practical difficulties such as the compatibility of computer systems.

*International Dark-Sky Association.* David Crawford reported on this organization, whose goal is the preservation of the astronomical environment in both developed and developing countries. It has over

2000 members in 62 countries. Since the IAU has a commission (50) which deals with this issue, and since our vice-president Syuzo Isobe is past president of that commission, that could provide an appropriate link. We could also cross-link our web site with theirs (<http://www.darksky.org>).

#### 14. Astronomy Educational Material

The Commission formerly had a project - Astronomy Education Material (AEM) - which was a listing of educational resource material in various languages. It also had a Project Contratype, which was a collection of photographs and slides, for loan. The discussion by Hans Haubold, above, led to a discussion of the continued need for resource lists, and other teaching material.

Robert Robbins, who was responsible for the English-language AEM list, reported by e-mail message. He recommended a WWW-based listing, which could include mini-reviews by users of the material. The Internet "bookstore" Amazon.com contains reviews, and people could be encouraged to submit reviews of astronomy books.

John Percy reported that the Astronomical Society of the Pacific was developing a set of 40 slides to illustrate a core unit on astronomy at the grade 5-8 level. These might be useful to developing countries.

There were several comments about possible resource materials: listings of resources, publications, audio-visual materials, kits etc. (1) Slide projectors are unavailable at many institutions; overhead projectors may also be unavailable. Perhaps a corporation such as Kodak would be willing to fund a booklet of photos of selected astronomical objects. (2) Material should be written in the language of the country involved; the UN can possibly do the translation. (3) In India, teachers want information on how to build a small telescope, and also on "exotic" topics like space probes and black holes. It may therefore not be possible to satisfy every need through a single, short document. (4) Some resource materials, including images, are available on the WWW, but most institutions in the developing world do not have access to this.

#### 15. Other Business

*Rules and Guidelines of the Commission.* These were approved in 1973 and updated in 1988. The Organizing Committee has decided that, although the rules and guidelines are slightly out of date, no great effort will be made to revise them at this time. John Percy agreed to look into this matter in the near future.

*International Astronomy Day/Week.* The president was approached by Gary Tomlinson, the co-ordinator of International Astronomy Day (at least within North America), asking the Commission to co-sponsor or support this event. In the US, the Astronomical League, and Sky Publishing Corporation have developed a useful handbook on organizing this event locally. Although there was support in principle for the concept of International Astronomy Day (indeed, it is celebrated in many countries, though not necessarily on the same date), there was concern that the Commission had no control on the content of any local Astronomy Day event, and this could be a source of embarrassment. Various members of the audience spoke about their own local experiences with Astronomy Day. Derek McNally proposed a resolution: "to encourage adhering bodies to find an appropriate local body to organize an astronomy day or week in their respective countries". There was no objection. This resolution by the Commission will be transmitted to the National Representatives through the newsletter, and to other appropriate organizations; the International Union of Amateur Astronomers was one possibility.

Donat Wentzel brought forward a budget item: a request to support an annual newsletter on astronomy education, with a circulation of 4000, being distributed in the former Soviet Union. The editor is Edward Kononovich. The newsletter is in Russian. Wentzel had an English translation. Wentzel suggested that the commission provide \$500 on a one-time basis. There was no objection. Jay Pasachoff suggested placing the newsletter on the commission's web site. Terry Oswalt offered to place it on the web site of the International Amateur-Professional Photoelectric Photometry web site, because that organization has many members in the FSU.

In closing, John Percy thanked the outgoing past president Lucienne Gouguenheim, who is retiring from the Organizing Committee, for her long and effective service to the Commission. The incoming president Julieta Fierro expressed her happiness at becoming president, because of the importance of the Commission's work. She expressed the thanks of the Commission to the outgoing president John Percy, for his excellent work.

**COMMISSION 50: PROTECTION OF EXISTING AND POTENTIAL OBSERVATORY SITES/  
PROTECTION DES SITES D'OBSERVATOIRES EXISTANTS  
& POTENTIELS**

S. Isobe  
*National Astronomical Observatory*  
*2-21-1, Osawa, Mitaka, Tokyo 181, Japan*

PRESIDENT: S. Isobe  
VICE-PRESIDENT: W.T. Sullivan

After the adoption of the agenda for the meeting, President Isobe welcomed the nine other persons present. It was reported by the President that the IAU one-and half day long JD5 "Preserving the Astronomical Windows" had been successfully held with a total attendance of 200 in changing from one session to the other.

For the problem of light pollution, CIE and IAU Commission 50 nicely worked out together to bring its guideline for minimizing sky glow to the CIE Division 4 resolution and the IAU resolution. For the problem of radio interference, Commission 50 did not work hard contrary to that of light pollution. A report by J. Cohen a representative of Commission 40, showed a difficult situation of radio interference and requested a strong support from Commission 50. Three resolutions were proposed at the JD5 under the directorship of Commission 50 and were discussed and approved.

Following tradition, W.T. Sullivan, who had been vice-president, was approved as President of Commission 50. As for the next vice-president, Isobe proposed J. Cohen, a radio astronomer, since the problem of radio interference should be worked on more in Commission 50. This proposal was accepted together with the proposal to set up an SOC. Commission 50 did not have an SOC, and therefore, its President and vice-president should work on the matter in most cases. This limited its activities within light pollution, and some other problems were not properly worked on.

The following SOC members were appointed considering distributions of astronomical fields and geometry in the world. They are:

D. McNally	UK
T.A. Spoelstra	Netherland
D. Crawford	USA
B. Hidayat	Indonesia
S. Isobe	Japan
S. Jiang	China
D. Malin	Australia).

Four members expressed their wish to retire from Commission 50. They are:

Dr. Victor M. Blanco (USA)  
Dr. Wolfgang Mattig (Germany)  
Dr. Sidney van der Bergh (Canada)  
Dr. J. Dommanget (Belgium)

who are thanked for their past activities.

There were a number of inactive members who will, we hope, be active in the future because the activities of Commission 50 relate to all the fields of astronomy. There are 4 members to whom our correspondence no longer reaches. It was decided to delete their names from the Commission 50 member list after the final contact of the new Commission president to them. One new member, Dr. Hubertus Wöhl (Germany), and one consulting member, Mr. Javier Diaz-Castro, were accepted. During the JD5, 26 people expressed their intention to be members of Commission 50. After checking who are IAU member or not, W. Sullivan will make a decision who will be members or consulting members.

Considering that a joint project between CIE and IAU on light pollution is approaching the final stage it was decided that S. Isobe would continue to be a liaison to the CIE. W. Sullivan proposed to have an IAU Colloquium in 1999, adjacent to the UNISPACE III held in Wien, July 1999. Its proposal should be sent to the EC by the new Commission 50 President. As we found at the JD5, many astronomers are interested in the activities of Commission 50. We concluded to continue to work these

## COMMISSIONS NON ATTACHED TO A DIVISION

### COMMISSION 41: HISTORY OF ASTRONOMY/(HISTOIRE DE L'ASTRONOMIE)

President: S. M. R. Ansari  
Vice President: Steven J. Dick  
Secretary (Business meeting): W. Orchiston

#### 1. Business Sessions (Friday, August 22 and Tuesday, August 26, 1997)

##### 1.1 GENERAL

Commission Vice President S. Dick called the meeting to order at 1400 hours, August 22 in Room H of the Kyoto International Conference Hall. W. Orchiston was appointed Secretary, and S. Débarbat balloteer for the elections. Of the members of the 1994-1997 Organizing Committee S. Débarbat was present; the remaining members (A. Gurshtein, J. North, S. Nakayama) were unable to attend. 21 others were in attendance. A moment of silence was observed for members deceased since the last G.A., including LeRoy Doggett (U. S. Naval Observatory, Washington) and Bruno Morando (Bureau des Longitudes, Paris).

President Ansari reported on the attempts to organize a symposium on several themes, including "Astronomy in Asia and the Far East", for the current General Assembly; in the end the EC approved the present 1.5 day Joint Discussion on "The History of Oriental Astronomy". He also reported that S. Dick sent out two Commission Newsletters over the past year. In an attempt to raise the Commission membership, the President wrote a message that was posted on the World Wide Web and sent to Commission Presidents.

##### 1.2 ELECTION OF OFFICERS, NEW MEMBERS AND CONSULTANTS

Elections duly held, taking into account absentee ballots, resulted in the following officers for the 1997-2000 triennium:

President: S.J. Dick (USA)  
Vice-President: F.R. Stephenson UK  
Immediate Past President: S.M.R. Ansari (India)  
Organizing Committee: Wolfgang Dick (Germany)  
Alex Gurshtein (Russia)  
Il.-S. Nha (Korea)  
Wayne Orchiston (New Zealand)  
Edoardo Proverbio (Italy)  
Woodruff T. Sullivan (USA)  
Xi Zezong (China)

New members of the Commission approved were Emmanuel Danezis (Greece), Joseph. S. Mikhail (Egypt), Dimitrios Papathanasoglou (Greece), Efstratios Theodossiou (Greece), Maria Stathopolou (Greece), Theofanis Grammenos (Greece), Ian Glass (S. Africa), John Hearnshaw (New Zealand), Alan Batten (Canada), Brian Warner (S. Africa), Kwan-Yu Chen (USA), Jang-Hae Jeong (Korea), Yong-Sam Lee (Korea), Chun-Hwey Kim (Korea), Yonggi Kim (Korea) Hi-Il Kim (Korea), Woo-Baik Lee (Korea), Kyu-Dong Oh (Korea), Tiberiu Oproiu (Romania), Y. Sobouti (Iran), Virginia Trimble (USA), Shi-zhu Cui (China PR), Roslynn Haynes (Australia), Thomas Hockey (USA), Wolfgang Kokott (Germany), Chun-yuu Ma (China PR), Nagahoshi

Ohashi (USA), John Perdrix (Australia), Sh. Ehgamberdiev (Uzbekistan), John Whiteoak (Australia), David Jauncey (Australia), Mike Bessell (Australia), Don Matthewson (Australia), Bruce McAdam (Australia), Ken Freeman (Australia), William Tobin (New Zealand), Kitiro Hurukawa (Japan). Of these Cui, Haynes, Hockey, Kokott, Ma, Ohashi and Perdrix were elected new members of the IAU during this General Assembly.

New consultants voted were Brenda Corbin (USA), David A. King (Germany), E. S. Kennedy (USA), K. Locher (Switzerland), Stephen McCluskey (USA), J. F. Oudet (France), Clive Ruggles (UK), and M. Yano (Japan). Consultants reelected were J. Tenn (USA), J. Bennett (UK), K. Bracher (USA), J. Evans (USA), R. Freitag (USA), A. Jones, S. R. Sarma (India), B. G. Sidharth (India), B. van Dalen (Netherlands), T. Williams (USA) and L. Włodarczyk.

The total membership of the Commission, including the new members, stands at 147, plus 17 consultants.

### 1.3 RESOLUTIONS

Débarbat read the resolutions passed at the last General Assembly regarding the organizing and cataloguing of IAU archives and the preservation of relics related to F.G.W. Struve's measurement of the arc of the meridian. Regarding the first, Débarbat reported that the IAU archives have been deposited in Paris with the General Secretariat. Regarding the latter, Batten reported that the resolution has had some effect, notably by contacts with the International Union of Geodetic Surveyors, and that efforts are continuing.

New resolutions included the following:

- 1) Whereas historical astronomical records are important to the heritage of astronomy and may be essential to applied astronomy

The IAU supports the recovery, inventory and preservation of astronomical archives of national and international institutions, including observatories, societies and other institutions.

- 2) That Commission 41 records its serious concern regarding grave losses at Pulkovo as the result of fire, and supports the assessment of these losses to the cultural heritage of astronomy.
- 3) That, in order to facilitate research into the history of astronomy in a country (the "host country") that was subjugated or governed by another country ("governing country"), and where the relevant source material now resides in the governing country, every attempt should be made to provide copies of such source material to the host country.
- 4) Noting that vital primary source material pertaining to history of astronomy in a country (the host country) that was ruled or governed by another (the governing country) resides in the governing country, it is recommended that visiting fellowships be created by IAU, European Union, and bilateral agreements between countries to enable researchers from a host country to consult source material in a governing country.

### 1.4 COMMISSION 41 STATUS IN IAU

The members voted to support the position that "History of astronomy is a discipline that overarches the entire field of study of the IAU, and therefore should not be confined to one Division. We wish to remain a separate Commission until such time as we can become a separate History of Astronomy Division".

Discussions with incoming General Secretary Johannes Anderson and incoming President Robert Kraft indicated that this is not a problem.

### 1.5 FUTURE MEETINGS

The Commission endorsed a proposal by Edoardo Proverbio that a meeting (probably an IAU colloquium) on "Polar Motion: Historical and Scientific Problems" be held in Italy on the occasion of the centenary of the International Latitude Service (ILS) in 1999. The meeting would be held immediately before or after the Italian Astronomical Society meeting in September/October, 1999, hosted by the Cagliari Astronomical Observatory. Co-sponsorship by Commissions 19 (Earth Rotation) and 31 (Time) are being sought.

Looking forward to the next General Assembly in Manchester, the chair proposed as a possible topic for a Joint Discussion "Applied History of Astronomy", especially since the world's leading scholar in the field (F. R. Stephenson) is in the UK, and he is now V.P. of Commission 41. This proposal was enthusiastically endorsed by the members.

In light of the fact that the next General Assembly will be held in the year 2000, it was suggested that Commission 41 sponsor an Invited Discourse on "The History of Astronomy in the 20th Century". President S. Dick will follow up.

## 1.6 OTHER NEW BUSINESS

W. Orchiston (New Zealand) discussed a proposal to form a new "Journal for the History and Heritage of Astronomy". It would replace the current Australian Journal of Astronomy, and John L. Perdrix (Australia) would remain its editor. It would not wish to be competitive with the current Journal for the History of Astronomy, but would seek to publish a wider variety of articles.

## 1.7 COUNTRY REPORTS AND OTHER PAPERS

At the end of the first business meeting Rajesh Kochhar spoke on the History of Astronomy in India, and Wayne Orchiston on history of astronomy activities in New Zealand. Following the Joint Discussion at the second business meeting, Suzanne Débarbat spoke on the history of astronomy activities in the Department of Fundamental Astronomy at Paris Observatory, and Il.-S. Nha reported on a new Museum of Astronomy in Korea, to open in October, 1998.

Incoming President S. Dick thanked outgoing President Ansari, Professor Yano, and the members of the Scientific Organizing Committee of JD 17 for putting together a successful meeting. He also thanked the outgoing members of the Commission 41 OC, and wished Suzanne Débarbat best wishes in her retirement.

## 2. SCIENTIFIC SESSIONS: JOINT DISCUSSION 17, AUGUST 25-26

The entire day Monday, August 25 and the first part of the morning August 26, were devoted to JD 17 "History of Oriental Astronomy". Approximately 100 people in attendance heard papers on the ancient and medieval periods, including: the earliest stage of Chinese astronomy (Y. Maeyama), Islamic astronomy in China (B. van Dalen), an Arabic commentary on al-Tusi's *Tadhkirah* and its Sanskrit translation (T. Kusuba), Ancient Indian astronomy in China (J. Xiao-Yuan), Korean star maps of the 18th century (Il.-S. Nha), Knowledge of the starry sky in Indonesia (B. Hidayat), the projection method of star mapping in the Song Dynasty, astronomy in the Orient to the 12th and 13th centuries (K.-Y. Chen), Vedanga astronomy (Y. Ohashi), spherical trigonometry in the astronomy of the medieval Kerala school (K. Plofker), and astronomical dating and statistical analysis of Shang dynasty oracle bone records (K. Pang, K. Yau and H. Chou).

Among the papers in the modern astronomy session were *The Drkpaksasarani*: A Sanskrit version of de la Hire's *Tabulae Astronomicae* (D. Pingree), Modern astronomy in Indo-Persian sources (S.M.R. Ansari), Takamine and Saha's contacts with western astrophysics (D. DeVorkin), contemporary astronomy in Iran (Y. Sobouti), astronomy education in the East (S. Isobe), Kepler's law in China (K. Hashimoto), the status of astronomy in Uzbekistan (S. Ehgamberdiev), Power and politics in 19th century Australian astronomy (W. Orchiston), old Burmese sky charts (M. Nishiyama), and an overview of Oriental astronomy (S. Nakayama).

## 3. Other Sessions

In addition to JD 17, Commission 41 also supported JD 8 "Stellar Evolution in Real Time," JD 20 "Enhancing Astronomical Research and Education in Developing Countries" and JD 23 "The Leonid Meteor Stream: Historical Significance and Upcoming Opportunities". S. Dick gave a paper in the latter on "Observations of the Leonids over the Last Millennium".



**WORKING GROUPS OF THE EXECUTIVE COMMITTEE**

<b>WORKING GROUP</b>	<b>ON PLANETARY SYSTEM NOMENCLATURE</b>
<b>WORKING GROUP</b>	<b>ON ENCOURAGING THE INTERNATIONAL DEVELOPMENT OF ANTARCTIC ASTRONOMY</b>
<b>WORKING GROUP</b>	<b>FOR THE WORLDWIDE DEVELOPMENT OF ASTRONOMY</b>
<b>WORKING GROUP</b>	<b>ON FUTURE LARGE SCALE FACILITIES</b>

## ANTARCTIC ASTRONOMY

*WGDA Report for Period July 1993—June 1996*

COMPILED BY M.G. BURTON

*Joint Australian Centre for Astrophysical Research in Antarctica  
University of New South Wales  
Sydney, NSW 2052, Australia*

### 1. Introduction

The Antarctic plateau provides the best site conditions on the Earth for a wide range of astronomical observations, both of photons and particles. This is a result of the unique combination of cold, dry and tenuous air found only there. Wintertime temperatures average below  $-60^{\circ}\text{C}$ , with minimal diurnal variation, the precipitable water vapour content is below  $250\ \mu\text{m}$ , the katabatic wind is low on top of the plateau and there are no jet streams at high altitude. The vast quantities of pure ice can be used as an absorber for particle detectors. Secondary benefits include continuous viewing for any source visible, lack of pollution and dust in the atmosphere, and low electromagnetic interference. Considerable activity is now focussed at the South Pole on developing facilities for astronomy. Initial investigations of higher sites have begun, particularly at Dome C.

### 2. South Pole Observatory (2,900 m)

Two principle astronomical activities are underway at the Amundsen–Scott South Pole station, operated by the National Science Foundation of the USA, those of CARA and of AMANDA. Scientists from Australia, France, Germany, Sweden and the UK also participate in these projects.

#### 2.1. CENTER FOR ASTROPHYSICAL RESEARCH IN ANTARCTICA

AST/RO, the ‘Antarctic Sub–mm Telescope / Remote Observatory’, a 1.7–m diameter sub–mm telescope, was commissioned in 1995. It has surveyed the southern Milky Way in the 492 GHz [CI] line, only observable infrequently from other good observing sites. Carbon emission has been found to be widespread and at least as extensive as regions of CO emission. The first detection of [CI] from the Magellanic Clouds has been made. Lines as weak as 0.02 K have been measured.

COBRA, the ‘Cosmic Background Anisotropy Experiment’, using the 0.75–m Python telescope, has reliably reproduced structure observed in the CMBR on angular scales from  $0.75^{\circ}$  to  $5.5^{\circ}$  over 4 successive austral summers. The sky coverage has been increased from 8 to 123 square degrees in that time. Significantly greater anisotropy is detected on degree scales than found by the COBE satellite at  $20^{\circ}$ .

SPIREX, the ‘South Pole Infrared Explorer’, a 60–cm near–IR telescope, was installed in 1994. SPIREX has achieved exceedingly dark backgrounds at  $2.4\ \mu\text{m}$ , as low as  $23.5\ \text{mags/arcsec}^2$  for long integrations. It enjoyed a nearly uninterrupted view of the collisions of Comet Shoemaker–Levy with Jupiter. Only 4 of 20 events were obscured by clouds and over 3,000 images were obtained. These were also transferred back to the ‘mainland’ during the event over the internet, demonstrating the level of communication links that are now established to Pole.

A comprehensive series of site testing measurements have been conducted at the South Pole, demonstrating the quality of the site. The 25% quartile for ppt  $\text{H}_2\text{O}$  in winter is 0.19 mm, compared to 1.05 mm on Mauna Kea. Both SPIREX and an Australian experiment, the IRPS (‘Infrared Photometer Spectrometer’), have measured the sky brightness in the  $2.29\text{--}2.46\ \mu\text{m}$  window, where airglow emission is minimal. It is found to be typically  $100\ \mu\text{Jy/arcsec}^2$ , a factor  $\sim 40$  times lower than Mauna Kea. In the L–band,  $3\text{--}4\ \mu\text{m}$ , the sky brightness is typically  $20\text{--}100\ \text{mJy/arcsec}^2$ , a factor  $\geq 20$  times lower than good mainland

sites. Above a surface inversion layer typically 200 m high, the mean visual seeing is 0.36". The isoplanatic angle is  $\geq 5'$  at  $2.4 \mu\text{m}$ .

## 2.2. ANTARCTIC MUON AND NEUTRINO DETECTOR ARRAY

AMANDA is designed to observe high-energy ( $\sim 1 \text{ TeV}$ ) neutrinos. Strings of widely spaced photomultiplier tubes (PMTs) are placed into deep water-drilled holes in the ice. High energy neutrinos coming up through the earth will occasionally interact with ice or rock and create a muon. The Cerenkov photons produced are tracked by the PMTs.

During 1994 four strings were placed in the ice, with PMTs from 800–1000 m in depth ('AMANDA-A'). Four more strings were deployed in 1996 at 1600–2000 m depth ('AMANDA-B'). Optical properties of the ice have been determined. It has an extraordinarily long absorption length,  $\sim 150 \text{ m}$ . The scattering length is nearly two orders of magnitude higher at the lower depth,  $\sim 25 \text{ m}$ .

SPASE, the 'South Pole Air Shower Experiment', continues to monitor cosmic rays above 100 TeV with two arrays and is using the muon detection capability of AMANDA, together with an air-Cerenkov detection system, to measure the mass composition of cosmic rays above 1000 TeV. The second array, SPASE-II, was constructed in 1995 and placed 300 m from AMANDA, to assist with the coincidence timing in screening for neutrino detections.

## 3. Dome C (Circe, Concorde or Charlie; 3,200 m)

A French-Italian collaboration started construction of a station on this site in 1995. Currently an ice-core drilling operation is underway. The first winter-over is scheduled for 2,000. Daytime measurements of the micro-turbulence in the atmosphere were conducted in 1996.

## 4. Other Sites

On the 2,960 m elevation Hercules Névé, near the Italian Terra Nova station, measurements of the mid-IR sky emission have been carried out, as a trial for operating an instrument at Dome C, using a 0.8 m telescope and liquid  $^4\text{He}$  cooled photometer.

Australia operates a cosmic ray research station at Mawson, containing a neutron monitor and muon telescope.

At the Argentinian Belgrano Base an 11" Celestron telescope has been operated, recording seeing measurements and determining atmospheric extinction coefficients.

## 5. Further Information

The following URL's provide links to web pages which serve as resources for further information on this subject area:

AMANDA <http://dilbert.lbl.gov/www/amanda.html>  
CARA <http://pen.k12.va.us/~alloyd/CARA.html>  
JACARA <http://www.phys.unsw.edu.au/~mgb/jacara.html>

Volume 13 of the *Publications of the Astronomical Society of Australia* (1996) is devoted to articles on Antarctic astronomy. In addition to the WGDA of the IAU, SCAR, the 'Scientific Committee for Antarctic Research', have established a sub-committee, STAR, 'Solar Terrestrial and Astrophysics Research', to coordinate astronomical activities in Antarctica.

**WORKING GROUP FOR PLANETARY SYSTEM NOMENCLATURE (WGPSN)  
(GROUPE DE TRAVAIL POUR LA NOMENCLATURE DU SYSTEME PLANETAIRE)**

**PRESIDENT:** K. Aksnes  
**MEMBERS:** M. E. Davies, M. Ya. Marov, B. G. Marsden, P. Moore,  
T. C. Owen, V. V. Shevchenko, B. A. Smith  
**CONSULTANTS:** G. A. Burba, L. Gaddis, P. Masson, J. Blue

## **1. Introduction**

WGPSN held two morning sessions on 20 August 1997 in Kyoto during the 23rd IAU General Assembly. The meeting was attended by five WG members and one member of an adhering nomenclature Task Group plus four guests. The absent WG members had beforehand by e-mail commented on most of the agenda items, so that representative decisions could be made.

Classifications and names for a record number (815) of features on planetary bodies were approved at this meeting. Since the IAU-approved planetary nomenclature is scattered in many volumes of the IAU Transactions, there is a need for a comprehensive listing of this nomenclature. The U.S. Geological Survey in Flagstaff has in cooperation with WGPSN published such a listing complete up to 1994: *Gazetteer of Planetary Nomenclature 1994* (USGS Bulletin 2129).

### **1.1. MEMBERSHIP CHANGES**

D. Morrison is replaced on the WG and as Mercury Task Group Chair by M.E. Davies. Other TG Chairs 1997-2000 are: V.V. Schechenko (Lunar TG), G.A. Burba (Venus TG), B.A. Smith (Mars TG), T.C. Owen (Outer Solar System TG), and B.G. Marsden (Small Bodies TG).

## **2. Nomenclature Corrections**

- VENUS:
  - In *IAU Trans. XIXB 1985*, change *Fedosova (crater)*, *Siddons (crater)* and *Mist Fossae* to respectively *Fedosova Patera*, *Siddons Patera* and *Mist Chasma*.
  - In *IAU Trans. XXIA 1991*, change *Ba'het Patera* to *Ba'het Corona*.
  - In *IAU Trans. XXIB 1991*, change crater names *Amalasthuna* and *Goppert-Mayer* to *Amalasintha* and *Goepfert-Mayer*.
  - In *IAU Trans. XXIIA 1993*, change *Ciuacoatl Corona* and *Kunapipi Corona* to *Ciuacoatl Mons* and *Kunapipi Mons*.
  - In *IAU Trans. XXIIB 1994*, change *Anget Farrum* and *Oduduwa Corona* to *Anget Farra* and *Oduduwa Corona*, and change coordinates of *Citlalpul Valles* from 57.4S and 185.0E to 53.0S and 183.0E.
  
- MARS:
  - In *IAU Trans. XVIIIB 1979*, change *Cerberus Rupes* to *Cerberus Fossae*.
  - In *IAU Trans. XXIA 1991*, delete *Peneus Mons*.

- EUROPA, GANYMEDE, CALLISTO:
- In *IAU Trans. XVIIIB 1979*, change *Tyre Macula* on *Europa* to *Tyre (Large Ringed Feature)* and change coordinates and diameter of the crater *Adlinda* on *Callisto* from 56.6S, 23.1W, 274 km to 46.0S, 33.0W, 600 km.
- In *IAU Trans. XIXB 1985*, change *Punt Facula* on *Ganymede* to *Punt (crater)*.
- In *IAU Trans. XXA 1988*, delete *Sais Facula* on *Ganymede*.

### 3. New Feature Descriptor Terms

The following new feature descriptor terms have been introduced:

- EUROPA:
  - *Lenticula* with a theme of Celtic gods and heroes (as for craters).
  - *Large Ringed Feature* with a theme of Celtic stone circles.
  - *Chaos* with a theme of places associated with Celtic myths.
- GANYMEDE:
  - *Catena* with a theme of gods and heroes of ancient Fertile Crescent people (as for craters).
- MIRANDA:
  - *Sulci* with a theme of characters and places from Shakespeare's plays.
- IO:
  - Name *Montes, Plana, Regiones, Tholi, and Mensae* for nearby named features, but use names from Dante's *Inferno* if no nearby features have been named.
  - Use themes for *Patera* and *Eruptive Centers* for *Fluctus* not located near a named feature.

### 4. New Nomenclature

M A R S (17)				
NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CRATERS (11)</b>				
Bonestell	42.3N	30.3W	39	Chesley; Am. space artist (1888-1986).
Calahorra	26.8N	38.7W	35	Town in Spain.
Kayne	15.5S	186.4W	32	Town in Botswana.
Nier	43.1N	253.9W	46	Alfred O.C.; Am. physicist (1911-1994).
Lydda	24.6N	31.9W	32	Town in Israel.
Masursky	12.0N	32.5W	110	Harold; Am. astrogeol. (1922-1990).
Novara	25.2S	10.5W	85	Town in Italy.
Peta	21.5S	9.1W	80	Town in Greece.
Pollack	7.9S	334.7W	95	James B.; Am. physicist (1938-1994).
Swanage	26.7N	33.7W	9	Town in England.
Thira	14.5S	184.0W	20	Town on Santorini Isl., Aegean Sea.
<b>PLANUM (1)</b>				
Lucus Planum	0.0	160.0W	2900	Albedo feature name.
<b>THOLI (2)</b>				
Apollinaris Tholus	17.8S	184.2W	40	Albedo feature name.
Zephyria Tholus	19.9S	187.1W	32	Albedo feature name.
<b>VALLES (3)</b>				
Athabasca Vallis	9.0N	204.5W	175	River in Canada.
Durius Valles	17.8S	188.0W	210	Classical name, Douro River, Portugal.
Elaver Vallis	9.5S	49.6W	175	Classical name, Allier River, France.

## M O O N (3)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
CRATERS (3)				
Cailleux	60.8S	153.3E	50	Andre; French geologist (1907-1986).
Kozyrev	46.8S	129.3E	65	Nikolay A.; Russ. astron. (1908-1983).
Oberth	62.4N	155.4E	60	Hermann; Austr. space sc. (1894-1989).

## C A L L I S T O (34)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
CATENAE (7)				
Eikin Catena	8.5S	15.9W	191	Norse river.
Fimbulthul Catena	8.4N	65.4W	378	Norse river.
Geirvimul Catena	49.0N	347.1W	90	Norse river.
Gomul Catena	35.4N	48.0W	324	Norse river.
Gunntro Catena	19.3S	343.3W	136	Norse river.
Sid Catena	48.7N	105.4W	78	Norse river.
Svol Catena	11.0N	37.1W	140	Norse river.
CRATERS (27)				
Aegir	45.9S	104.4W	46	Norse sea god.
Agloolik	47.9S	82.9W	49	Eskimo spirit of the seal caves.
Arcas	85.0S	66.8W	41	Callisto's child by Zeus.
Audr	31.0S	81.2W	70	Ottar's ancestor.
Austri	81.3S	64.1W	9	Norse dwarf.
Barri	31.6S	71.0W	83	Ottar's ancestor.
Biflindi	53.8S	74.3W	57	Another name for Odinn.
Doh	30.4N	142.1W	55	Ketian shaman who created the earth.
Gandalfr	81.0S	63.3W	12	Norse dwarf.
Ginandi	85.7S	50.0W	30	Ottar's ancestor.
Jalkr	38.6S	83.2W	74	Another name for Odinn.
Keelut	77.3S	92.1W	47	Eskimo evil spirit resembling a dog.
Lofn	57.0S	24.0W	200	Norse goddess of marriage.
Lycaon	45.2S	5.8W	55	Callisto's father.
Nakki	56.6S	69.9W	65	Finnish water god.
Numi-Torum	50.2S	93.4W	65	Mansi creator god.
Nyctimus	62.7S	3.8W	29	Brother of Callisto.
Oluksak	47.9S	63.9W	74	Eskimo god of lakes.
Orestheus	44.5S	50.1W	30	Brother of Callisto.
Randver	72.3S	53.6W	21	Ottar's ancestor.
Reginleif	66.2S	97.2W	32	Servant of the gods.
Reifnir	50.8S	63.8W	39	Ottar's ancestor.
Uksakka	49.5S	42.3W	22	Lapp protector goddess.
Skeggold	49.6S	31.9W	39	Servant of the gods.
Thekkr	80.8S	61.6W	10	Norse dwarf.
Thorir	32.0S	67.3W	43	Ottar's ancestor.
Yuryung	54.9S	86.1W	74	Yakutian heaven god.

## G A N Y M E D E (35)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
CATENAE (3)				
Enki Catena	39.5N	13.2W	151	Principal water god of the Apsu.
Khnum Catena	32.1N	350.9W	59	Egyptian creation god.
Nanshe Catena	14.7N	355.0W	59	Water goddess, daughter of Enki.

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CRATERS (24)</b>				
Aleyin	16.3N	134.7W	12	Son of Ba'al, spirit of springs.
Amset	14.5S	178.2W	10	God of the dead, son of Horus.
Anhur	32.6N	193.9W	25	Egyptian warrior god.
Chryсор	16.5N	134.9W	6	Phoenician god of fishing.
Cisti	32.0S	65.0W	65	Iranian healing god.
Ea	18.7N	149.2W	20	Assyro-Bab god of water, wisdom, earth.
El	1.9N	151.2W	50	"Father of Men", preceded the gods.
En-zu	12.2N	168.6W	7	Babylonian moon god.
Epigeus	24.0N	181.0W	320	Phoenician god.
Erichthonius	15.5S	174.6W	35	Possible father of Ganymede.
Hay-tau	15.8N	133.6W	28	Nega god, forest spirit.
Khensu	1.8N	152.8W	15	Egyptian moon god.
Khepri	21.5N	148.1W	50	God for transforming the Heliopitans.
Latpon	61.0N	175.0W	45	One of the sons of El.
Lugalmeslam	23.5N	195.0W	70	Sumerian god of the underworld.
Maa	1.0N	203.8W	30	Egyptian god of the sense of sight.
Mont	43.5N	314.0W	10	Theban war god.
Mot	10.5N	166.2W	25	Harvest spirit, son of El.
Nefertum	43.0N	323.0W	30	Divine son of the Memphis triad.
Nergal	38.5N	202.3W	8	Assyro-Babyl. king of underworld.
Ningishzida	14.0N	190.5W	30	Sumerian vegetation god.
Serapis	10.0S	50.0W	155	Egyptian healing god.
Upuant	45.0N	321.5W	15	Jackal-headed warrior god of the dead.
Zakar	30.5N	335.2W	150	Assyrian supreme diety.
<b>FACULAE (3)</b>				
Akhmin Facula	28.0N	191.0W	225	Egyptian town of Min worship.
Heliopolis Facula	19.5N	147.6W	50	Sacred Egyptian city of the sun.
Hermopolis Facula	22.0N	196.0W	200	Place where Unut was worshipped.
<b>SULCI (5)</b>				
Akitu Sulcus	39.0N	197.0W	380	Place where Marduk was worshipped.
Byblus Sulcus	38.0N	202.0W	600	Ancient city of Adonis worship.
Nineveh Sulcus	26.0N	60.0W	1000	City where Ishtar was worshipped.
Philae Sulcus	68.5N	175.0W	900	Temple, chief sanctuary of Isis.
Xibalba Sulci	35.0N	80.0W	2000	Mayan "place of fright" for the dead.
<b>E U R O P A (12)</b>				
<b>CHAOS (1)</b>				
Conamara Chaos	9.5N	273.3W	127	Place in Ireland named for Conmac.
<b>CRATERS (3)</b>				
Govannan	37.5S	302.6W	10	A smith and brewer, child of Don.
Manann\%an	2.0N	240.0W	30	Irish sea and fertility god.
Pwyll	26.0S	271.0W	38	Celtic god of the underworld.
<b>LINEAE (6)</b>				
Agave Linea	12.6N	273.0W	1250	Daughter of Harmonia and Cadmus.
Chthonius Linea	0.1N	311.3W	1850	A founder of Thebes.

## E U R O P A (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>LINEAE</b>				
Harmonia Linea	27.0N	168.0W	925	Wife of Cadmus.
Hyperenor Linea	3.1S	314.7W	2200	A founder of Thebes.
Ino Linea	5.0S	163.0W	1400	Daughter of Harmonia and Cadmus.
Pelagon Linea	34.0N	170.0W	800	King who sold Cadmus a Moon cow.
<b>REGIONES (1)</b>				
Moytura Regio	47.9S	297.1W	347	Fomorians vs Tuatha de Danan battle ground.
<b>LARGE RINGED FEATURES (1)</b>				
Callanish	16.0S	333.4W	100	Stone circle in the Outer Hebrides.
<b>I O (44)</b>				
<b>ERUPTIVE CENTERS (2)</b>				
Kanehekili	18.0S	40.0W		Hawaiian thunder god.
Zamama	18.0N	174.0W		Babylonian sun, corn, and war god.
<b>FLUCTUS (6)</b>				
Acala Fluctus	11.0N	337.0W	300	Japanese fire god.
Fjorgynn Fluctus	11.5N	358.0W	300	Norse thunder god.
Kanehekili Fluctus	16.0S	38.0W	250	Hawaiian thunder god.
Lei-Kung Fluctus	38.0N	204.0W	400	Chinese thunder god.
Marduk Fluctus	27.0S	209.0W	150	Sumero-Akkadian fire god.
Masubi Fluctus	48.0S	60.0W	800	Japanese fire god.
<b>MENSAE (1)</b>				
Hermes Mensa	43.0S	247.0W	130	Freed Io from Argus.
<b>MONTES (9)</b>				
Caucasus Mons	33.0S	239.0W	150	Mountains where Io fled from a gadfly.
Dorian Montes	24.0S	198.0W	450	Region in ancient Greece.
Egypt Mons	41.0S	257.0W	300	Io ended her wanderings here.
Euxine Mons	27.0N	126.0W	200	Io passed by here in her wanderings.
Ionian Mons	9.0N	236.0W	150	Io crossed this sea in her wanderings.
Nile Montes	52.0N	253.0W	450	Where Zeus restored Io to a human.
Rata Mons	35.0S	201.0W	200	Maori sun hero.
Skythia Mons	26.0N	98.0W	200	Io passed by here in her wanderings.
Tohil Mons	29.0S	157.0W	300	Centr. Am. god who gave fire to man.
<b>PATERAE (24)</b>				
Aidne Patera	2.0S	178.0W	50	Irish creator of fire.
Altjirra Patera	34.0S	108.0W	50	Australian thunder god.
Arusha Patera	38.0S	101.0W	60	Hindu god of the rising sun.
Catha Patera	53.0S	100.0W	60	Etruscan sun god.
Dusura Patera	37.0N	119.0W	70	Nabataean sun god.
Fo Patera	40.5N	192.0W	50	Chinese fire and sun god.
Gish Bar Patera	17.0N	90.0W	150	Babylonian sun god.
Hi'iaka Patera	3.0S	80.0W	80	Sister of Pele.



NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>PATERAE</b>				
Isum Patera	29.0N	208.0W	100	Assyrian fire god.
Janus Patera	3.0S	42.5W	60	Italian sun god.
Karei Patera	2.0N	16.0W	100	Semangan (Malayan) thunder god.
Kurdalagon Patera	49.5S	218.0W	50	Ossetian celestial smith.
Laki-io Patera	37.5S	62.5W	130	Bornean hero who invented fire.
Monan Patera	19.0N	106.0W	50	Brazilian god who destroyed the world.
Mulungu Patera	17.0N	218.0W	50	African thunder god.
Pillan Patera	12.0S	244.0W	80	Araucanian thunder, fire, and volcano.
Rata Patera	35.5S	199.5W	30	Maori sun hero.
Sethlaus Patera	52.0S	194.0W	80	Etruscan celestial smith.
Shamshu Patera	8.0S	64.0W	90	Arabian sun goddess.
Sigurd Patera	5.0S	98.0W	60	Norse sun hero.
Tiermes Patera	22.5N	351.5W	50	Lapp thunder god.
Tupan Patera	18.0S	141.0W	50	Tupi-Guarani (Brazil) thunder god.
Ukko Patera	33.0N	20.0W	40	Finnish thunder god.
Zal Patera	42.0N	76.0W	130	Iranian sun god.

**REGIONES (2)**

Bosphorus Regio	0.0	120.0W	1200	Where Io passed escaping the gadfly.
Illyrikon Regio	72.0S	160.0W	700	Io passed by here in her wanderings.

**M I R A N D A (3)****REGIONES (1)**

Ephesus Regio	15.0S	250.0E	225	Setting for "The Comedy of Errors".
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**SULCI (2)**

Naples Sulcus	32.0S	260.0E	260	Destination in "The Tempest."
Syracusa Sulcus	15.0S	293.0E	40	Home of twins in "Comedy of Errors".

**I D A (1)**

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
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**CRATERS (1)**

Peacock	2.0S	52.0E	0.2	Cave in Florida.
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**V E N U S (666)****CRATERS (287)**

Abra	6.2N	97.4E	8.5	Ewe first name.
Adzoba	12.8N	117.0E	10.0	Ewe (Ghana) first name.
Afiba	47.1S	102.7E	11.4	Ewe first name.
Afiruwa	4.3N	3.8E	5.2	Hausa first name.
Aftenia	50.0N	324.0E	7	Moldavian first name.
Afua	15.5N	124.0E	10.0	Akan (Ghana) first name.
Agee	13.1N	4.3E	6.3	Eve first name.
Aigul	38.2N	280.4E	6	Kalmyk first name.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CRATERS</b>				
Ailar	15.8S	68.4E	8.2	Turkman first name.
Aisha	39.3N	53.3E	10.6	Kyrgyz first name.
Akosua	58.6S	18.1E	6.2	Akan first name.
Akuba	9.6N	23.0E	5.5	Eve first name.
Altana	1.4N	69.9E	6	Kalmyk first name.
Aminata	6.6N	25.2E	9.7	Mandingo first name.
Avene	40.4N	149.4E	10.0	Akan (Ghana) first name.
Ayashe	22.7N	31.4E	6.7	Hausa first name.
Ayisatu	34.6N	5.5E	7	Fulbe first name.
Bachira	26.5N	10.0E	7.3	Algerian first name.
Bahriyat	50.3N	357.5E	5	Kumyk (Daghestan) first name.
Bakisat	26.0N	356.8E	7.4	Chechen first name.
Barauka	10.6N	346.3E	12.9	Hausa (Nigeria) first name.
Bineta	57.3N	144.1E	10.7	Mandingo (Africa, Mali) first name.
Chechek	2.6S	272.3E	7.2	Tuva (Siberia) first name.
Cholpon	40.0N	290.0E	6.3	Kyrgyz first name.
Chubado	45.3N	5.6E	7	Fulbe first name.
Clio	6.3N	333.5E	11.4	Greek first name.
Dado	13.9S	87.6E	11.2	Fulbe first name.
Dafina	28.6N	244.1E	5.5	Albanian first name.
Defa	32.2N	11.3E	8.5	Fulbe first name.
Degu	27.3N	289.8E	5.5	Adygan (N. Caucasus) first name.
Domnika	18.4N	294.3E	6.7	Moldavian first name.
Dunghe	56.2S	295.3E	5.5	Kalmyk first name.
Dyasya	5.1N	297.6E	7.8	Nganasan (Samoyed) first name.
Eila	75.0S	94.6E	9.5	Finnish first name.
Eini	41.6S	96.4E	5.9	Finnish first name.
Elma	10.1S	91.1E	10.2	Finnish first name.
Emilia	26.5S	88.2E	12.5	Swedish first name.
Emma	13.7S	302.3E	11.8	German first name.
Erkeley	43.9N	103.3E	8	Altai first name.
Esmeralda	64.4N	104.5E	9.8	Gypsy first name.
Eugenia	80.6N	105.4E	6	Greek first name.
Faina	71.1N	100.7E	10.0	Turkish first name.
Faufau	18.8N	8.3E	7.8	Polynesian first name.
Fava	0.7S	87.4E	9.7	Dunghan (Kyrgyzstan) first name.
Fazu	32.4N	106.0E	6.1	Avarian (Daghestan) first name.
Feruk	64.0S	107.6E	8.3	Nivkhi (Sakhalin Isl.) first name.
Firuza	51.8N	108.0E	6	Persian first name.
Florence	15.2S	85.0E	10.5	English first name.
Flutra	68.4S	112.0E	6	Albanian first name.
Frosya	29.5N	113.4E	9.8	Russian first name.
Gahano	80.2S	77.4E	4.5	Seneca first name.
Giselle	11.8S	298.0E	10.4	French first name.
Gulchatay	20.5N	295.5E	9	Arabic first name.
Gulnara	23.7S	174.0E	5	Uzbek first name.
Guzel	57.6S	298.7E	7.3	Arabic first name.
Hadisha	39.0S	97.2E	8.9	Kazakh first name.
Halima	28.5N	14.6E	8.9	Hausa first name.

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CRATERS</b>				
Hanka	27.3S	114.3E	5	Czech first name.
Hapei	66.1N	178.0E	4.2	Cheyenne (Oklahoma) first name.
Helga	10.4S	116.7E	8.8	Norwegian first name.
Helvi	12.4N	82.7E	12.2	Estonian first name.
Hilkka	69.0S	72.0E	10.3	Finnish first name.
Hiriata	15.3N	23.5E	5	Polynesian first name.
Hiroimi	35.2N	287.3E	6	Japanese first name.
Huarei	15.0N	32.3E	8.5	Polynesian first name.
Icheko	6.6N	97.9E	5.9	Evenk/Tungu first name.
Imagmi	48.4S	100.7E	7.6	Eskimo (Chukotka) first name.
Ines	67.1S	241.9E	11.2	Spanish first name.
Inga	38.1N	226.6E	10.0	Danish first name.
Inkeri	28.3S	223.9E	10.1	Finnish first name.
Iondra	10.5N	286.5E	7.9	Selkup (Samoyed) first name.
Iraida	27.8N	108.1E	6.5	Greek first name.
Irinuca	51.4N	121.9E	8	Romanian first name.
Irma	50.9S	122.0E	9.5	Finnish first name.
Isolde	74.5S	211.9E	11.9	English first name.
Istadoy	51.8S	132.6E	5.4	Tajik first name.
Ivne	27.0S	132.8E	9	Koryak (Kamchatka) first name.
Izakay	12.3S	210.8E	10.2	Mari first name.
Izudyr	53.9S	153.2E	6.6	Mari (Volga Finn) first name.
Jaantje	46.5N	123.0E	7.8	Dutch first name.
Jalgurik	42.3S	125.1E	7.5	Evenk/Tungu first name.
Jamila	45.8N	134.8E	7.9	Afghan first name.
Janice	87.3N	261.9E	10.0	English first name.
Janina	2.0S	135.7E	9.3	Polish first name.
Janyl	28.0S	138.8E	5.6	Kyrgyz first name.
Jitka	61.9S	70.9E	13.0	Slovakian first name.
Jodi	35.7S	68.7E	10.2	English first name.
Jumaisat	15.1S	135.6E	7.5	Kumyk (Daghestan) first name.
Jutta	0.0N	142.6E	7	Finnish first name.
Kafutchi	26.7N	16.4E	7.1	Bantu first name.
Kaisa	13.5N	293.3E	12.0	Finnish first name.
Kalombo	30.5S	34.0E	9.6	Bantu first name.
Karo	21.9N	37.2E	7	Maori first name.
Kastusha	28.6S	59.9E	13.0	Mordovian (Volga River) first name.
Katrya	29.5S	108.0E	9.2	Ukrainian first name.
Katya	57.8N	285.7E	10.5	Russian first name.
Kavtora	59.0N	23.3E	9.8	Afghan first name.
Ketzia	3.9N	300.5E	14.6	Hebrew first name.
Khadako	54.2N	139.3E	7.4	Nenets (Samoyed) first name.
Khafiza	6.0N	299.2E	7	Arabic first name.
Kimitonga	25.1S	48.3E	5	Polynesian first name.
Kodu	0.9N	338.7E	10.5	Wolof (Africa, Senegal) first name.
Koinyt	30.9S	293.2E	11.7	Nivkhi (E. Siberia) first name.
Kollado	61.0S	53.4E	5.5	Fulbe first name.
Kosi	43.9S	54.9E	7.7	Ewe first name.
Kumba	26.3N	332.7E	11.4	Fulbe (W. Africa, Guinea) first name.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
CRATERS				
Kumudu	61.3N	154.1E	4.4	Singalese first name.
Kuro	7.8N	57.6E	8.8	Fulbe first name.
Kyen	6.2S	64.7E	5.2	Bantu first name.
Kylli	41.1N	67.0E	13.2	Finnish first name.
Lhagva	75.8S	300.1E	7.9	Mongolian first name.
Liv	21.1S	303.9E	11.2	Norwegian first name.
Loan	28.3N	60.0E	7.4	Vietnamese first name.
Lorelei	55.7N	243.9E	15.0	German first name.
Lu Zhi	42.6S	303.4E	8.3	Chinese first name.
Lyuba	1.6N	283.9E	12.4	Russian first name.
Madina	22.7N	58.0E	6.3	Kabarda first name.
Mae	40.5S	345.2E	7.5	From Margaret, Greek first name.
Mamajan	65.1S	257.3E	2	Turkman first name.
Mansa	33.9S	63.4E	8.1	Akan first name.
Marere	19.6N	65.8E	6.3	Polynesian first name.
Maret	33.3S	280.2E	11.7	Estonian first name.
Mariko	23.3S	132.9E	12.7	Japanese first name.
Marysya	53.3N	75.1E	6.3	Belorussian first name.
Masha	60.7N	88.5E	6.4	Russian first name.
Matahina	72.3S	65.9E	8.5	Polynesian first name.
Maurea	39.5S	69.1E	9.9	Polynesian first name.
Mbul'di	23.8N	74.7E	6	Fulbe/Wodabi first name.
Melanka	34.4N	19.2E	9	Ukrainian first name.
Meredith	14.5S	278.9E	11.4	English first name.
Miovasu	72.1N	99.9E	4.5	Cheyenne first name.
Mosaido	17.3N	75.2E	7.4	Fulbe/Wodabi first name.
Nadeyka	54.8S	305.3E	9.3	Belorussian first name.
Nakai	61.0S	286.2E	4.5	Cheyenne first name.
Nalkuta	30.1N	307.8E	6.5	Ossetian (N. Caucasus) first name.
Namiko	43.4N	56.2E	13.0	Japanese first name.
Nastya	49.0S	275.8E	12.5	From Anastasiya, Russian first name.
Ndella	15.9S	60.7E	5.9	Wolof first name.
Neda	16.7N	313.5E	7.7	Macedonian first name.
Nedko	8.8S	317.6E	8.5	Nenets (Samoyed) first name.
Neeltje	12.4N	124.4E	10.0	Dutch first name.
Nelike	26.8S	329.2E	6.3	Nanay (E. Siberia) first name.
Ngaio	53.3S	61.8E	9.5	Maori first name.
Ngone	6.0N	331.9E	12.2	Wolof (Africa, Senegal) first name.
Nilanti	38.2S	331.4E	9.2	Singalese first name.
Ninzi	15.9N	331.7E	7.1	Burma (Myanmar) first name.
Nomeda	49.2S	55.5E	10.4	Lithuanian first name.
Nsele	6.7N	64.2E	5.1	Mandingo first name.
Nuon	78.6N	336.6E	6.5	Khmer first name.
Nutsa	27.5N	341.2E	8	Abkhazian (Georgia) first name.
Nyal'ga	17.0N	64.5E	5.5	Fulbe/Wodabi first name.
Nyele	22.7S	318.4E	11.9	Mandingo (Africa, Mali) first name.
Nyogari	46.4S	306.4E	13.0	Ewe (W. Africa, Ghana) first name.
Odarka	40.8N	138.2E	7	Ukrainian first name.
Odikha	41.6S	238.1E	10.6	Uzbek first name.

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
CRATERS				
Ogulbek	2.4N	145.0E	6.5	Turkman first name.
Oivit	73.9S	195.5E	4.8	Cheyenne first name.
Oku	64.2S	232.2E	13.3	Karelian first name.
Olena	10.9N	149.0E	7	Ukrainian first name.
Olesya	5.6N	273.3E	12.0	Ukrainian first name.
Olivia	37.2N	207.9E	10.2	Dutch first name.
Onissya	25.6S	150.2E	8.2	Komi-Permyak (Urals Finn) first name.
Opika	57.1S	151.9E	9.8	Chuvash (Volga area) first name.
Orguk	23.5S	198.2E	11.7	Nivkhi (E. Siberia) first name.
Orlette	68.1S	193.3E	12.5	French first name.
Ortensia	7.6N	155.7E	7	Italian first name.
Oshalche	29.7N	155.5E	8.3	Mari (Volga Finn) first name.
Ottavia	47.5S	187.1E	12.9	Roman first name.
Outi	61.6N	267.7E	10.5	Finnish first name.
Parishan	0.2S	146.5E	6.8	Kurdian first name.
Parvina	62.2S	153.0E	7	Tajik first name.
Pasha	42.7N	156.3E	7.2	Russian first name.
Pat	2.9N	262.6E	10.1	English first name.
Patimat	1.3S	156.5E	5.1	Avarian (Daghestan) first name.
Pavlinka	25.5S	158.7E	7.5	Belorussian first name.
Pirkko	44.8N	254.6E	12.3	Finnish first name.
Puhioia	20.6N	69.4E	5.5	Maori first name.
Purev	31.1S	46.4E	11.6	Mongolian first name.
Pychik	62.4S	33.8E	10.1	Chukcha (NE Siberia) first name.
Qarlygha	33.0S	162.9E	9.3	Kazakh first name.
Qulzhan	23.5N	165.4E	7.9	Kazakh first name.
Quslu	6.2N	166.8E	8.7	Kazakh first name.
Radhika	30.3S	166.4E	7.9	Tamil first name.
Radmila	69.1N	167.0E	5.2	Serbocroatian first name.
Rae	8.9S	58.4E	5.5	From Rachel, Hebrew first name.
Rafiga	62.9N	175.6E	5.7	Azeri first name.
Raki	49.4S	70.0E	7.5	Fulbe first name.
Rampyari	50.6N	179.3E	7.7	Hindu first name.
Raymonde	48.4N	191.5E	5.3	French first name.
Reiko	22.6N	192.1E	9.7	Japanese first name.
Retno	52.9S	192.3E	7.2	Indonesian first name.
Roptyna	62.2N	28.9E	11.5	Chukcha (NE Siberia) first name.
Royle	32.7S	193.7E	6.1	Bashkir first name.
Rufina	74.6S	195.1E	5	Greek first name.
Ruit	25.5S	72.9E	6.4	Polynesian first name.
Runak	58.5S	196.3E	7.6	Kurdian first name.
Safarmo	10.8S	161.4E	7.4	Tajik first name.
Saida	28.2N	302.0E	9.5	Arabic first name.
Sandugach	59.9N	143.5E	10.0	Tartar first name.
Sasha	38.3N	277.3E	4.6	Russian first name
Sayligul	73.6N	172.9E	4.3	Tajik first name.
Seseg	36.3S	312.6E	9.8	Buryat (Siberia) first name.
Shasenem	44.0S	258.9E	9	Turkman first name.
Sheila	19.9N	50.2E	5.6	Irish/Celtic first name.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
CRATERS				
Shushan	43.8S	70.2E	8.5	Armenian first name.
Simbya	74.4S	130.0E	4.0	Nganasan (Samoyed) first name.
Tahia	44.3N	73.7E	6.1	Polynesian first name.
Tako	25.1N	285.3E	10.7	Fulbe first name.
Talvikki	41.9N	22.0E	12.6	Finnish first name.
Tehina	30.4S	76.4E	5.4	Polynesian first name.
Tekarohi	21.2N	76.4E	9.3	Polynesian first name.
Temou	10.0S	83.4E	9.3	Polynesian first name.
Terhi	45.7N	253.1E	10.7	Finnish first name.
Teroro	75.8S	88.1E	9.2	Polynesian first name.
Teumere	38.3S	88.1E	5.4	Polynesian first name.
Teura	12.3S	90.2E	9.3	Polynesian first name.
Tinyl	9.7N	132.1E	12.8	Chukcha (NE Siberia) first name.
Tolgonay	68.8N	271.1E	4.6	Kyrgyz first name.
Tsetsa	31.3N	317.7E	9.9	Mordovian (Volga Finn) first name.
Tsyрма	14.1S	318.5E	7.8	Buryat (Siberia) first name.
Tursunoy	80.9N	229.3E	4.7	Uzbek first name.
Tuyara	62.9S	15.5E	13.2	Yakut first name.
Ualinka	13.2N	168.6E	8.1	Ossetian (N. Caucasus) first name.
Udagan	10.7N	206.9E	11.5	Yakut first name.
Udyaka	30.9N	172.9E	7.7	Orochi (Amur River) first name.
Ugne	34.9N	205.8E	10.3	Lithuanian first name.
Ul'yana	24.3N	253.0E	12.5	Russian first name.
Uleken	33.7N	185.1E	10.9	Nanay (E. Siberia) first name.
Ulla	51.5S	184.5E	10.4	Swedish first name.
Ulpu	35.7S	179.0E	7	Finnish first name.
Uluk	62.2S	178.6E	10.3	Neghidalian (E. Siberia) first name.
Umaima	23.3S	195.4E	6.9	Arabic first name.
Umkana	53.3S	198.6E	6.2	Eskimo (Chukotka) first name.
Unay	53.5N	172.7E	11.4	Mari first name.
Unitkak	40.8N	199.5E	8	Eskimo (Chukotka) first name.
Urazbike	9.0S	202.5E	7	Tartar first name.
Ustinya	41.2S	251.6E	11.8	Russian first name.
Uyengimi	76.9S	204.9E	8.9	Khanty, Mansi (Ob R. Finn) first name.
Vaka	41.4S	8.9E	11.8	Bulgarian first name.
Vard	17.5N	314.5E	6.1	Armenian first name.
Varya	2.8N	211.8E	14.3	Russian first name.
Vasilutsa	16.5N	334.4E	5.7	Moldavian first name.
Vassi	34.4N	346.5E	8.5	Karelian first name.
Veriko	20.4N	350.1E	5.2	Georgian first name.
Veta	42.6N	349.5E	6.4	Romanian first name.
Viola	36.1S	240.5E	10.0	English first name.
Virga	26.9S	7.7E	10.3	Lithuanian first name.
Vlasta	28.4N	250.1E	10.7	Czech first name.
Volyana	60.6N	359.9E	5.3	Gypsy first name.
Wazata	33.6N	298.3E	13.9	Hausa (Nigeria) first name.
Wendla	22.5N	207.6E	5.7	Swedish first name.
Wilma	36.7N	1.7E	12.5	English first name.
Wiwi-yokpa	73.8S	228.4E	4.5	Abenaki/Algonquin (Canada) first name.

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CRATERS</b>				
Wynne	55.0N	53.6E	10.0	English first name.
Xenia	30.3S	249.4E	13.5	Greek first name.
Xi Wang	14.0N	208.0E	7.7	Chinese first name.
Ximena	68.2S	243.6E	12.8	Portuguese first name.
Yakyt	2.1N	170.2E	13.8	Karakalpak first name.
Yambika	32.6N	208.7E	6.5	Mari (Volga Finn) first name.
Yasuko	26.1S	169.0E	10.6	Japanese first name.
Yazruk	21.2N	160.2E	10.5	Nivkhi (E. Siberia) first name.
Yelya	47.5S	211.7E	8.6	Nenets (Samoyed) first name.
Yemysh	11.9N	214.7E	6	Mari (Volga Finn) first name.
Yenlik	16.0S	225.4E	8.6	Kazakh first name.
Yerguk	42.7N	226.8E	6.3	Neghidalian (Amur River) first name.
Yeska	27.4N	230.1E	9.1	Selkup (Samoyed) first name.
Yokhtik	50.1S	158.1E	11.4	Nivkhi (E. Siberia) first name.
Yoko	5.7S	232.0E	5	Japanese first name.
Yolanda	7.8N	152.7E	11.4	Greek first name.
Yomile	27.3S	138.7E	13.6	Bashkir first name.
Yonok	65.1S	234.1E	9.5	Korean first name.
Yonsuk	34.0S	234.8E	8.5	Korean first name.
Ytunde	49.9N	81.1E	6.1	Yoruba first name.
Yvette	7.5N	249.6E	10.6	French first name.
Zakiya	66.5S	234.1E	7.5	Arabic first name.
Zarema	16.8N	235.2E	5	Avarian (Daghestan) first name.
Zeinab	2.2S	159.6E	12.5	Persian first name.
Zemfira	46.2S	157.7E	11.4	Gypsy first name.
Zerine	29.6S	258.6E	6.5	Persian first name.
Zivile	48.8N	113.1E	13.5	Lithuanian first name.
Zosia	18.9S	109.2E	10.5	Polish first name.
Zuhrah	34.7N	357.0E	5.8	Arabic first name.
Zula	7.3N	282.0E	5	Chechen first name.
Zulfiya	18.4N	101.9E	12.9	Uzbek first name.
Zulma	7.7S	102.0E	11.0	Spanish first name.
Zumrad	32.1N	94.8E	12.9	Uzbek first name.
Zurka	12.8S	275.2E	5.5	Gypsy first name.
<b>CHASMATA (22)</b>				
Aikhylu Chasma	32.0N	292.0E	300	Bashkir myth's moon daughter.
Ardwinna Chasma	21.0N	197.0E	500	Continental Celtic wildwood goddess.
Artio Chasma	35.5S	39.0E	450	Celtic wildlife bear-goddess.
Chang Xi Chasmata	59.0S	17.0E	220	Chinese, gave birth to twelve moons.
Gamsilg Chasma	46.0S	64.0E	600	Chechen and Ingush evil forest deity.
Geyaguga Chasma	56.5S	70.0E	800	Cherokee moon deity.
Gui Ye Chasma	9.0S	337.1E	210	Chinese moon fairy.
Hanghepiwi Chasma	48.5S	18.0E	1100	Dakota name of the moon and night.
Kokomikeis Chasma	0.0N	85.0E	1000	Blackfoot/Algonquin moon goddess.
Kov-Ava Chasma	58.8S	21.8E	470	Mordovian (Finnish) forest mistress.
Nang-byon Chasma	4.0N	316.5E	450	Vietnamese moon goddess.
Olapa Chasma	42.0S	208.5E	650	Massai (Kenya, Tanzania) moon goddess.
Pinga Chasma	20.0S	287.0E	500	Eskimo goddess of hunt.

V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CHASMATA</b>				
Reitia Chasma	1.0N	285.0E	1300	Venetian health and hunting goddess.
Seo-Ne Chasma	63.5S	26.0E	430	Korean moon deity, sun's wife.
Sutkatyn Chasmata	64.0S	11.0E	350	Kumyk (Daghestan) forest spirit.
Tellervo Chasma	60.0S	125.0E	600	Finnish maiden of woods.
Tkashi-mapa Chasma	13.0N	206.0E	1100	Georgian forest goddess.
Tsects Chasma	61.6S	35.0E	600	Haida spirit of forest underworld.
Karatanga Chasma	54.0S	70.0E	1300	Tarascan (Mexico) moon goddess.
Zewana Chasma	9.0N	212.0E	900	W. Slavic/Polish hunting goddess.
Zverine Chasma	18.5N	271.0E	1300	Lithuanian hunting goddess.
<b>COLLES (6)</b>				
Chernava Colles	10.5S	335.5E	1000	Russian sea czar daughter.
Marake Colles	55.7N	217.8E	150	Mansi (Ob River Ugra) sea mistress.
Nahete Colles	38.0N	241.0E	400	Fon (Benin) wife of sea god Agbe.
Nuliayoq Colles	48.0N	224.0E	350	Netsilik Inuit sea mistress.
Ruad Colles	68.0S	118.0E	400	Irish female deity, sank into the sea.
Salofa Colles	63.0S	167.0E	250	Samoa tale's girl/sea turtle.
<b>CORONAE (70)</b>				
Ama Corona	45.7S	278.2E	300	Jukun (Nigeria) goddess of birth.
Ambar-ona Corona	70.0S	82.5E	550	Uzbek women's and fertility goddess.
Atahensik Corona	19.0S	170.0E	700	Huron/Iroquois goddess, sun and moon creator.
Bibi-Patma Corona	47.0S	302.0E	450	Turkman goddess of women.
Boala Corona	70.0S	359.0E	220	Bantu name for the first woman.
Codidon Corona	46.0S	56.0E	250	Araukan (Colombia) mother goddess.
Demvamvit Corona	65.5S	38.0E	370	Gurage (SW Ethiopia) women's goddess.
Deohako Corona	67.5S	118.0E	300	Seneca Iroquois crops spirit.
Dhorani Corona	8.0S	243.0E	300	Thai earth and love goddess.
Didilia Corona	19.0N	38.0E	320	E. Slavic childbirth goddess.
Dunne-Musun Corona	60.0S	85.0E	630	Evenk (Tungu) earth mistress.
Dyamenyuo Corona	57.5S	42.5E	200	Enets (Samoyed) women's and childbirth deity.
Eingana Corona	5.0N	350.0E	375	Australian aboriginal snake goddess.
Ekhe-Burkhan Corona	50.0S	40.0E	600	Buryatian creator goddess.
Emegen Corona	37.5N	290.5E	180	Tuva (S. Siberia) childcare goddess.
Enekeler Corona	46.0S	264.0E	350	Altay childbirth goddess.
Erigone Corona	34.5S	284.0E	325	Greek harvest goddess.
Flidais Corona	24.5S	177.3E	150	Irish fertility goddess.
Furachoga Corona	38.0S	258.0E	550	Chibcha/Muisca earth goddess.
Hlineu Corona	38.7S	241.0E	150	Chin/Kieng (Burma) ancestor goddess.
Iang-Mdiye Corona	47.0S	86.0E	300	Ede (Vietnam) goddess of rice.
Ilyana Corona	69.5S	65.0E	300	Moldavian main female deity.
Ituana Corona	19.5N	153.5E	220	Amazon River people great goddess.
Juksakka Corona	19.5S	44.5E	320	Lapp goddess of birth.
Kaltash Corona	0.5N	75.0E	450	Mansi (Ob River Ugra) mother-goddess.
Katieleo Corona	12.5S	327.5E	210	Senufo (Burkina Faso) creator goddess.
Latmikaik Corona	64.0S	123.0E	500	Palau (Micronesia) fertility goddess.
Latta Corona	38.6S	287.0E	225	Chechen/Ingush (Caucasus) earth goddess.



## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>CORONAE</b>				
Marzyana Corona	53.0S	67.5E	550	Slavic grain and fertility goddess.
May-Enensi Corona	42.5S	68.0E	330	Teleutan (S. Altay) fertility goddess.
Moombi Corona	64.5S	235.5E	100	Gikuyu (Kenya), the first woman.
Mou-nyamy Corona	49.5S	59.0E	200	Nganasan (Samoyed) goddess of life.
Mukylchin Corona	12.5S	46.0E	525	Udmurt (Ural) fertility goddess.
Mykh-Imi Corona	73.0S	99.0E	150	Khanty (Ob River Ugra) earth goddess.
Naotsete Corona	58.3S	249.5E	200	Keresan Pueblo ancestor goddess.
Navolga Corona	48.6S	296.5E	170	Ganda (Uganda) goddess of childbirth.
Nungui Corona	42.5S	245.2E	150	Hibaro (Peru/Eq.) fertility goddess.
Nzambi Corona	45.0S	287.5E	225	Bantu goddess, mother of all beings.
Obasi-Nsi Corona	53.5S	291.0E	230	Ekoi (S. Nigeria) fertility goddess.
Obiemi Corona	31.9S	276.6E	300	Bini (Nigeria) childbirth goddess.
Obilukha Corona	81.5S	19.0E	220	E. Slavic crop protection deity.
Okhin-Tengri Corona	70.5S	40.0E	400	Kalmykan fertility goddess.
Omosi-Mama Corona	64.5N	306.0E	480	Manchoo childbirth goddess.
Pasu-Ava Corona	29.0N	319.0E	250	Mari (Volga Finn) harvest goddess.
Pugos Corona	19.0S	335.0E	180	Khanty (Ob' River) goddess of life.
Romi-Kumi Corona	81.2S	180.0E	150	Tukano (Colombia) great mother goddess.
Santa Corona	34.5S	288.0E	200	Sabine goddess of fertility/health.
Saunau Corona	1.3S	173.0E	200	Abkhazian goddess of corn milling.
Seisui Corona	62.0S	241.0E	150	Tupi/Huarani fertility goddess.
Semiramus Corona	37.0S	293.0E	375	Assyrian fertility goddess.
Shulamite Corona	38.8S	284.3E	275	Hebrew fertility goddess.
Shyv-Amashe Corona	57.0S	63.0E	410	Chuvash (Volga Region) water goddess.
Su-Anasy Corona	78.0S	39.0E	300	Tartar/Kumyk/Karachay water mother.
Tangba Corona	47.0S	258.0E	200	Lobi (Burkina Faso) earth goddess.
Tonatzin Corona	53.0S	164.0E	400	Aztec earth and childbirth goddess.
Triglava Corona	53.5S	95.0E	400	Slavic earth goddess.
Tureshmat Corona	51.5S	289.5E	150	Ainu (Japan) creator of Hokkaido.
Tutelina Corona	29.0N	348.0E	180	Roman harvest goddess.
Ugatame Corona	76.5S	255.0E	370	Kapauku (Papua) Great Mother goddess.
Umay-ene Corona	27.5S	50.5E	370	Kazakh childcare goddess.
Utset Corona	55.5S	167.0E	150	Zia (SW USA) the First Mother.
Ved-Ava Corona	33.0N	143.0E	200	Mordovian (Volga Finn) water mother.
Vesuna Corona	65.5S	275.0E	200	Italic (Umbrian) vegetation goddess.
Xcacau Corona	56.0S	131.0E	200	Quiche (Guatemala) cacao goddess.
Xcanil Corona	37.0S	43.0E	200	Aztec and Quiche maize goddess.
Xmukane Corona	28.2S	269.5E	200	Mayan mother and fertility goddess.
Yanbike Corona	1.5S	328.5E	200	Bashkir mythical first woman.
Zemire Corona	31.5N	312.5E	200	Kumyk (Daghestan) fertility goddess.
Zemlika Corona	33.5S	50.0E	150	Latvian earth goddess.
Zhivana Corona	13.0N	287.5E	180	Slavic goddess of life.
Zywie Corona	38.6S	291.2E	200	Polish goddess of life.
<b>DORSA (53)</b>				
Abe Mango Dorsa	47.0N	212.0E	800	Tukano (Brazil) daughter of sun god.
Achek Dorsa	37.0S	220.0E	100	Dinka (Sudan) wife of rain god Deng.
Aida-Wedo Dorsa	73.0N	214.0E	450	Haitian rainbow spirit.
Akewa Dorsa	45.5N	184.0E	900	Toba (Argentina) sun goddess.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
DORSA				
Akuanda Dorsa	57.0N	236.0E	1000	Adygan light deity.
Alkonost Dorsa	5.0S	341.0E	730	E. Slavic wonder bird with woman's face.
Amitolane Dorsa	77.0S	335.0E	900	Zuni (SW USA) name of the Rainbow.
Anpao Dorsa	62.0N	207.0E	550	Dakota name of the Dawn.
Asiaq Dorsa	52.5S	55.0E	400	Eskimo weather goddess.
Barbale Dorsa	15.0N	143.0E	1200	Georgian sun goddess.
Biliku Dorsa	46.5S	138.0E	600	Andaman Isl. moonsoon deity.
Charykh-Keyok Dorsa	54.5N	285.0E	550	Khakasian (S. Siberia) magic bird.
Dylacha Dorsa	19.0S	76.0E	650	Evenk/Tungu (Siberia) sun goddess.
Etain Dorsa	45.0S	199.0E	1400	Irish sun and horse goddess.
Kadlu Dorsa	69.5S	188.0E	500	Eskimo thunder deity, noisy girl.
Kalm Dorsa	18.0N	309.0E	300	Mansi winged messenger from the gods.
Kastiatsi Dorsa	53.0S	245.0E	1200	Acoma (SW USA) name of the Rainbow.
Khadne Dorsa	14.0S	334.5E	220	Nenets (Samoyed) snowstorm maiden.
Kotsmanyako Dorsa	76.0S	242.0E	1900	Keresan Pueblo girl, put stars in sky.
Kuldurok Dorsa	50.4S	61.0E	1100	Uzbek thunder and lightning goddess.
Laverna Dorsa	50.0S	132.0E	1100	Roman night darkness goddess.
Lemkechen Dorsa	19.0N	65.0E	2000	Berber pole star goddess, holds camel.
Lumo Dorsa	24.5N	149.0E	500	Tibetan goddess of sky, rain, mist.
Metelitsa Dorsa	16.0N	31.0E	1300	E. Slavic snowstorm deity.
Naatse-elit Dorsa	64.0S	249.0E	950	Navajo rainbow goddess.
Naran Dorsa	56.0S	234.0E	600	Mongolian sun goddess.
Natami Dorsa	71.5S	258.0E	800	Mon (Burma/Myanmar) beauty fairy.
Norwan Dorsa	65.0N	163.0E	450	Wintun (Calif.) light goddess.
Nuvakchin Dorsa	53.0S	212.0E	2200	Hopi snow maiden ('kachina').
Ojuz Dorsa	6.0N	37.0E	800	Tajik deity of frost and cold wind.
Oshumare Dorsa	58.5S	79.0E	550	Yoruba rainbow deity.
Poludnitsa Dorsa	5.0N	179.5E	1500	E. Slavic witch, corn fields deity.
Pulugu Dorsa	65.0S	225.0E	650	Andaman Isl. moonsoon wind deity.
Ragana Dorsa	69.0S	246.0E	950	Latvian witch.
Rokapi Dorsa	55.0S	222.0E	2200	Georgian main witch.
Shishimora Dorsa	37.0N	297.0E	800	E. Slavic night and dream deity.
Siksaup Dorsa	73.0S	228.0E	650	Kachin (Burma/Myanmar) sun goddess.
Sinanevt Dorsa	67.0N	177.0E	1800	Itelmen (Kamchatka) wife of sky man.
Sogbo Dorsa	40.0S	237.0E	900	Fon (Benin) thunder goddess/god.
Spidola Dorsa	73.5S	325.0E	950	Latvian witch, flies in sky.
Sunna Dorsa	53.0S	134.0E	500	Norse sun goddess.
Tikoiwuti Dorsa	56.0N	225.0E	1000	Hopi goddess of darkness.
Tinianavyt Dorsa	51.0S	239.0E	1500	Koryak (Kamchatka) wife of sky man.
Tsovinar Dorsa	46.0S	254.0E	1100	Armenian lightning deity.
Tukwunag Dorsa	67.0S	160.0E	1000	Hopi cumulus cloud maiden ('kachina').
Unelanuhi Dorsa	12.0N	87.0E	2600	Cherokee sun goddess.
Unuk Dorsa	4.5S	351.5E	400	Eskimo (Chukotka) night maiden.
Urkuk Dorsa	12.0S	320.0E	600	Nivkhi (Sakhalin Isl.) night maiden.
Vejas-mate Dorsa	71.0S	245.0E	1600	Lithuanian "wind mother".
Wala Dorsa	17.0S	62.0E	500	Fox (US Plains) name of the Dawn.
Yalyane Dorsa	7.0N	177.0E	1200	Nenets (Samoyed) maiden of light.
Zaryanitsa Dorsa	0.0N	170.0E	1100	E. Slavic night lightning goddess.
Zimcerla Dorsa	47.5S	73.5E	850	W. Slavic dawn goddess.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>FLUCTUS (21)</b>				
Agrimpa Fluctus	0.0N	175.5E	950	Scythian goddess of love.
Alpan Fluctus	7.5S	349.0E	500	Lezghin (Daghestan) fire goddess.
Arubani Fluctus	55.0S	132.0E	620	Urartu supreme goddess.
Bolotnitsa Fluctus	50.0N	160.0E	1100	E. Slavic swamp mermaid.
Cavillaca Fluctus	72.0S	340.0E	800	Huarochiri (Peru) virgin goddess.
Djabran Fluctus	43.5S	183.0E	300	Abkhazian goddess of goats.
Djata Fluctus	66.5N	307.5E	280	Ngadju (Indonesia) water goddess.
Dotetem Fluctus	6.0S	177.5E	530	Ketian (Yenisey R.) evil spirit.
Hikuleo Fluctus	52.5N	208.0E	600	Tonga (Polynesia) underworld goddess.
Juturna Fluctus	76.0S	350.0E	900	Roman nymph, wife of Janus.
Koti Fluctus	12.5N	318.0E	400	Creek (SE USA) water-frog spirit.
Mamapacha Fluctus	60.0N	185.0E	900	Inca earthquake goddess.
Medb Fluctus	56.0S	127.0E	350	Irish mother of gods, wife of Ailil.
Nambubi Fluctus	61.0S	135.0E	850	Ganda goddess, mother of god Mukasa.
Praurime Fluctus	16.0N	154.0E	750	Lithuanian fire goddess.
Rafara Fluctus	65.0S	159.0E	700	Malagasy (Madagascar) water goddess.
Sobra Fluctus	6.0N	248.0E	700	Marindanim (New Guinea) creator goddess.
Sonmunde Fluctus	60.0S	120.0E	400	Korean mountain goddess.
Tsunghi Fluctus	67.0S	130.0E	800	Hibaro (Ecuador) water goddess.
Turgmam Fluctus	56.0N	220.0E	500	Nivkhi (Sakhalin Isl.) fire mistress.
Uilata Fluctus	17.0N	314.0E	700	Cherokee stone-clad female monster.
<b>FOSSAE (16)</b>				
Aife Fossae	67.0N	131.0E	280	Irish warrior deity.
Ajina Fossae	45.0S	258.0E	300	Tajik evil spirit.
Albasty Fossae	9.0S	336.5E	500	Tartar evil spirit.
Brynhild Fossae	23.0S	20.0E	1800	Norse warrior maiden.
Gulaim Fossae	5.0S	329.0E	800	Karakalpak amazon leader.
Hanekasa Fossae	29.0N	148.5E	700	Sanema (Venezuela) amazon warrior.
Karra-m\~ahte Fossae	28.0N	342.0E	1800	Latvian warrior goddess.
Khosedem Fossae	13.0S	303.0E	1800	Ketian (Yenisey R.) evil goddess.
Magura Fossae	12.0S	332.5E	600	E. Slavic winged warrior maiden.
Naijok Fossae	70.2S	337.0E	450	Dinka (Sudan) evil deity.
Narundi Fossae	66.5S	329.0E	700	Elam goddess of victory.
Penthesilea Fossa	12.0S	214.0E	1700	Greek amazon queen.
Perunitsa Fossae	10.0S	307.0E	1300	E. Slavic winged warrior maiden.
Saykal Fossae	73.0N	139.0	300	Kyrgyz warrior maiden.
Yenkhoboy Fossae	48.0S	7.0E	900	Buryatian warrior sisters.
Yuzut-Arkh Fossae	48.0N	224.0E	550	Khakas (S. Siberia) evil deity.
<b>LINEAE (4)</b>				
Badb Linea	14.0N	15.0E	1750	Irish war goddess.
Discordia Linea	58.0S	246.5E	800	Roman war goddess, close to Bellona.
Sarykyz Linea	77.3S	200.0E	370	Uzbek evil spirit.
Sui-ur Linea	61.0S	260.0E	700	Mansi (Ob River Ugra) wife of war god.
<b>MONTES (45)</b>				
Abeona Mons	44.8S	273.1E	375	Roman goddess of travelers.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>MONTES</b>				
Aleksota Mons	9.0S	308.5E	250	Lithuanian goddess of love.
Atai Mons	22.0S	291.0E	250	Efik (Ghana) wife of sky god Abassi.
Atsyrkhus Mons	78.5S	227.0E	170	Ossertian, daughter of sun god Khur.
Awenhai Mons	60.0S	248.0E	100	Mohawk/Iroquois fertility goddess.
Bagbartu Mons	65.5N	279.0E	600	Uratu goddess, worshipped at Musasir.
Chloris Mons	45.4S	294.6E	180	Greek flower goddess.
Chuginadak Mons	38.0S	246.0E	450	Aleutian volcano goddess.
Cipactli Mons	31.5S	32.5E	200	Aztec monster, origin of Earth.
Dzalarhons Mons	0.5N	34.0E	120	Haida (NW Coast) volcano goddess.
Egle Mons	59.0S	134.0E	110	Lithuanian underwater queen.
Faravari Mons	43.5S	309.0E	500	Malagasy (Madagascar) water goddess.
Erzulie Mons	68.0S	8.0E	300	Haitian voodoo goddess of love.
Gurshi Mons	47.5S	58.5E	210	Buryatian fishing deity.
Iseghey Mons	9.0N	171.0E	500	Yakutian/Saha goddess of cows.
Katl-Imi Mons	69.0S	126.0E	120	Khanty (Ob River Ugra) sun goddess.
Kokyanwuti Mons	35.5N	212.0E	400	Hopi earth goddess - "Spider Woman".
Kshumay Mons	54.9S	58.0E	250	Nuristan (NE Afghanistan) vegetation goddess.
Laka Mons	79.9N	262.0E	220	Hawaiian uncultivated area goddess.
Lanig Mons	68.5S	91.0E	400	Semang (Malay Peninsula) creator goddess.
Loo-Wit Mons	59.5S	56.0E	150	NW Indian St. Helens volcano goddess.
Ludjatako Mons	12.0S	251.0E	500	Creek (SE USA) Giant Turtle deity.
Mem Loimis Mons	9.5N	209.0E	300	Wintun (California) goddess.
Mertseger Mons	38.1S	270.3E	450	Snake goddess of Theban necropolis.
Mielikki Mons	27.8S	280.5E	450	Finnish forest goddess.
Nahas-tsan Mons	14.0N	205.0E	500	Navajo Mother Earth.
Nayunwi Montes	2.0N	83.0E	900	Cherokee stone-clad female monster.
Ne Ngam Mons	43.0S	257.5E	200	Lao world creator goddess.
Niola Mons	45.0N	185.0E	150	Lithuanian underworld goddess.
Ongwuti Mons	2.0S	194.5E	500	Hopi salt-woman deity; predicts seasons.
Pahto Mons	64.5S	114.5E	300	NW Indian mountain goddess.
Polik-mana Mons	24.5N	264.0E	600	Hopi butterfly maiden ('kachina').
Rakapila Mons	43.7S	321.5E	130	Malagasy (Madag.) sacred trees diety.
Rhpisunt Mons	2.5N	301.5E	250	Haida (NW Coast) Bear Mother deity.
Samodiva Mons	13.6N	291.0E	200	Bulgarian winged water deity.
Sakwap-mana Mons	4.0N	322.0E	400	Hopi maiden of blue corn ('kachina').
Siduri Mons	42.3S	297.3E	105	Babylonian goddess of wine & wisdom.
Ts'an Nu Mons	27.2S	272.9E	310	Chinese goddess of silkworms.
Tuzandi Mons	42.5S	41.5E	200	Palaun (Burma) ancestor deity.
Ua-ogreere Mons	40.5N	117.0E	200	Kivai (New Guinea) ancestor deity.
Uretsete Mons	12.0S	261.0E	500	Keresan Pueblo ancestor goddess.
Uti Hiata Mons	16.0N	69.0E	500	Pawnee Mother Corn deity.
Vostrukha Mons	6.3S	299.4E	180	Belorussian deity of home.
Yolkai-Estsan Mons	17.0N	194.0E	600	Navajo myth female deity.
Yunya-mana Mons	18.0S	285.0E	500	Hopi prickly pear cactus maiden.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>PATERAE (18)</b>				
Bakhtadze Patera	45.5N	219.5E	50	Kseniya; Georgian tea geneticist, (1899-1978).
Fedchenko Patera	24.0S	226.5E	75	Olga; Russian botanist (1845-1921).
Grizodubova Patera	16.7N	299.6E	50	Valentina; Soviet aviator (1910-1993).
Jaszai Patera	32.0N	305.0E	70	Mary; Hungarian actress (1850-1926).
Jotuni Patera	6.5S	214.0E	100	Maria; Finnish writer (1880-1943).
Kvasha Patera	9.5S	69.0E	50	Lidiya; Soviet mineralogist, meteorite expert (1909-1977).
Mansfield Patera	29.5N	227.5E	80	Cathrin (Cathleen Beauchamp); New Zealand writer (1888-1923).
Mehseti Patera	16.0N	311.0E	60	Ganjevi; Azeri/Persian poetess (c.1050-c.1100).
Mikhaylova Patera	26.8S	348.2E	70	Dariya (Dasha of Sevastopol); Russian (c.1830-c.1915).
Nordenflycht Patera	35.0S	266.0E	140	Hedwig; Swedish poetess (1718-1763).
Panina Patera	13.0S	309.8E	50	Varya; Gypsy/Russian singer (1872-1911).
Pchilka Patera	26.5N	234.0E	100	Olena (Olga Kosach); Ukrainian writer and ethnographer (1849-1930).
Serova Patera	20.0N	247.0E	60	Valentina (Polovikova); Soviet actress (1918-1975).
Shelikhova Patera	75.7S	162.5E	60	Natalia; Russian explorer of Alaska (c.1750-c.1800).
Shulzhenko Patera	6.5N	264.5E	60	Klavdiya; Soviet singer (1906-1984).
Villepreux-Power Patera	22.0S	210.0E	100	Jeannette; French marine biologist (1794-1871).
Vovchok Patera	38.0S	310.0E	80	Marko (Mariya Vilinskaya-Markovich); Ukrainian/Russian writer (1833-1907).
\vZemaite Patera	35.0S	263.0E	60	Julia; Lithuanian writer (1845-1921).
<b>PLANITIAE (21)</b>				
Aibarchin Planitia	73.0S	25.0E	1200	Uzbek "Alpamysh" epic tale heroine.
Akhtamar Planitia	27.0N	65.0E	2700	Armenian epic heroine.
Alma-Merghen Planitia	76.0S	100.0E	1500	Mongol/Tibet/Buryat "Gheser" epic tale heroine; wife of knight Gheser.
Dzerassa Planitia	15.0S	295.0E	2800	Ossetian golden-haired heroine.
Fonueha Planitia	44.0S	48.0E	3000	Samoan blind old woman, became a shark.
Gunda Planitia	16.0S	267.0E	1200	Abkhazian epic beautiful heroine.
Hinemoa Planitia	5.0N	265.0E	3700	Maori tale heroine.
Imapinua Planitia	60.0S	142.0E	2100	E. Greenland Eskimo sea mistress.
Kanykey Planitia	10.0S	350.0E	2100	Kyrgyz "Manas" epic tale heroine.
Laimdota Planitia	58.0S	117.0E	1800	Latvian myth heroine, beautiful girl.
Libu\vse Planitia	60.0N	290.0E	1200	Czech folktale heroine.
Llorona Planitia	18.0N	145.0E	2600	Mexican/Spanish folktale heroine.
Lowana Planitia	43.0N	98.0E	2700	Australian aboriginal tale heroine.
Mugazo Planitia	69.0S	60.0E	1500	Vietnamese tale heroine.
Nuptadi Planitia	73.0S	250.0E	1200	Mandan (US Plains) folk heroine.
Sologon Planitia	8.0N	107.0E	1600	Mandingo (Mali) epic heroine.

V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>PLANITIA</b>				
Tahmina Planitia	23.0S	80.0E	3000	Iranian (Farsi) epic heroine.
Tilli-Hanum				
Planitia	54.0N	120.0E	2300	Azeri "Ker-ogly" epic tale heroine.
Undine Planitia	13.0N	303.0E	2800	Lithuanian water nymph, mermaid.
Wawalag Planitia	30.0S	217.0E	2600	Yulengor (Arnhemland) tale heroines.
Zhibek Planitia	40.0S	157.0E	2000	Kazakh "Kyz-Zhibek" epic tale heroine.
<b>PLANUM (1)</b>				
Astkhik Planum	45.0S	20.0E	2000	Armenian goddess of love.
<b>REGIONES (4)</b>				
Dsonkwa Regio	53.0S	167.0E	1500	Kwakiutl (NW Coast) forest giantess.
Ishkus Regio	61.0S	245.0E	1000	Makah (NW Coast) forest giantess.
Neringa Regio	65.0S	288.0E	1100	Lithuanian seacoast giantess.
Vasilisa Regio	11.0S	332.0E	1200	Russian tale heroine.
<b>TESSERAE (41)</b>				
Adrasthea Tesseræ	30.0N	55.0E	750	Greek goddess of law.
Athena Tessera	35.0N	175.0E	1800	Greek goddess of wisdom.
Chimon-mana Tessera	3.0S	270.0E	1500	Hopi (SW USA) goddess of the insane.
Clidna Tessera	42.0S	29.0E	500	Irish bird goddess of afterlife.
Cocomama Tessera	62.0S	23.0E	1600	Quechua (Peru) happiness goddess.
Dolya Tessera	8.0S	296.0E	1100	E. Slavic good fate goddess.
Dou-Mu Tesserae	60.0S	244.0E	400	Chinese life/death ruling goddess.
Gbadu Tessera	1.0S	38.0E	700	Fon (Benin) goddess of guessing.
Gegute Tessera	17.0N	121.0E	1600	Lithuanian goddess of time.
Giltine Tesserae	39.0S	250.0E	300	Lithuanian bad fate goddess.
Haasttse-baad				
Tessera	6.0N	127.0E	2600	Navajo good health goddess.
Hikuleo Tesserae	42.0S	54.0E	1400	Tonga underworld goddess.
Humai Tessera	53.0S	250.0E	350	Iranian happiness bird.
Husbishag Tesserae	28.0S	101.0E	1100	Semitic underworld goddess.
Kruchina Tesserae	36.0N	27.0E	1000	E. Slavic goddess of sadness.
Lahevhev Tesserae	29.0N	189.0E	1300	Melanesian dead souls goddess.
Lhamo Tessera	51.0S	15.0E	800	Tibetan time and fate goddess.
Likho Tesserae	40.0N	134.0E	1200	E. Slavic deity of bad fate.
Mago-Halmi Tesserae	70.0N	157.0E	400	Korean helping goddess.
Magu Tessera	52.0S	305.0E	300	Chinese goddess of immortality.
Mamitu Tesserae	22.0N	44.0E	900	Akkadian destiny goddess.
Minu-Anni Tessera	20.0S	30.0E	1300	Assyrian fate goddess.
Nedolya Tesserae	5.0N	294.0E	1200	E. Slavic bad fate goddess.
Norna Tesserae	50.0S	263.0E	700	Norse fate goddess.
Nortia Tesserae	50.0S	150.0E	650	Etruscan fate goddess.
Nuahine Tessera	9.0S	157.0E	1000	Rapanui (Easter Isl.) fate goddess.
Oddibjord Tessera	82.0N	85.0E	900	Scandinavian volvas (fortune deity).
Pasom-mana Tesserae	33.0S	49.0E	1200	Hopi goddess of dreams and insanity.
Senectus Tesserae	50.0N	292.0E	1400	Roman goddess of old age.
Shait Tessera	54.0S	173.5E	220	Egyptian human destiny goddess.
Snotra Tesserae	24.0N	134.0E	1000	Scandinavian goddess of wisdom.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
<b>TESSERAE</b>				
Sopdet Tesseræe	45.0S	243.0E	500	Egyptian goddess of Sirius star.
Sudenitsa Tesseræe	33.0N	270.0E	4200	E. Slavic fate deities.
Sudice Tessera	37.0S	112.0E	500	Czech goddess of fate.
Urd Tessera	40.0S	174.5E	250	Norse fate goddess; a Norna.
Ustrecha Tesseræe	40.0S	263.0E	1000	Old Russian goddess of chance.
Verpeja Tesseræe	58.0S	160.0E	600	Lithuanian life thread goddess.
Vako-nana Tesseræe	27.0N	40.0E	1200	Adygan wise future-teller.
Xi Wang-mu Tessera	30.0S	62.0E	1300	Chinese goddess of eternal life.
Yuki-Onne Tessera	39.0N	256.0E	1200	Japanese spirit of death.
Zirka Tessera	33.0N	300.0E	450	Belorussian happiness goddess.
<b>THOLI (14)</b>				
Amra Tholus	53.0N	98.0E	50	Abkhazian sun deity.
Angerona Tholus	29.8S	287.2E	200	Italian goddess of silence.
Angrboda Tholus	73.8S	116.0E	80	Norse Titaness.
Gerd Tholi	54.5S	291.5E	50	Scandinavian sky maiden.
Justitia Tholus	28.7S	296.5E	60	Roman goddess of justice.
Khotal-Ekva Tholi	9.1S	177.8E	50	Mansi (Ob River Ugra) sun goddess.
Kwannon Tholus	26.3S	296.8E	135	Japanese Buddhist goddess of mercy.
Meiboia Tholus	44.7S	281.3E	85	Greek bee goddess.
Muru Tholus	9.0S	305.5E	40	Estonian deity of meadows.
Ndara Tholus	57.5S	16.0E	70	Toraji (Indonesia) underworld and earthquake goddess.
Podaga Tholus	56.3S	2.0E	40	Slavic weather goddess.
Rohina Tholus	40.6S	295.4E	30	Hindu cow goddess.
Vilakh Tholus	6.5S	176.5E	15	Lakian/Kazikumukhan fire goddess.
Vupar Tholus	13.5S	306.0E	100	Chuvash (Volga area) evil spirit causing lunar and solar eclipses.
<b>VALLES (42)</b>				
Albys Vallis	29.5S	30.5E	240	Tuva/Altay river deity.
Apisuahts Vallis	66.5S	17.0E	550	Blackfoot/Algonquin name for Venus.
Austrina Vallis	49.5S	177.0E	600	Latvian name for planet Venus.
Chasca Vallis	52.8S	359.0E	400	Quechua name for planet Venus.
Dzyzlan Vallis	16.0S	182.0E	250	Abkhazian river goddess.
Fetu-ao Vallis	61.0S	254.7E	400	Samoan name for planet Venus.
Fufei Vallis	46.0N	341.0E	170	Chinese goddess of Lo River.
Gendenwitha Vallis	63.0S	259.0E	900	Iroquois name for planet Venus.
Helmud Vallis	33.9S	171.3E	280	Afghanistan river goddess.
Hoku-ao Vallis	28.0N	166.5E	450	Hawaiian name for planet Venus.
Ikhwezi Vallis	16.0N	147.8E	1700	Zulu name for planet Venus.
Jutrzenka Vallis	27.0N	155.8E	970	Polish name for planet Venus.
Khalanasy Vallis	51.0S	168.5E	320	Azeri river mermaid.
Kinsei Vallis	13.6N	141.0E	800	Japanese name for planet Venus.
Koidut\ :aht Vallis	76.5S	130.0E	700	Estonian name for planet Venus.
Kumanyefie Vallis	80.5S	335.0E	600	Ewe name for planet Venus.
Kumsong Vallis	59.0S	152.5E	700	Korean name for planet Venus.
Lunang Vallis	68.2N	310.0E	250	Nuristan goddess of Parun River.
Lusaber Vallis	47.5S	164.0E	500	Armenian name for planet Venus.

## V E N U S (Cont.)

NAME	LAT	LONG	DIAM (km)	ATTRIBUTE
VALLES				
Martuv Vallis	23.0N	156.0E	250	Kyrgyz river deity.
Matlalcue Vallis	33.0S	167.5E	300	Aztec fresh water goddess.
Merak Vallis	63.5S	162.0E	200	Balochi (Pakistan) river deity.
Nahid Valles	55.1S	171.0E	500	Persian name for planet Venus.
Nantosuelta Vallis	61.9S	193.0E	320	Celtic (Gaullic) river goddess.
Neptra Vallis	0.2N	23.5E	350	E. Slavic goddess of Dneper River.
Ngyandu Vallis	62.0S	12.0E	500	Swahili name for planet Venus.
Nyakaio Vallis	47.5N	339.0E	150	Shilluk (Sudan) river deity.
Olokun Vallis	81.5N	269.0E	150	Bini sea and river goddess.
Omutnitsa Vallis	33.0N	292.0E	150	E. Slavic river deeps deity.
Poranica Vallis	21.0S	178.5E	550	Slovenian name for planet Venus.
Sezibwa Vallis	44.0S	37.0E	300	Ganda river spirit.
Tai-pe Valles	11.0N	156.5E	400	Chinese name for planet Venus.
Tan-yonozo Vallis	41.5S	87.0E	800	Bashkir name for planet Venus.
Tapati Vallis	27.0N	304.0E	150	Indian Tapti (Tapi) River goddess.
Tawera Vallis	11.6S	67.5E	500	Maori name for planet Venus.
Tingoi Vallis	6.0N	318.6E	250	Mande (Sierra Leone) river spirit.
Umaga Valles	49.0S	152.0E	400	Old Tagal name for planet Venus.
Uottakh-sulus Valles	12.5N	239.0E	1100	Yakutian/Saha name for planet Venus.
Utrenitsa Vallis	55.0N	280.0E	700	Old Russian name for planet Venus.
Veden-Ema Vallis	15.0S	141.0E	300	Finnish goddess of fishing.
Xulab Vallis	57.4S	185.0E	1000	Mayan name for planet Venus.
Yuvkha Valles	10.5N	239.5E	200	Turkman river spirit.



**WORKING GROUP FOR THE WORLDWIDE DEVELOPMENT OF ASTRONOMY**  
**GROUPE DE TRAVAIL POUR LE DEVELOPPEMENT MONDIAL DE L'ASTRONOMIE**

Members of the Working Group held a business session during the lunchtime break of the Joint Discussion. They considered such matters as the future organization of the Group, the continuation of the annual newsletter, and plans for further meetings along the lines of the Joint Discussion.

**Composition of the Working Group**

The composition of the Working Group is the following:

CHAIRMAN:		A.H. Batten	Canada	
MEMBERS:	ex officio	J. Fierro	Mexico	
		J.B. Hearnshaw	New Zealand	
		B. Hidayat	Indonesia	
		Y. Kozai	Japan	
		D. McNally	UK	
	ex officio	M.C. Pineda de Carias	Honduras	
		M.S. Roberts	USA	
		D.G. Wentzel	USA	
		CONSULTANT:	S. Raither	UNESCO

**Joint Discussion 20: Enhancing Astronomy Research and Education in Developing Countries**

Chairmen: A.H. Batten, J.R. Percy, H. Jørgensen and S.M.R. Ansari.

The principal meeting of the Working Group during the General Assembly was Joint Discussion 20 on Enhancing Astronomy Research and Education in Developing Countries. Some 60 to 100 persons attended the day-long session, and many of them contributed to the discussions. Twenty-two papers were presented during the Joint Discussion. These papers will be printed in full in the forthcoming Volume 11 of Highlights in Astronomy, which will also contain a summary of the discussions. Nine poster papers were on display in connection with the Joint Discussion. The question of the relationship between the IAU and the UN/ESA series of workshops on Basic Space Science for Developing Countries was also discussed. It was planned to continue discussing these matters by correspondence, after the Assembly.

**WORKING GROUP ON FUTURE LARGE SCALE FACILITIES**

Report not received