

DIVISION IV STARS

(Etoiles)

Division IV supports and coordinates astronomers studying the characteristics, interior and atmospheric structure, and evolution of stars of all masses, ages, chemical compositions, and multiplicity.

PRESIDENT	Christopher Corbally
VICE-PRESIDENT	Francesca D’Antona
PAST PRESIDENT	Monique Spite
BOARD	Martin Asplund, Corinne Charbonnel, Jose Angel Docobo, Richard O. Gray Nikolai E. Piskunov

DIVISION I COMMISSIONS

Commission 26	Double and Multiple Stars
Commission 29	Stellar Spectra
Commission 35	Stellar Constitution
Commission 36	Theory of Stellar Atmospheres
Commission 45	Stellar Classification

DIVISION IV WORKING GROUPS

Division IV WG	Abundances in Red Giants
Division IV WG	Massive Stars

INTER-DIVISION WORKING GROUPS

Division IV-V WG	Active B Stars
Division IV-V WG	Ap & Related Stars

TRIENNIAL REPORT 2009-2012

1. Introduction

This Division IV was started on a trial basis at the General Assembly in The Hague 1994 and was formally accepted at the Kyoto General Assembly in 1997. Its broad coverage of “Stars” is reflected in its relatively large number of Commissions and so of members (1266 in late 2011). Its kindred Division V, “Variable Stars”, has the same history of its beginning. The thinking at the time was to achieve some kind of balance between the number of members in each of the 12 Divisions. Amid the current discussion of reorganizing the number of Divisions into a more compact form it seems advisable to make this numerical balance less of an issue than the rationalization of the scientific coverage of each Division, so providing more effective interaction within a particular field of astronomy. After all, every star is variable to a certain degree and such variability is becoming an ever more powerful tool to understand the characteristics of every kind of

normal and peculiar star. So we may expect, after hearing the reactions of members, that in the restructuring a single Division will result from the current Divisions IV and V.

Division IV has strong connections with other Divisions such as Div.II (Sun & Heliosphere) and Div.VII (Galactic Systems). These connections will continue to be valued in the newly proposed Divisions, along with their reorganized Commissions and Working Groups.

2. Developments and conferences within the past triennium

Summaries of recent progress in Division IV's science will be found in the reports of its Commissions and Working Groups which follow. Here let us just note some highlights.

- Commission 26 (Double and Multiple Stars) has been active in observation, both speckle and traditional, and in the cataloging of fundamental data. It has had a broad outreach, especially during IYA2009. Its science included: a comparison of binary periods for Population I and II dwarfs, which was used to explain why exoplanets are rare around Pop.II dwarfs; the dynamics of multiple systems analyzed with respect to star formation and the dynamical evolution of stellar groups; preparations in the expectation that the Gaia mission will reveal even more binaries among Cepheids, with adverse effects on the current luminosity relations of these stars.

- The report of Commission 29 (Stellar Spectra) remarks that over 8000 papers in its field were published just in refereed journals during the reporting period. This considerable activity is attributed both to continuous technology development and to closer integration of fields within astrophysics. Interest in exoplanets and their host stars has certainly been a driver, while the study of chemically peculiar stars has benefited from new spectropolarimeters and Doppler imaging techniques. In obtaining fundamental stellar parameters there has been considerable overlap of interest with other Commissions.

- Commission 35 (Stellar Constitution) has sponsored and participated in significant meetings; and we all know the value of such well-planned meetings in reflecting and promoting development within an area of astronomy. Hence there has been progress in massive star models and observations, in understanding the progenitors of type Ia supernovae and the explosion mechanism for core collapse, in investigating binarity in Planetary Nebulae, and in the transport processes in stars. Techniques and the application of helio- and asteroseismology are particularly flourishing, thanks both to ground-based and satellite data, while Surface Brightness Fluctuations are revealing ever more information on stellar populations in clusters and galaxies.

- Commission 45's report (Stellar Classification) is excited to announce the discovery of Y-type dwarfs. These fill the temperature gap between the coolest spectroscopically confirmed brown dwarfs and Jupiter. Further, the mass/age/spectral-type degeneracy in L-type brown dwarfs has been resolved by high-resolution spectroscopy. Spectral libraries of L-, T-, and now Y-type dwarfs are expanding, though curating all these is a problem under current discussion. Such curating of spectral and photometric surveys is an important activity of members of this Commission 45, and the future deep Galactic surveys will make this even more true.

- The Working Group on Abundances in Red Giants (WG-ARG) has a Newsletter with approximately 1000 subscribers. To these have gone announcements of specialist meetings, such as the second in the series "Why Galaxies Care About AGB Stars", 2010, in Vienna. The WG is working closely with members of Commission 35 in whose report many WG-ARG topics are included. The first comprehensive millimeter wavelengths studies are being carried out, and these are discovering dominant and unusual molecular

species in the envelopes of giant stars. Multi-dimensional hydrodynamical studies are getting increasing attention as computing power increases.

- The Working Group on Massive Stars (WG-MS) has implemented an efficient automatic process to produce its Newsletter. Such newsletters are a valuable contribution to communication and so to progress in a WG's task area. Perhaps counter-intuitively, the WG-MS has been turning its attention to the infrared bands, since these have strong potential for circumstellar and atmospheric diagnostics. Also, new techniques and observations are allowing former assumptions on massive-star evolution to be undergoing revision.

- The Working Group on Active B Stars (WG-ABS) saw significant advances in our understanding of the activity and the evolution of B-type stars. New observations, many the result of large collaborations, and new stellar models that include rotation and magnetic fields in their computation were reported at IAUS-272, Paris, 2010. Noteworthy are interferometric observations with VLTI/MIDI, VLTI/AMBER, CHARA, and NPOI that have provided information on the geometry and structure of circumstellar disks and the degree of stellar flattening due to a star's rapid rotation. The MiMeS (Magnetism in Massive Stars) Project is yielding information on the origin, presence, and geometry of magnetic fields in B stars. The pulsational characteristics of B stars have been studied from photometry that continues to be accumulated from the Kepler and CoRoT spacecraft. The Spitzer SAGE survey of the Magellanic Clouds reveals a higher percentage of Be stars in the SMC and frequent transitions from a Be-phase to a non-emission state. The VLT-FLAMES surveys of OB stars in the Magellanic Clouds are providing fundamental parameters for thousands of objects.

- The Working Group on Ap & Related Stars (WG-Ap) announces new work on large-scale magnetic fields, especially the weak ones in stars. This WG shares with WG-ABS in the MiMeS Project's activity and results. MOST, CoRoT, and Kepler data continue to surprise researchers and promote the development of more consistent theoretical models. An important role is the WG-Ap's contact with the atomic physics community, mediating requests to the latter for new atomic data specific to the analysis and modeling of Ap and related stars.

3. Closing remarks

The coming triennium's prospects for this Division's members are more fully outlined in the respective reports that follow. Certainly members can look forward to a stimulating time at the XXVIII General Assembly in Beijing, China, where 7 Symposia, 4 Joint Discussions, and 12 Special Sessions have sponsorship from and/or direct relevance to this Division.

Since web links change, especially after a General Assembly, readers are advised to consult the IAU website <http://www.iau.org> for the most current links to this Division, its Commissions, and Working Groups, and so to its ongoing activities.

Christopher Corbally
president of the Division