

## 37. COMMISSION DES AMAS STELLAIRES ET DES ASSOCIATIONS

### Report of Meetings

PRESIDENT: H. Haffner.

SECRETARIES: J. B. Irwin, A. G. Velghe, V. Vanýsek.

Two joint meetings were held, one with Commission 25 (Stellar Photometry) and the other with Commission 27 (Variable Stars); the reports are included with those of Commissions 25 and 27.

#### Business meeting, 17 August 1961

In opening the first session the President paid tribute to the late W. Baade (died 25 June 1960) who was a member of the Commission for many years and its President from 1948 to 1952.

The President explained to the Meeting the meaning of the new Constitution of the Union. The following Organising Committee was proposed and elected:

President: H. Haffner.

Vice-President: M. F. Walker.

Members: O. J. Eggen, A. R. Hogg, H. L. Johnson, P. N. Kholopov.

Including 21 Astronomers who have recently applied for membership Commission 37 will now comprise 46 members. Their names were read.

The *Draft Report* was adopted after several technical questions had briefly been discussed in connection with it. The President then referred to the Prague Card Catalogue of Clusters and Associations which is currently being supplemented by the co-operative work of G. Alter, J. Ruprecht, Mrs H. Sawyer-Hogg, and V. Vanýsek. To facilitate the continuation of this catalogue authors are urgently requested to send reprints of their papers to the Astronomical Institute, Ondrejov, Czechoslovakia.

In opening the presentation of several minor communications on catalogue and similar work, the President then introduced the new Prague Atlas of Galactic Clusters which is just being published by G. Alter. Unfortunately an advance copy of the Atlas mailed to Berkeley prior to the General Assembly, had been mis-directed by the local Post Office and could not be produced at the meeting. Vanýsek briefly described the Atlas. It consists of a large map covering the whole field of the Milky Way and 36 detailed maps each covering  $10^\circ$  of longitude. The large map has a width of  $\pm 45^\circ$ , and the small maps  $\pm 20^\circ$ . The diameters of the circles representing the clusters on the small maps correspond generally with the angular diameters of the clusters. Nine symbols have been selected to represent various properties of the clusters, such as star number, colour index, colour excess, spectrum, photo-electric photometry, proper motion, radial velocity.

Mrs K. A. Barkhatova presented a number of copies of the second part of her Atlas of Colour Magnitude Diagrams (Moscow, 1961). It gives diagrams for 4 associations and 52 clusters, most of which have been published between 1958 and 1960.

A. R. Hogg commented on the new Mount Stromlo Atlas of galactic clusters south of  $-50^\circ$ . It has been based on blue plates taken with the 74-inch reflector; limiting magnitude 17 to 18. Copies will be supplied by Mount Stromlo on personal request. So far, no extension to red plates and further to the north has been considered, though highly desirable.

H. F. Weaver reported that a second edition of his and F. Setteducati's Atlas of Newly Found Clusters is in progress. He further explained the present position in editing Trumpler's posthumous cluster work. (Charts of 100 clusters;  $B-V$  magnitudes, radial velocities, spectral types and rectangular co-ordinates of approximately 5 000 stars.) After considerable difficulties at the printers had been overcome, the work is now going to press. He was glad to show a sample of the first proof sheets.

Mrs H. Sawyer-Hogg spoke on her bibliographic work in globular clusters which is to bring up to date the catalogue given in *Publ. David Dunlap Obs.* Vol. 1, No. 20.

P. Th. Oosterhoff said that G. Pels at Leiden has investigated the outer regions of the Pleiades and discovered roughly 50 new physical members.

#### RECOMMENDATIONS

1. *Nomenclature of associations.* Following A. Blaauw's suggestion to revise the present somewhat confusing system of nomenclature of associations (*e.g.* II Cas and Cas II which mean different things), a small Working Group (Blaauw, Markarian, Morgan, Schmidt, Vanýsek, Haffner (Chairman)) was established and entrusted to make precise proposals for remedying the annoying situation. At the second meeting the Working Group presented the following recommendations:

(a) The nomenclature introduced by Markarian in 1952 will be kept as a basic system.

(b) Associations subsequently discovered and denominated by other observers will get new designations within the Markarian system.

(c) A vocabulary will be worked out within the next months which will give the new designation for all associations contained in the lists of Morgan and Schmidt.

(d) This vocabulary will be drafted by Dr Vanýsek and Dr Ruprecht, approved by the Working Group and published in five astronomical periodicals.

These recommendations were unanimously adopted.

2. *Duplication of cluster photometry.* The question had been asked to what extent photometric work in clusters will serve a sensible purpose after so many clusters (at least the brighter ones north of  $-25^\circ$ ) have been studied. In reply, H. L. Johnson commented on the newly published (*Publ. U.S. Naval Obs.* Vol. VII, 19, and *Lowell Obs. Bull.* No. 113) papers on 70 clusters. He emphatically stressed that he does not consider this work of himself and his collaborators to settle the photometric questions in those clusters. Rather would he like to encourage any further work on these and other clusters, both observational and theoretical. As a striking example M 25 was mentioned by the President, which has been investigated by four different astronomers within twelve months (*Ap. J.* 131 and 133). In spite of that, the results do not agree and the problem still remains unsolved.

3. *Presentation of Cluster data.* A vivid discussion on the publication of cluster work resulted in the following recommendations:

Any paper on photometric cluster work should give:

(a) In the introduction, equatorial and new galactic co-ordinates (to  $0^\circ.1$ ) of the cluster;

(b) a finding chart with orientation and scale indicated;

(c) full photometric data on the photo-electric standard sequence stars marked on the finding chart.

This was unanimously adopted.

4. *Symposium.* The suggestion of holding a symposium on clusters in 1962 or 1963 was frankly discussed, but finally the plan had to be dropped since there appeared to be no interest or enthusiasm for it. B. J. Bok commented on the joint Symposium of Commissions 28 and 33 with special emphasis on the southern hemisphere to be held in Mount Stromlo, probably early in 1963.

#### Scientific meetings, 22 and 23 August 1961

*A. A. Hoag and H. L. Johnson* commented in some detail on the comprehensive photometric work on 70 clusters which has been carried out by A. A. Hoag, H. L. Johnson, B. Iriarte, R. J. Mitchell, K. L. Hallam and S. Sharpless as a joint programme of Lowell Observatory and U.S. Naval Observatory. Ample copies were distributed of these two papers, one dealing with observations, the other with the results pertaining to stellar evolution and galactic structure. Johnson drew special attention to NGC 6940 the only cluster so far known which shows a giant branch sloping downwards to redder stars. That, of course, is of high importance for the theory of stellar evolution. In the discussion L. Mavridis pointed out the need of good proper motions to check the physical membership of those giant-branch stars in NGC 6940. The slope seems to depend on three or four stars only. He, further, referred to his systematic search for M-, S-, and C-type stars in selected galactic clusters (Warner and Swasey Schmidt with infra-red objective-prism plates) and asked for evidence of the existence of such very red stars in the *C-m* diagrams of the new material. There are indeed some cases. No doubt the new material has much bearing on those and similar problems. F. Zwicky mentioned that he had found clusters of stars ("pygmy galaxies") in the nearby inter-galactic space (30 to 100 kpc). They have from 50 to 10 000 stars. Some of them, but not all, contain red ordinary giants as their brightest stars. Widened spectra recently taken by Zwicky with the 200-inch nebular prime-focus spectrograph show G 5 to K 5 types. But it is expected to find a variety of types. The classification of the spectra of the brightest stars would give powerful means of determining the total absorption through the whole of the galactic system in various directions. The apparent magnitudes of stars which are being investigated in the pygmy galaxies range from 16 to 20.

*G. Alter* delivered a paper (read by the President) on the galactic structure as deduced from the apparent distribution in galactic longitude of 864 galactic clusters. The shape of the curve confirms the presence of obscuring clouds in the vicinity of the galactic centre. It is further suggested that the cluster system has an elongated shape with its major axis in the direction of the galactic rotation. This is supported by the fact that the number of clusters contained in the sectors enclosing the major axis exceeds by 8:5 the number contained in the sectors enclosing the perpendicular direction, centre to anti-centre.

*K. A. Grigorian* reported on new photo-electric observations (16-inch at Burakan) of polarisation in 6 clusters: NGC 2422, 7092, IC 4665; NGC 6530, 6514; IC 1590. The clusters of the first group are situated in regions of small and/or smooth interstellar absorption. Correspondingly the planes of vibration of the cluster members are found to be fairly parallel, although the dispersion of  $\theta$  for NGC 7092 is four times larger than for IC 4665. Further, the amount of polarisation in NGC 7092 increases with increasing *m* of the cluster members. These two facts are explained by the author by the hypothesis that in NGC 7092 a stellar polarisation contributes to the interstellar component. The second group of clusters shows a rather chaotic distribution of the planes of vibration. It is easily accounted for by the heavily turbulent structure of the clouds of interstellar material in which these clusters are embedded. (See Figs. 1-3 on the following pages.)

*A. A. Hoag and V. Bappu* reported on their independent work on  $H\gamma$  photometry in associations (*e.g.* Ori 1) carried out at the U.S. Naval Observatory Station at Flagstaff and at Naini Tal, India. It aims at determining very accurate absolute magnitudes.

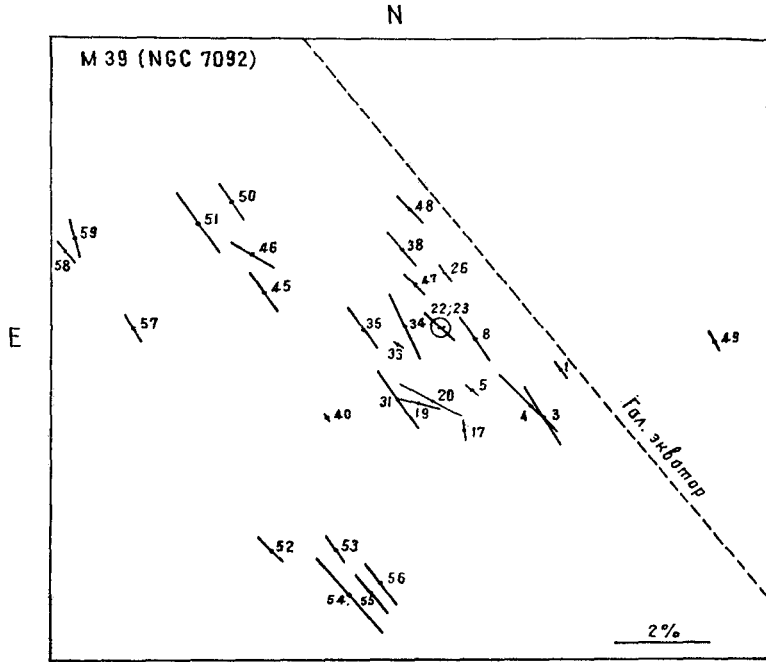


Fig. 1. Polarisation in NGC 7092

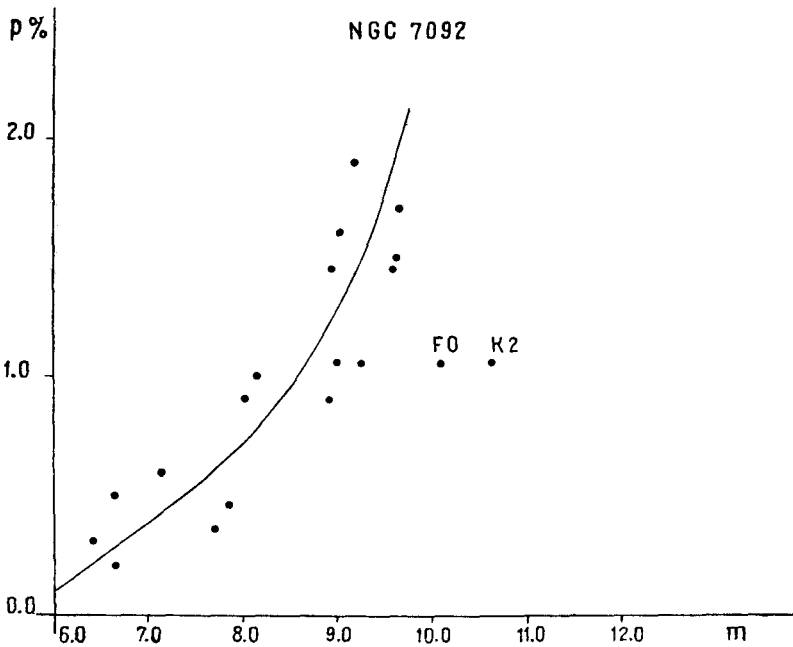


Fig. 2. Polarisation in NGC 7092

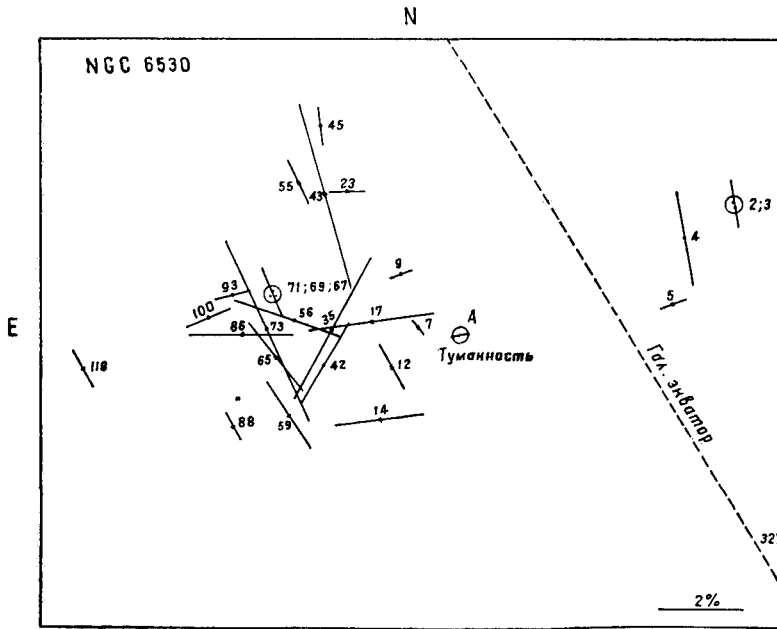


Fig. 3. Polarisation in NGC 6530

V. A. Ambartsumian spoke on a cluster of white dwarfs recently found by him in the vicinity of  $\delta$  Lyr. He expressed the opinion that clusters of white dwarfs may be a very common feature in our Galaxy and that it is only due to their faintness that they have escaped our attention so far.

A similar, but not identical, object was dealt with by W. J. Luyten. He summarized the results of his search for faint blue stars in galactic clusters as follows. In clusters with well-known proper motions many white dwarfs have been established: Hyades (7 to 8, found largely by Zwicky), Pleiades (1 possible), Praesepe (2, and 50 to 100 blue stars down to 21 mag. in the general area). For more distant clusters we can only proceed statistically. M 36, 38, 39, 41, NGC 129 and 6885 have been blinked on Palomar Survey plates together with corresponding control areas. Fewer blue stars were found in the clusters than in the control areas. In NGC 752 and IC 4665 large numbers of blue stars were found, but the same numbers in the control areas. In M 34 and 67 a few possible white dwarfs are indicated at the expected apparent magnitude 19 to 21.

Finally, I. R. King gave a report on the results of a programme that aims at determining the density-distributions in about 15 globular clusters. Plates taken with the 48-inch Schmidt camera have made it possible to trace the density out to a low level at the edges of the clusters. In the outer parts of a globular cluster the surface density  $f$  is found to follow the law

$$f = c \left( \frac{1}{r} - \frac{1}{r_t} \right)^2 \tag{1}$$

where  $r$  is the projected distance from the centre of the cluster. As observed in several clusters, the limiting radius  $r_t$  lies close to the expected cut-off due to the tidal force of the Milky Way.

In the observations of the central parts of globular clusters, the star counts have been supplemented by photo-electric measurements of surface brightness. Near the centre of a cluster the surface density is approximated by

$$f = f_0 \{1 + (r/a)^2\}^{-1/2} \quad (2)$$

This is very similar to Hubble's law (*Ap. J.*, **71**, 131, 1930) for elliptical galaxies. Since Hubble showed that his law closely resembles the projection of the central parts of an isothermal sphere, it appears that the profile of the central parts of a globular cluster is simply a consequence of the resemblance of its velocity distribution to a Gaussian shape.

A possible combination of formulae (1) and (2) is

$$f = f_0 [\{1 + (r/a)^2\}^{-1/2} - \{1 + (r_i/a)^2\}^{-1/2}]^2 \quad (3)$$

This law represents the observed density-distributions in globular clusters and Sculptor-type galaxies. It also approximates to the profiles of elliptical galaxies, provided  $r_i$  is taken to be very large. Apart from the inevitable scale factors, the law has only one free parameter, the central concentration  $r_i/a$ , which is the accidental result of a combination of external and internal circumstances.

Some tentative dynamical conclusions can be drawn: (1) If the observed density-distribution is to be reconciled with a slowly relaxing velocity-distribution, then the motions in the outer parts of a globular cluster must show a moderate but not an extreme preference for the radial direction. (2) If the resemblance between globular clusters and elliptical galaxies is more than accidental, then some relaxation must have taken place in the elliptical galaxies. A likely source of relaxation is in the initial mixing, at the time when the stars settled down from the primeval gas distribution to the final stellar distribution.

#### CORRECTIONS AND AMENDMENTS TO THE DRAFT REPORT (VOL. XIA)

With reference to the quotation on page 440, second paragraph, concerning the papers of A. J. Meadows (40) and D. H. McNamara (42) on rotational velocities of B stars in clusters compared with those of field stars, A. J. Meadows has drawn attention to the fact that for the Orion association he found the Be stars to be distinctly under-abundant, other than in clusters where they had been found over-abundant. Hence there is actually no contradiction with McNamara's results which indicated small values of  $v \sin i$  for the Orion association corresponding to under-abundant Be stars.

On page 445, the report on S. von Hoerner's paper (86) is to be supplemented by a reference to M. Dirikis, *Publ. Ap. Lab. Acad. Sci. Latvian S.S.R.*, **7**, 5, 1958. This author has made similar computations for some cases of three mass points.

On page 446, first paragraph, a paper of E. A. Dibai, F. A. Tsitsin, A. S. Sharov (*Astr. Zh. Moscow*, **37**, 659, 1960) should also be mentioned. These authors have considered the problem of determining the mean distance between the stars in a cluster in connection with the application of the virial theorem in the dynamics of clusters.