

## 27. COMMISSION DES ÉTOILES VARIABLES

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It is well-nigh impossible to give, in a short report, an adequate idea of the enormous activity in Variable-Star Astronomy during the past three years. Without attempting to be complete I shall give a summary of the most important recent occurrences in this field of research.

Statistical data for eclipsing binaries were given by Gaposchkin (*Veröff. Berlin-Bab. 9*, Heft 5), for long-period variable stars by Ludendorff (*Sitz.-ber. Ak. d. Wiss. Berlin*, 1932), Thomas (*Veröff. Berlin-Bab. 9*, Heft 4) and Sterne and L. Campbell (*Harvard Annals*).

Some valuable catalogues have been issued: a *Finding List for Observers of Eclipsing Variables* by Dugan (*Princeton Contr. No. 15*), a *Catalogue of Eclipsing Variables*, together with a *Program of Investigations*, by Martinoff (*Engelhardt Obs. Bull. No. 2*), a *Catalogue and Ephemeris of Short-period Cepheids* by Zessewitsch (*Len. Un. A. O. Bull. No. 3*).

Further we may welcome the first Series of an *Atlas d'étoiles variables* by Kopal and Vand, Series VIII of the renowned *Atlas Stellarum Variabilium* by J. Stein, with photovisual sequences of the comparison stars, measured by Miss Wright, and, last but not least, the first volume of the second edition of another almost classical work, the *Geschichte und Literatur des Lichtwechsels der veränderlichen Sterne* by Prager. No less than the first edition, the second edition of this reliable book of reference will be indispensable for all students of stellar variability. Prof. Prager is to be heartily congratulated on the completion of the first part of the important and enormous task he has undertaken.

As a consequence of a wish uttered at the Harvard meeting of the International Astronomical Union, Grouiller has prepared and nearly completed a list of unpublished observations of variable stars, which will be of great value for anyone who undertakes the study of a star, and wants to know where the available observational material is to be found.

Finally, the attention of the members of the Commission may be called to the co-operative agreements reached by representatives of the English, French and American organizations at a meeting, held at Harvard in Sept. 1932, immediately after the fourth General Assembly of the Union. At this meeting the feeling was expressed that all such organizations should co-operate to the fullest extent, especially in the matter of using similar sequences of comparison stars, however incomplete they might be, or what methods of observation might be used. Also it was agreed that all sequences should be, in so far as is possible, on a uniform photometric scale, preferably on the Harvard scale, in view of the general use to which this scale has been put.

It would obviously be impossible even to summarize the enormous quantity of observational work performed by professional astronomers as well as by the large Associations of amateurs. Exception may be made of the *Eleventh Report of the V.S.S. of the B.A.A.* by de Roy, and of the important photographic work carried on at the Harvard Observatory, where a systematic search for variable stars is being instituted in selected fields of various galactic latitudes, and where many hundreds of Cepheids in the Magallanic Clouds have been studied. Pettit and Nicholson have continued their remarkable radiometric measurements, which may possibly lead the way, together with systematic spectrographic researches, to the unveiling, sooner or later, of the mystery of stellar variability. In this connection we mention the interesting method of analysing stellar variability, consisting in plotting the logarithm of the radius of the star against the absolute bolometric magnitude (Milne and Getting, *M.N.R.A.S.* **94**, 418, 1934; **95**, 139, 1934).

The great event of the past triennium is undoubtedly the efficient organization of the Russian variable-star observers, who, under the supervision of the Sternberg State Astronomical Institute, have undertaken deliberately to attack the problem of stellar variability on a broad front. In 1928 the Astronomical Society in Gorki (Nijni-Novgorod) founded a journal *Veränderliche Sterne*, intended for the publication of original papers of Soviet astronomers. In 1932 three centres were chosen in charge of the work on RR Lyrae variables (Leningrad University Observatory), long-period Cepheids (Sternberg Institute at Moskva in collaboration with the Tashkent Observatory), Eclipsing Variables (Engelhardt Observatory near Kazan), to which a fourth was added in 1934, when the Pulkovo Observatory was entrusted with the stars of U Gem and Z Cam types. In the course of not quite three years (Jan. 1932–Nov. 1934) these observatories, in collaboration with the astronomical institutes of Simeiz, Moskva and Stalinabad, managed to secure some 100,000 observations of variable stars; ephemerides and catalogues were published and for a great many stars the visual magnitudes of sequences of comparison stars were determined. Special attention has been given to the U Gem and Z Cam types. A co-operation to promote the assiduous study of these interesting stars has been initiated; and the Pulkovo Observatory is ready to provide the photovisual magnitudes of comparison stars.

In Aug. 1934 the Chairman, through the courtesy of the General Secretary of the Union, had a questionnaire circulated to the members of the standing Committee, in order to prepare a programme for the present meeting. About half of them answered more or less amply. It appears—to mention only the more important points—

(a) That the great majority of correspondents wish to stick to the two-letter system of designating variable stars.

(b) That nearly all non-American and several American members prefer Argelander's step method, modified, if need be, so as to bring it into close contact with instrumental photometry. The disadvantages of the fractional method might be reduced by publishing not merely the resulting magnitudes but also the comparison stars used in deriving them (Grouiller; McLaughlin). It is also recommended (Prager) that observers should be invited to use four or more comparison stars instead of two.

(c) That, though the enthusiasm of the various Associations of amateur observers and the skill and devotion of the leaders are highly appreciated, the actual scheme of co-operation is, in the opinion of the majority of correspondents, open to some

criticism, as was to be expected, indeed. It is generally admitted that there is for some long-period variable stars perhaps a surplus of co-operation, whereas, on the other hand, many stars for which co-operation is urgently needed are being neglected. Perhaps the surplus does no harm, but, obviously, the lack of co-operation in numerous cases is more serious. Many stars, viz. RX And, SS Aur, Z Cam, SS Cyg, R CrB, U Gem, SU Tau, are being watched so assiduously by the large bodies of variable-star observers that only a few observable maxima (or minima), if any, have a chance to escape being caught. But the same does not hold for some other stars, easily observable with moderate instruments. Why is it that the interesting star RU Peg, an easy object for the amateur, is constantly neglected, and likewise the members of the RV Tau group, in the first place RV Tau itself, the leader and the most remarkable star of the group?\*

As to the faint members of the U Gem group, viz. CZ Ori, UV Per, SU UMa, TW Vir, etc.—too faint indeed for most amateur observers—here the fault lies with the professional astronomers. Co-operation in this case is, it seems, not easily set into action, but is, for all that, urgently needed. The same holds for quickly—or even abruptly—changing irregular variables as RW Aur, etc.; these stars, the details of whose light-curves must be accurately studied, had better not be included in the programmes of the amateur Associations.

As regards the long-period variable stars, the organization of the co-operative Associations might be improved if the stars were distributed so that each observer would be in charge of fewer stars, and would be made to feel personally responsible for his stars. (McLaughlin.)

Together with the replies to the questions raised in the circulating letter the Chairman obtained a good many suggestions and proposals, to be discussed at the present meeting.

1. Miss Cannon urges that the Commission should discourage the multiplication of series of nomenclatures for new variables and references to these in current discussions of the star. Thus designations as *HV* 1000, *Ross* 300, *SVS* 500 should be avoided.

2. All observations to be recorded in Greenwich (mean) astronomical time, counted from noon to noon. (Hoffmeister.)

3. Ten Bruggencate points to the desirability of simultaneous observations, viz. photometric measurements in monochromatic light, radial velocities, measurements of the intensity of spectral lines, colour-indices, etc.

4. The Central Bureau for Variable Stars in U.S.S.R. (the Sternberg State Astronomical Institute):

(a) proposes a new procedure in searching for variable stars. An exact and thorough study of variable stars in different parts of the sky is of great importance in many aspects of stellar astronomy. To be effective, this study must embrace practically all variable stars of a region within a wide range of magnitudes, say, from  $7^m$  to  $16^m$ – $18^m$ ; furthermore, the area of the region should be determined so as to ensure the completion of a detailed investigation (not a rough classification only) of the stars it contains within a reasonable time. It is evident that the present trend in variable-star discovery is at variance with the conditions formulated in the above paragraph. The Central Bureau for Variable Stars in U.S.S.R. proposes therefore to select 44 areas (24 in the galactic plane, 12 at the latitudes  $\pm 30^\circ$ , 6 at the latitudes  $\pm 60^\circ$  and 2 at the galactic poles), on which should be concentrated the

\* Dr Grouiller informs me that the star has been regularly watched by the French Association for two or three months past.

efforts of the observatories carrying on the search and investigation of variable stars. Since the study must cover as great a range in magnitudes as possible, it is desirable to employ instruments of various power;

(b) recommends a new system of investigation of newly discovered variable stars: several fields in the constellations CMa, Lyr, Mon, Pup and UMa have been selected by the Tashkent and Moskva observatories and *all* variable stars in the fields within the reach of the instruments used have been systematically observed. The comparatively small area occupied by each field (about 300 square degrees) obviates the necessity of the rotation of domes, the turning of instruments, etc. The productivity of the observers increased 2–3 times, as compared with the work involving the search all over the sky;

(c) suggests that observers, in publishing their results in the form of mean light-curves, should mention the formula used in phase-reckoning, its zero-point and the mean epoch of the series of observations used.

5. Dugan suggests:

(a) the observation of short sequences of stars of differing spectral type and colour-index with full aperture, then with successively smaller apertures;

(b) an investigation of the effect of position by setting on a field near the Zenith, making the comparison facing in one direction and another facing in the opposite direction;

(c) the preparation of a list D containing stars that should be avoided as comparison stars, being themselves variable.

6. The question of changes in the light-curves of Cepheids is in an unsatisfactory state and will remain so until intensive and continuous observations of these stars are extended over a period of years. The question might be answered by the inter-agreement of several independent contemporaneous series of visual estimates, but it would be much better if photo-electric observations were available. Photo-electric curves for bright Cepheids so far available show that no changes occur from cycle to cycle, within the errors of observation; but, since such series were obtained within intervals of only a few months, they tell us nothing of slow changes which may require several years to run their course. (McLaughlin.)

7. In view of the great interest manifested in the study, both photometrically and spectroscopically, of the recent Nova in Hercules, it is hoped that all observations of whatever nature be published as promptly as possible. Visual observers should clearly indicate the scale of magnitudes used, in order that all observations may be reduced to a uniform system, whatever system that may be.

A systematic watch of the sky for the discovery of Novae is recommended, the same to be under the auspices of the various national Variable Stars associations.

8. The Harvard members of Commission No. 27 suggest:

(a) that more photometric work with a simple type of photometer be encouraged among both the professional and amateur astronomers;

(b) that a more concentrated effort be made to observe the light variations throughout the light-curves of a selected list of stars, preferably those which are visible throughout the entire year, both far south and far north.

9. McLaughlin recommends a continuous photo-electric study of Be spectrum variables, to be carried on in connection with spectroscopic observations.

10. La Commission No. 27 ne pourrait-elle être compétente pour tant ce qui concerne l'observation photométrique des petites planètes? (Cox.)

11. Le congrès national français d'astronomie des 21, 22 et 23 juillet 1934 a émis deux vœux que voici:

(a) De grosses difficultés se présentent lorsqu'il s'agit de discuter des observations spectroscopiques et photométriques de variables à éclipses. Ces observations ont été souvent effectuées à des époques différentes, et, dans le cas où le système est affecté de perturbations singulières, le défaut de concordance chronologique des deux modes d'observations peut conduire à des contradictions. Il est donc nécessaire d'obtenir une co-ordination dans ces observations et une entente entre les Commissions 27 (étoiles variables) et 30 (vitesses radiales) pour l'organisation d'observations simultanées par des méthodes spectrographiques et photométriques des étoiles à éclipses.

(b) Les observations photométriques d'étoiles variables faites par des méthodes visuelles présentent toujours un grand intérêt pour la comparaison des résultats obtenus à ceux donnés par d'autres récepteurs dans des domaines spectraux différents. Mais les mesures visuelles globales sont affectées de causes d'erreur résultant de la trop grande étendue spectrale du domaine de sensibilité de l'œil. Dans le cas des mesures photométriques ponctuelles ou par la méthode d'Argelander, M. Danjon propose de réduire cette étendue en éliminant les radiations violettes qui sont le plus nuisibles à la précision par l'emploi d'un écran jaune approprié qui serait adopté par tous les observateurs après entente internationale.

Le choix des filtres a été discuté e.a. par MM. Minnaert et van der Bilt (*M.N.R.A.S.* mars 1932), et M. Danjon (*Ann. Obs. Strasbourg* 2, 1, p. 40). Consultez aussi l'Appendice No. 2 (rédigé par M. de Roy) au Rapport de la Commission No. 27 du Congrès de Cambridge (Mass.).

Les membres français des Commissions 25 (photométrie) et 27 (étoiles variables) proposent qu'une entente se fasse sur le choix du filtre à adopter provisoirement dans les observations projetées, en l'occurrence le filtre de verre vert de Schott VG 1, 2 mm., et ils présentent une liste d'étoiles rouges sur lesquelles pourront porter les premières observations visuelles avec filtre.

Ils demandent à la Commission de bien vouloir s'entremettre pour obtenir le plus rapidement possible la détermination des magnitudes avec filtre des étoiles de comparaison relatives à ces variables.

*Liste d'étoiles variables proposées pour les observations visuelles avec le filtre de verre vert de Schott VG 1, 2 mm.*

Désignation	Max. m	Min. m	Pér. j	Spectre
o Ceti	2.0	10.4	329.50	M5e
U Monocerotis	5.6	7.3	92.26	G9v
R Leonis	5.0	10.5	314.80	M7e
R Hydrae	3.5	10.1	417.10	M7e
R Scuti	4.5	9.0	142.90	K5ev
T Cephei	5.2	10.8	395.90	M6e

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