

27. COMMISSION DES ETOILES VARIABLES

PRÉSIDENT: M. B. V. Kukarkin, Sternberg State Astronomical Institute, Moscow, U.S.S.R.

MEMBRES: MM. Ashbrook, Banachiewicz †, Banerji, Bertaud, Blazhko †, Bochniček, Brun, Mlle Canavaglia, MM. de Kock, Detre, Efremov, Eggen, Gadomski, Gaposchkin, Hacar, Mlle Harwood, MM. Hertzsprung, Heyden, Hoffmeister, Hogg, Huffer, Huruhata, Irwin, Istchenko, Joy, Kholopov, Kopal, Kordylewski, Kron, Kulikovskiy, Lacchini, Lindley, Martynov, Mme Walton Mayall, MM. P. W. Merrill, W. J. Miller, Nielsen, O'Connell, Oosterhoff, Opolski, Parenago, Mme Pels-Kluyver, MM. Peltier, Piotrowski, Plaut, Rosino, Savedoff, Mme Sawyer Hogg, MM. Schneller, H. Shapley, Mme Shapley, MM. Solov'yev, Steavenson, Stebbins, Mlle Szafraniec, MM. Szeliowski, Tecza, Tempesti, Tsevevich, Vandekerkhove, van Hoof, Wachmann, Walraven, Wesselink.

27a. SOUS-COMMISSION POUR LA CO-ORDINATION DES RECHERCHES GALACTIQUES

MEMBRES: MM. Baade, Blaauw, Kukarkin, Oosterhoff.

[The activity of Sub-commission 27a, organized at the Groningen meeting of June 1953, did not proceed further than an interchange of letters between its members. Dr Baade neither answered the offer to act as President of the sub-commission, nor the subsequent letters that were addressed to him. Consequently, no separate report of the work done in the field of the above sub-commission was prepared. Studies and recommendations in the domain of the sub-commission are mentioned in the report of Commission 27.]

INTRODUCTION

On 17 November 1954 one of the oldest members of the commission died, namely Prof. T. Banachiewicz, the Director of the Astronomical Observatory of Krakov University. Prof. Banachiewicz was actively participating in the work of the commission and maintained a close contact with its president up to his last days.

The domain of variable star studies is extremely vast. Almost a quarter of all the studies in the field of astronomy is directly or indirectly connected with the problem of stellar variability. A complete report on the studies in the domain of variable stars for the period of 1952–54 would require more than 200 pages. As a consequence of the establishment of Commission 42 (eclipsing binary systems) and of sub-commissions for the spectra of novae and variable stars, many important questions were isolated from the field embraced by Commission 27, but it is not possible to avoid altogether mention of studies now related to the domains of the commission and sub-commissions mentioned above.

In the period of time after the Rome Assembly efforts to maintain active relations with the members of the commission were made. Many letters and two memoranda were prepared and distributed, which were answered by almost all the members of the commission. It is impossible to give a detailed report of these answers.

In preparing the present report it was, accordingly, obvious that the selection of data both in respect to published and unpublished papers, as well as letters, should be approached from a subjective standpoint. Expressing his extreme gratitude to all his correspondents, both to the members of Commission 27 and to those engaged in studies carried out in adjacent fields of astronomy, the author regrets that no personal credits could be given or detailed mention made of all data essential to his correspondents. In any case an attentive and detailed analysis of the numerous letters made it possible to understand the cause of some of the deficiencies in our work and to make definite recommendations in respect to a number of questions.

MEMORANDA

Proceeding from the desire for, and recognizing the undoubted benefit of, personal contact with the members of Commission 27 and fully realizing the importance of information on the state of studies and planned future work in the field of variable star studies, the following memorandum was distributed to all members of the commission on 31 December 1952.

The most important aim of Commission 27 (variable stars), as, of course, of any other commission of the International Astronomical Union, is evidently the problem of co-ordination of work carried out by investigators throughout the world and of planning the future work on the basis of such co-ordination.

Proceeding from such an obvious statement, I should like to place before you several questions. A detailed answer to these questions will help me to prepare a second memorandum to all members of Commission 27 and other active variable star investigators who are not members of the commission. The second memorandum will contain an analysis of the data received and recommendations concerning the planning and co-ordination of variable star studies for the next 6–8 years.

My questions are the following:

1. What problems in the field of variable star studies do you personally, or your staff, intend to investigate in the course of the next 6–8 years?
2. What aims do you follow in your current studies, or studies that you intend to undertake?
3. What new instruments or devices do you intend to apply in the course of the above-mentioned period of time for variable star studies and for the solution of some adjacent problems?
4. What new instruments or devices should you think desirable to design and build within the next few years to solve specific problems connected with variable star studies?
5. What theoretical studies do you intend to plan for the future?
6. What theoretical problems should you think desirable to be undertaken at some other institutions?
7. What reference books, tables, or atlases should you think desirable to prepare and publish in order to simplify variable star studies? Which of them could be prepared and published by you and which of them should you recommend to be prepared and published by others (to whom personally)?
8. What are your suggestions to improve the form and contents of the *General Catalogue of Variable Stars* and its Supplements?
9. Whom, from among the actively working variable star investigators not being members of the I.A.U. Commission 27, could you recommend to take part in the activity of the commission?

I hope to receive an answer to this letter not later than 1 March 1953. Early answers will permit use of the spring for additional inquiries and exchange of letters, which will inevitably be necessary to reach better understanding and to define recommendations. I hope to analyse the data received in the course of spring and summer of 1953 and to distribute in autumn definite suggestions concerning the planning and co-ordination of work in the field of variable star investigations.

More than half of the members of Commission 27 have sent me their answers to the above memorandum in the course of 1953. Several answers were received in 1954. All the answers were utilized by me for the preparation of the subsequent memorandum of 26 August 1954. The second memorandum was aimed at analysing the state of variable star studies on the basis of a summary of all the published variable star investigations and the answers to the first memorandum. The second memorandum was distributed not only to members of the commission, but also to some other astronomers, who carried out work in adjacent fields of astronomy, or to those who direct institutions taking an active part in variable star observations. Actual data and recommendations, contained

in the answers to the first memorandum, found their reflection in the further text of the report.

An analysis of numerous answers to my memorandum distributed on 31 December 1952 and the successive correspondence permitted me to realize more or less fully the present state of variable star studies in the whole world.

The answers dealt in the majority of cases only with some particular questions of interest to my correspondents, totally ignoring the general problems and the chief purposes of variable star studies. Only two or three answers contained valuable general considerations and suggestions concerning a co-ordination of various activities of variable star investigators of the whole world.

In the course of the past ten years we observed a removal of a number of particular topics from Commission 27. Commission 42 (eclipsing binaries) was created in 1948. A sub-commission of Commission 29—variable star spectra—was organized at the same time (still earlier a sub-commission on spectra of Novae had been organized). A sub-commission for the study of the structure of the Galaxy on the basis of variable star studies was organized in 1953. Thus all these questions were in a quite apparent way removed from the field embraced by Commission 27.

What should be at present the activity of Commission 27? This commission must be the main headquarters of all the work in the domain of variable star studies and maintain a close contact with the isolated commissions and sub-commissions.

It is evident that Commission 27 does not accomplish as yet its chief purpose—a co-ordination of all variable star studies. The publication of extremely heterogeneous reports previous to International Assemblies may hardly be considered as a co-ordination of work. It is sufficient to examine the reports since 1922 to see that the attention of the members of Commission 27 has been concentrated on particular technological questions of no principal significance.

What is the reason that commissions of the I.A.U. are often unable to manage their apparent tasks?

This fact may be referred to two main causes belonging to totally different categories.

1. In order to advance some problems in a proper way and to solve them correctly, it is necessary to formulate clearly the main and particular aims that are pursued. The majority of variable star investigators follow some particular aim, but as is seen from experience, all these aims are of a chance character and are not connected with the general purposes facing modern astronomy. Observations of variable stars, being obtained for the sake of observations only, or out of a sporting interest, cannot, naturally, represent either the general or the particular aims of an investigation. The absence of such a general aim, as also of some concrete aims subordinated to this purpose, exclude the possibility of a real co-ordination of studies.

2. The possibility of accomplishment of some kind depends upon economic conditions. We often witness that the best wishes of astronomers remain but wishes, or are carried out only partially. It is sufficient to remember the history of the international enterprise *Carte du Ciel*, the execution of which has already been in progress for over 70 years, in order to see how difficult is an international planning of work. Financial difficulties sometimes create an unsound attitude in investigators and managers of institutions towards questions of planning, as well as towards the utilization of the collected data.

Is it possible to eliminate or to decrease the influence of these causes and to establish a real co-ordination of scientific studies, for instance, in the field of variable star investigations? I believe that this is quite possible and reasonable.

1. The chief aim of science is the knowledge of the laws of the development of nature and society and the use of these laws for the welfare of mankind. The purpose of astronomy is the study of the laws of origin and evolution of cosmic bodies in general and of the Sun and the Earth in particular. The importance of the knowledge of these laws for mankind is quite evident. Concrete purposes that are pursued in solving the particular problems of astronomy must be subordinated to that general aim.

Variable stars are objects which deserve especial attention. Variable stars (some types of

them, at least) represent a turning stage of stellar evolution in general. Consequently, the study of variable stars of such types must help to reveal and study the origin and evolution of stars and stellar systems. On the other hand, variable stars are easily detectable. Numerous types of variables possess a definite luminosity, closely connected with morphological characteristics, the detection of which is also simple. This important circumstance permits us to study the laws of their distribution in space, to compare them with their kinematics and dynamics and to come in this way to definite conclusions about the structure and evolution of galaxies and their parts. A study of the data concerning variable stars, combined with data on other objects (various types of stars, dust, gas, and so on), inevitably leads to the discovery of new dependences and to the discovery of the laws of the origin of cosmic bodies and their systems.

Therefore, the chief aim of the study of variable stars lies in the solution of the problem of the origin of stars and stellar systems. All the particular aims for which variable stars of various types, and individual 'interesting' variables, are studied must be subordinated to this main aim. Only then the question concerning a real co-ordination of the work might be advanced in its full scale. This problem is simplified by the fact that in recent times a number of institutions and individual variable star investigators are partly consciously, partly spontaneously subordinating their work to this most important problem of modern astronomy.

2. Every true scientist is interested in the knowledge of the objective laws of nature, independent of the political, social and economic system of the government he is living under. The possibility of and necessity for scientific co-operation of the scientists of the whole world is based upon this chief idea. It is quite evident, that in planning his work in co-ordination with the work of scientists of other institutions and other countries it is possible to study the laws of nature more profoundly than in working alone. Thus, when planning and co-ordinating his particular work, every director, every scientist should clearly and coolly estimate the possibilities, taking into account the financial side of the question and the conditions which might affect the accomplishment of the planned work. When the approach to the questions of planning and co-ordination is sound and a strong desire to co-operate is felt, based on mutual respect and confidence and a serious attitude towards the obligations taken upon oneself (sometimes even unprofitable from the point of view of personal interest), then the difficulties connected with financial conditions might be considerably lessened.

From the point of view of the general state of variable star studies, the following most important problems in the domain of their studies for the nearest future might be formulated as follows:

1. Work on sky patrol in the northern hemisphere might be co-ordinated more precisely. It should be recommended to observatories like Harvard, Sonneberg, Moscow, Odessa and Stalinabad to strengthen their co-operation. A co-ordination of these observatories, organized in a proper way, will permit study of any star brighter than 12^m in its maximum brightness. These, together with observatories which are photographing selected areas of the sky by means of short-focus cameras, could cover any problem, connected with the sky patrol (a determination of the epochs of maxima of the Mira Ceti type stars, of the light curves of Novae, and of continuous curves of irregular variables, and so on). In the case of 'difficult' stars such co-operation will always produce splendid results.

2. It is quite obvious that ways should be found to continue sky patrol in the southern hemisphere.

3. Studies of the faint variable stars in selected areas are of especial importance for the solution of questions concerning the structure of the Galaxy. Similar work is being carried out at the Harvard College Observatory and at Sonneberg, Leiden, Castel Gandolfo, Moscow, and Mount Wilson and Palomar Observatories. This work must be well co-ordinated with considerable aid from Commission 33.

4. Individual variable star studies in globular stellar clusters and other galaxies, carried out by the David Dunlap, Bologna-Asiago, Mount Wilson and Palomar, Budapest, Cordoba, Pretoria and Harvard College Observatories must be closely co-ordinated. A comparison of the morphological features of variable stars of different systems with peculiarities of these stellar systems promises to give a direct answer to the question concerning the laws of evolution of stellar systems.

5. A close co-ordination of the working plans of the observatories engaged in spectral studies of variable stars is highly desirable. Of especial importance is a joint study of the spectral and photometric variations of stars of new sequences (RW Aurigae, UV Ceti stars and so on). In this case a close connexion with the corresponding sub-commission of Commission 29 of the I.A.U. is required. A lag in our knowledge about the spectra and radial velocities of variable stars of the southern hemisphere (especially of the cepheids and Mira Ceti type stars) must be eliminated. In this case special attention should be paid to the work of the southern station of the Harvard Observatory, as also to that of the Pretoria, Cordoba, and La Plata Observatories, which should be properly co-ordinated.

6. Observers using photo-electric photometers should pay attention to the fact that not only the eclipsing variable stars, but also the physical variables of all types, are good objects for systematic and continuous observations. There is no doubt that precise photo-electric light curves of the physical variables of various types for time intervals of sufficient duration will lead to a discovery of new dependences, new principles of classification, bearing cosmogonical significance. The same relates also to photo-electric colorimetry.

7. A study of the kinematics of variable stars is also of a primary cosmogonical importance. Besides the radial velocities, the kinematics should also be studied by way of a determination of proper motions. This is, on the one hand, required to determine the absolute magnitudes of a number of objects. On the other hand, the determination of proper motions is, for the present, the *only* way to study the kinematics of some objects (Novae, for instance). And finally, the study of spatial velocities has some advantages in comparison with the study of individual components of motion. If the presence of photographs for astrographical catalogues and of other photographs obtained by means of long-focus astrographs are taken into account, it will become clear that there are unlimited possibilities in this field. A close co-ordination of work with that of Commission 33 is much needed.

8. The programme of work carried out by the Associations of variable star observers should also be checked. It is necessary for the American Association to provide observations of all the bright Mira Ceti, U Geminorum and Z Camelopardalis type stars and to supplement its programme systematically in connexion with each new discovery of a sufficiently bright star of the above-mentioned types. Permanent and well-skilled observers of other Associations should be used not only for observations of individual Mira Ceti stars, which are usually provided by the observations carried out by the American Association, but for the study of more complicated cases of stellar variability.

I hope that the contents of the present memorandum will serve as a basis for future correspondence and for a detailed discussion at the meeting of Commission 27 in Dublin.

Please direct to me your considerations concerning the above-mentioned questions, as also suggestions which you should like to discuss at the meetings of Commission 27.

More than three-quarters of the members of Commission 27 and a number of astronomers working in adjacent fields of astronomy answered the second memorandum. Essential answers continued to arrive during the preparation of this report, which hampered greatly its completion and caused delay. It was decided not to take into account all the letters that were received after 25 December 1954.

The majority of correspondents have agreed with the principles stated in the second memorandum. Only two correspondents did not agree with the main idea of the memorandum concerning the organizing role to be played by the commission in the co-ordination and planning of scientific studies. Further correspondence showed that the differences in opinions are of no principal character.

Answers to the second memorandum were also extensively used in the preparation of the present report and of problems recommended for discussion at the meetings of Commission 27 in Dublin.

CATALOGUES, EPHEMERIS, REFERENCE BOOKS

The staff of the Sternberg State Astronomical Institute, together with the scientific workers of the Astronomical Council of the Academy of Sciences of the U.S.S.R. at Moscow, prepared and published the fourth, fifth and sixth supplements to the *General Catalogue of Variable Stars* (1st ed. 1948). These supplements contain information about 105, 70 and 285 newly named variable stars and data about 613, 324 and 343 variable stars named earlier and defined more exactly. The seventh supplement is in preparation. It will contain information about 261 newly named variable stars and exact informations about 358 variable stars which were named earlier. The extensive work of preparation for the second edition of the *General Catalogue of Variable Stars* has been started. This catalogue will contain revised data about 14,000 variable stars. It will consist of 800 pages, auxiliary tables included. Recommendations and suggestions about the form of the new edition of the catalogue are among the problems recommended for discussion at the meetings of Commission 27 in Dublin.

An important event of the reported period was the issue of the third volume of *Geschichte und Literatur der veränderlichen Sterne* prepared by H. Schneller (Potsdam). This volume was issued before the Rome Assembly of 1952, but was not mentioned either in the preceding report of the President of Commission 27, or the proceedings of the meeting of Commission 27. Vol. III contains references of all the data published since 1916 up to 1950 for all the variable stars from Orion to Vulpecula, discovered and named up to 1930. H. Schneller is preparing now an additional volume, which will contain the history and references for all the stars, contained in the published three volumes and in the volume published by R. Prager (1) in 1941. Thus all the stars named up to 1938 will be supplied with a history and complete references up to 1954. This additional volume will be ready for print during the first quarter of 1955. Suggestions by H. Schneller concerning future work are mentioned in recommendations to be discussed at the meetings of Commission 27 in Dublin.

Cracow University Observatory published, as before, annual ephemerides of eclipsing variables.

F. B. Wood (2) published in 1953 'A Finding List for Observers of Eclipsing Variables'.

The extremely valuable catalogue and bibliography of emission-line stars of spectral types later than B were prepared and published by W. P. Bidelman (*Ap. J. Suppl.* no. 7, 1954).

The issue of special magazines and circulars in the domain of variable star investigations was continued. The Academy of Sciences of U.S.S.R. published twelve numbers of the bulletin *Variable Stars*, with a total of 1000 pages. The American Association of Variable Star Observers publishes regularly observations of stars. Observations obtained by the members of the variable star section of the New Zealand Astronomical Society are also being published regularly. The *Bulletin de l'Association Française des Observateurs d'Etoiles Variables* is published less regularly.

Valuable data and maps of the surroundings of variable stars are published by M. Petit in the *Documentation des Observateurs* (Institut d'Astrophysique de Paris), containing information about variable stars in the form of references.

PHOTOGRAPHIC OBSERVATIONS

Photographic observations of variable stars and the methods used for the discovery of new variables by means of a comparison of two photographs of the same region of the sky taken at two different times, will remain the fundamental method of survey and the initial investigation of variable stars. Mass variable star studies, of extreme importance in the solution of problems of the composition of stellar systems, will, evidently, be based for a long time chiefly upon the simple method of photographic observations.

One of the most important events of recent years is the completion of publication of the results of a survey of variable stars brighter than 10^m on the plates of the collection

of the Harvard College Observatory (the so-called Milton Bureau programme). Mrs C. H. Payne Gaposchkin and S. Gaposchkin⁽³⁾ completed and published the results of an investigation of about 1500 stars carried out on the basis of more than a million magnitude estimates. This work is an important contribution to the study of variable stars. But owing to limitations of time and money, a survey of the stars brighter than 10^m suspected of variability was regrettably not produced simultaneously with it, although it was part of the original plan. Investigation of stars suspected of variability would be an immense contribution to our knowledge about bright variable stars.

Simultaneously with the issue of the just-mentioned studies, S. Gaposchkin⁽⁴⁾ prepared a paper containing detailed informations about 285 eclipsing variables.

As is well known, the 'sky patrol' of the Harvard College Observatory secured continuously over 70 years' data for the whole sky. Sky patrols organized in the course of the last thirty years at the Sonneberg (German People's Republic), Stalinabad and Odessa (U.S.S.R.) observatories, and numerous photographs obtained by observatories of the northern hemisphere for different areas, are, to a certain degree, reducing the damage that was caused to variable star studies by the curtailment of the 'sky patrol' of the Harvard College Observatory. The state of affairs in respect to the southern sky calls for increased co-operation. As soon as the work carried out by the southern station of the Harvard College Observatory at Bloemfontein was curtailed and reorganized, the southern sky (to the south of -30°) was far less completely covered than formerly.

Active investigations of faint variable stars in selected areas on plates obtained at different observatories by means of powerful instruments are continued. In this respect should be mentioned observatories at Sonneberg (C. Hoffmeister, P. Ahnert and others), in Leiden (P. Th. Oosterhoff and his staff), in Moscow (the staff of the Sternberg State Astronomical Institute) and also the Harvard College Observatory (group of workers headed by H. Shapley). Investigations of hundreds of variable stars carried out at these observatories were published both in the publications of the observatories and other astronomical periodicals. An extensive study of 600 variable stars in Scutum in the vicinity of the bright cloud of the Milky Way was carried out by Miss M. Harwood (Maria Mitchell Observatory, U.S.A.) Twenty or thirty faint variable stars were investigated at the Castel Gandolfo Observatory (Rev. W. J. Miller). About thirty faint variable stars were observed photographically at Oklahoma (B. S. Whitney). The Rev. W. J. Miller proposed to photograph at Castel Gandolfo since 1955 faint variable stars with the new Schmidt telescope (25–38 in.). A vast amount of data is available at the Bergedorf Observatory (A. Wachmann). Investigations of individual variable stars were carried out at a number of observatories in different parts of the world.

As is known, extensive data with respect to several hundreds of selected areas were obtained in the programme of 'variable star fields' of Harvard College Observatory, embracing a wide region of the Milky Way and reaching into high galactic latitudes, but only a very insignificant part of the data have been reduced. It is most desirable that these studies be continued.

The great importance of investigations of extremely faint variable stars in small selected areas of the sky in the direction towards the centre of the Galaxy, as also in other important directions, is beyond doubt. Investigations of that kind were started by W. Baade at the Mount Wilson and Palomar Observatories. Plates were obtained with the 74-inch Radcliffe reflector of two regions in Sagittarius for an investigation of faint RR Lyrae type variables. Measurements will be started at the Leiden Observatory. It is desirable that observatories of the southern hemisphere should also take part in that work, as well as some observatories of the northern hemisphere possessing the required instruments. In particular, according to their main idea the studies of Prof. H. Shapley of the 'windows' in the plane of the Milky Way belong to that programme.

Of great interest are the studies of variable stars in the Magellanic clouds (H. Shapley and his collaborators at the Harvard College Observatory, A. Thackeray and A. J. Wesselink at the Radcliffe Observatory, Pretoria) and of those in the nearest spiral galaxies (W. Baade, Mount Wilson and Palomar Observatories).

F. Zwicky proposed to organize a search of five years duration for supernovae in about one thousand of the nearest galaxies. This work is to be carried out by the Lick, Lowell, Steward and Palomar Observatories, with possible participation of the Bern Observatory.

Another important problem is the study of variable stars in globular clusters. During recent years numerous observations of variable stars in globular clusters were carried out by Mrs H. B. Sawyer Hogg at the David Dunlap Observatory in Toronto, Canada, and L. Rosino at the observatories of Italy. Variable star studies in a number of globular clusters were started by L. Detre at the Budapest Observatory, Chang Yu-Che at the Nanking Observatory and L. Perek at the observatory in Brno. Mrs H. B. Sawyer Hogg is completing the important second issue of the Catalogue of variable stars in globular clusters. It will contain data for 1421 variable stars in globular clusters, for 41 stars which have not yet been published and for 48 stars suspected of variability.

It is quite evident that comparison of the peculiarities of variable stars contained in various stellar systems with the stars in globular clusters will give valuable data for the solution of the most important fundamental problems of stellar astronomy.

Astronomers of the Stalinabad Observatory (Tadjik S.S.R.) started a systematic survey of all the unstudied variables brighter than 12^m , using the numerous plates of the sky patrol for this purpose (5). An extensive study of bright variable stars from photographs of the sky patrol is carried out by the workers of the Sonneberg Observatory (6). Plates obtained by the sky patrols at the Sonneberg, Stalinabad and Odessa Observatories are systematically used for a determination of the epochs of maxima of the Mira Ceti type stars.

A large contribution to the study of variable stars is the basic investigation of stars in the region of the Orion nebula carried out by P. P. Parenago (7). This investigation is based upon the data of many observatories of the U.S.S.R. It contains, besides other data, observations of all the variable stars in photographic and visual light in a region of the sky of 9 square degrees with the Orion nebula in its centre.

As initiated by L. Perek (Brno), photographs of areas along the galactic meridians for longitudes of 57° , 147° , 237° and 327° are obtained at a number of observatories of Czechoslovakia.

F. J. Heyden (Georgetown College Observatory, U.S.A.) has been carrying out since 1947 a systematic photography in blue and red light of ten fields in the Milky Way rich in cepheids.

At the Abastumani Observatory (Georgian S.S.R.) I. Alania determines colour indices of a number of RR Lyrae type stars with the purpose of a study of cosmical light absorption.

An extremely valuable continuous series of photographic observations of a number of RR Lyrae type stars was obtained and is being continued at the Budapest Observatory (L. Detre and staff). On the basis of these observations many papers devoted to the study of the Blazhko-effect (periodic changes of the light curve) were published.

W. Baade started photography of some regions by means of the 48-inch Schmidt telescope of the Mount Palomar Observatory to study the galactic 'halo'. The investigation of the plates obtained will be carried out jointly with the Kapteyn Laboratory at Groningen (L. Plaut).

Sixteen selected areas are systematically photographed by S. Kaho at the Tokyo Observatory station with the purpose of investigating the variable stars.

VISUAL OBSERVATIONS

Direct visual estimates of brightness of variable stars in respect to comparison stars, especially popular among the numerous amateur astronomers, have not lost and will for a long time not lose their significance. Although the apparent parallelism existing

in the programmes of observations of the majority of amateur associations leaves a certain sense of dissatisfaction, it seems that there are no grounds to be frightened, as it depends upon ourselves to make these programmes most useful.

The work of the American Association of Variable Star Observers continues to be most active (recorder—Mrs M. W. Mayall). Observations of at least 400 Mira Ceti type stars, over 40 Novae and nova-like variables, of about 200 irregular and semi-regular and about 100 variable stars of other types are carried out by the members of the Association. It would be rather desirable to extend the programme of work of that Association on account of all the newly discovered bright Mira Ceti type stars to which no attention has been paid for many years. Mrs Mayall is completing the compilation of a list of maxima and minima of about 400 variable stars from 1921 to 1949, initiated by the late L. Campbell. A list of maxima and minima for the years 1949–54 will be prepared later. It would be desirable to publish the epochs of maxima and minima more systematically, as it was done formerly by Campbell in the *Harvard College Observatory Circulars*. One cannot refrain from expressing regret that in the course of the period under report the American Association was separated from the Harvard College Observatory, where it flourished during more than forty years of its existence.

L'Association Française des Observateurs d'Étoiles Variables restored its activity, but its work (both observations and their publication) evidently requires help and support. The programme of observations of that association needs revision.

The Variable Star Section of the British Astronomical Association was not active at all. Attempts by the President of Commission 27 to start systematic correspondence with any of its leaders were unsuccessful. There exist, however, extremely important problems for amateur variable star observers which are not included in the programmes of the existing societies and associations.

The Nordisk Astronomisk Selskab continued its activity in the domain of variable star studies as formerly. The programme of that organization (directed by A. V. Nielsen) is extremely original and overlaps to a very small extent the work of other amateur organizations.

Extremely active is the Variable Star Section of the New Zealand Astronomical Society (directed by F. M. Bateson). Magnificent observations of more than 200 variable stars are published systematically by that section. A more detailed co-ordination of its programme with that of the American Association is most desirable.

W. H. Steavenson (Cambridge, England) continues his series of observations of the old Novae.

R. P. de Kock (Cape Town) communicated that during the three recent years, which elapsed before 30 June 1954, the members of the variable star section of the Astronomical Society of South Africa obtained 30,500 visual observations, which they directed to the American Association of Variable Star Observers (A.A.V.S.O.).

There are also groups of amateur observers of variable stars in Japan and in Italy.

A. A. Batyrev and his collaborators (Rostov, U.S.S.R.) carry out systematically visual observations of about 50 RR Lyrae type stars.

V. P. Tsesevich (Odessa, U.S.S.R.) finished and partially published the results of the reduction of 40,000 observations of 250 eclipsing variable stars.

PHOTO-ELECTRIC OBSERVATIONS

The objectivity and precision of photo-electric observations are the advantages over photographic and visual photometry. If this method is correctly applied, photo-electric observations yield the characteristics of variable stars with a precision which is one or two orders of magnitude greater than that for the ordinary photographic or visual estimates of brightness. Attention of the observers was, up to the present time, almost exclusively concentrated upon eclipsing variables which gave a number of valuable results. But it is quite clear how important and necessary it is to embrace with systematic photo-electric observations a greater number of variable stars of different types.

An analysis of the results of photo-electric observations of the physical (intrinsic) variable stars is the best proof of the necessity for an extensive development of such observations.

Observations carried out by Th. Walraven and A. B. Muller in Leiden and Johannesburg made it possible to draw important conclusions with respect to the nature of the Blazhko effect (periodic variations of the light curves of the RR Lyrae type stars). O. Eggen's⁽⁸⁾ study devoted to an investigation of the light curves of thirty-two long-period cepheids led to a discovery of an essential morphological inhomogeneity in stars of that type. This discovery was confirmed by the unpublished observations of fifteen long-period cepheids carried out at the Lick and Mount Stromlo Observatories.

Interesting results were obtained by a number of authors working on some flare stars (type UV Ceti).

M. Huruwata (Tokyo, Japan) intends to observe not only eclipsing variables, but other types of variable stars, as well.

F. Lenouvel obtained recently most interesting results on the intrinsic variable AE Aquarii.

Extremely important data were some time ago obtained by M. F. Walker, with respect to β Canis Majoris type stars.

Valuable results were obtained by J. Stebbins and G. E. Kron on the six-colour photometry of β Cephei (*Aph. J.* **120**, 189, 1954).

About ten thousand photo-electric observations of RR Lyrae variables were obtained by L. Detre and his collaborators in Budapest.

J. B. Irwin (Bloomington, U.S.A.) made valuable suggestions according to photo-electric photometry and colorimetry of variable stars. He proposed to obtain the magnitudes and colours of several southern Cepheids at the Cape Royal and the Pretoria Observatories.

Quite recently M. F. Walker⁽⁹⁾ made his remarkable discovery proving that the classical Nova DQ Herculis is a close binary with a period of orbital rotation of $4^h 39^m$. I believe that this discovery is much more essential to understanding the nature of Novae than any of the preceding photometric and spectral investigations.

Owing to photo-electric observations only it was possible to establish a new type of stellar variability—similar to that of α_2 Canum Venaticorum.

It is thus quite obvious that the observers do not clearly realize the importance of systematic photo-electric observations of the physical (intrinsic) variable stars.

SPECTRAL INVESTIGATIONS

Studies of the spectra of variable stars are embraced by the field of a special sub-commission of Commission 29 (on Stellar Spectra). But I believe it quite impossible not to mention here some studies carried out in that field. Attention should be paid in the first place to such investigations which are a convincing example of the necessity of a complex study of variable stars, applying therein all the existing modern methods of investigation.

Numerous observations of stars with bright $H\alpha$ hydrogen lines, carried out by G. H. Herbig⁽¹⁰⁾ at the Lick Observatory and G. Haro with his staff at the Tonantzintla Observatory, produced a number of interesting results. These stars are connected with dark and bright nebulae. They are, as a rule, variable stars of the RW Aurigae type. Thus, the variability of numerous Haro objects in the Orion nebula was confirmed by investigations carried out by P. P. Parenago. The same must also be said with respect to Herbig's objects in NGC 2264, the variability of which was in many instances confirmed by T. A. Uranova (Moscow) and W. Wenzel (Sonneberg).

Extremely important investigations of the spectra of the Mira Ceti type stars were continued by P. Merrill (a number of his papers are published in the *Astrophysical Journal*) and A. Joy⁽¹¹⁾. The discovery of technetium in the spectra of some Mira type variables is of cosmological interest (P. Merrill, *Aph. J.* **116**, 21, 1952).

Prof. O. Struve, R. M. Petrie and many other variable star investigators continued their detailed investigations of the β Canis Major type stars.

Detailed studies of the variation of line intensities in the spectrum of RR Lyrae accompanied by a thorough comparison of these variations with the photometric picture of the change of brightness of RR Lyrae, were carried out by Mrs H. A. Pels-Kluyver⁽¹²⁾.

Interesting studies of the spectra of cepheids were carried out by R. Sanford, and his results have appeared in the *Astrophysical Journal*.

A. Joy⁽¹³⁾ discovered that the explosive variable AE Aquarii is a spectroscopic binary. This discovery is of decisive importance in understanding the nature of variable stars of that type.

A survey of infra-red spectra of stars aimed at discovery and investigation of the distribution of low-temperature stars in the Galaxy was carried out by J. J. Nassau and his staff. First attempts to compare the obtained data with the characteristics of stellar variability permitted him to arrive at some extremely interesting conclusions about a significant increase of the fraction of variable stars from early M type classes to the late ones. Only a small fraction of the stars earlier than M 4.5 corresponds to a range exceeding $0^m.4$. The percentage of variable stars rapidly increases when passing to the later classes, reaching 80% or even more in the case of the latest types. An investigation of a number of relations of red variable stars in the region of the Milky Way which is located in the interval between $l = 333^\circ$ and $l = 201^\circ$ (passing through zero) is being planned.

An investigation of the spectra of variable stars of spectral type S were made by P. C. Keenan (*Ap. J.* **120**, 484, 1954).

An interesting and promising investigation of the peculiarities of the spectra of RR Lyrae type stars was carried out by W. Iwanowska⁽¹⁴⁾ in Torun. She discovered certain morphological differences between these stars depending upon whether they belong to flat or spherical components of our Galaxy.

A. Joy is making valuable studies of the spectra of long-period cepheids with periods from 1.0 to 1.5 and from 10 to 25 days from the point of view of the peculiarities which depend upon the population to which they belong.

Interesting studies of the spectrum of γ Cas were conducted by E. Vandekerkhove (Uccle) and V. G. Gorbazky (Leningrad).

THEORETICAL INTERPRETATION OF OBSERVATIONS AND STATISTICAL STUDIES

This part of the report is of a rather formal and artificial character. Every observer makes efforts to give some theoretical explanation of the results he obtains and to compare them with our present knowledge. Some studies are but of a summarizing character and are based not only upon the proper observations of the author, but also on the attempts either to construct a theory according to suggestions made *a priori* (but not proved physically) or on the basis of an analysis of a number of facts and objects.

The majority of specialists share now the opinion of W. Baade on the necessity of changing the zero-point of the 'period-luminosity' relation of long-period cepheids by $-1^m.5$, or even $-2^m.0$ as compared with the usual zero-point according to H. Shapley. This question cannot, however, be solved so easily. W. Baade, has only proved that the cepheids contained in the flat component of our Galaxy (and possibly also in other galaxies) are at least $1^m.5$ brighter than the cepheids of the same period of the spherical component. The fact that the morphological features of long-period cepheids and of the RR Lyrae type stars are not identical and differ from one stellar system to another, or when comparing one component of a complex stellar system with another, speaks in favour of the fact that the zero-point of the 'period-luminosity' relation is not unique, and that there exist a great number of zero-points, depending on the origin of the cepheids in question⁽¹⁵⁾.

Studies carried out by A. Blaauw⁽¹⁶⁾ and A. Filin⁽¹⁷⁾ cannot, in spite of the precision with which they were executed, serve as a proof that W. Baade is right. A slight change of the parameters (for instance of the apex, precession constant and, particularly, of

solar rotation) can cause a very appreciable change of the results. The six-colour photometry of Cep and Aql serves also, possibly, in favour of Baade's conclusion (J. Stebbins, *P.A.S.P.* **65**, 118, 1953). However, the very accurate determinations of proper motions of some RR Lyrae stars by Mrs Dr E. D. Pavlovskaya gave the new value of absolute magnitude $+0^m.5$ (*Variable Stars*, **9**, 233, 1953 and **9**, 349, 1954).

Detailed investigation of a number of relations observed in respect to cepheids was carried out by P. P. Parenago⁽¹⁸⁾. He came to the following conclusions: the zero-point of the long-period cepheids of the flat component of our Galaxy should be changed by $-0^m.5$, and by $+0^m.6$ in the case of short-period cepheids contained in the spherical component (in relation to the zero-point obtained by B. Kukarkin in 1949).

Interesting studies of the theory of cepheid pulsation were carried out by S. A. Zhevakin⁽¹⁹⁾ and Franck-Kamenezky⁽²⁰⁾.

The asymmetry of the velocity curves of cepheids was studied by T. Dagmara (*Publ. Astr. Soc. Japan*, **3**, 74, 1951). The curve of growth of δ Cep was studied by Z. Hitotuyanagi and H. Inaba, who found the existence of micro-turbulence in its atmosphere (*Sc. Rep. of Tohoku Univ.* **1**, **36**, 321, 1952).

Important problems connected with variable stars for studies of the structure of the Galaxy were the object of a special symposium in Groningen in June 1953⁽²¹⁾.

Numerous theoretical studies, connected with the nature of novae, explosive stars, cepheids, Mira Ceti type stars, irregular and semi-regular variable stars were discussed at the cosmogonical conference, devoted to non-stable stars, held in Moscow in October 1954⁽²²⁾.

A number of important studies on the behaviour of the atmospheres of cepheids and of their continuous spectrum were carried out in Paris by Miss R. Canavaggia and R. Pecker and published in *Comptes Rendus* and in *Annales d'Astrophysique*.

An investigation of the relations in the distribution of stars in globular clusters and in particular of the RR Lyrae type stars was carried out by P. N. Kholopov and published in *Variable Stars*, **9**, 371, 1954.

Some peculiarities of the Mira Ceti type stars make us believe that these stars are young. As soon as they are met in the spherical component of our Galaxy and in globular clusters, we may conclude that the process of star formation takes place not only in the spiral branches, but also in the spherical component of our Galaxy, in globular clusters and in elliptical galaxies⁽²³⁾.

In his investigations of variable stars in the Orion nebula, mentioned earlier, P. P. Parenago⁽²⁴⁾ made quite a number of most valuable cosmogonical conclusions (*Publ. of the Sternberg State Astronomical Institute*, **25**, 1954).

I. M. Kopylov⁽²⁵⁾ carried out a detailed systematic study of Novae and nova-like stars.

V. P. Tsesevich and his staff studied the behaviour of colour indices of RV Tauri type stars.

An investigation of the special distribution and kinematics of some semi-regular and irregular variable stars (carbon stars, in particular) was carried out by J. J. Ikaunieks (e.g. *Variable Stars*, **8**, 393, 1952).

An interesting work on the possibility of making use of high-speed electronic computing machines for the determination of a period for a variable star was carried out by P. Fagg (Georgetown University, U.S.A.).

PROBLEMS RECOMMENDED FOR DISCUSSION AT THE MEETINGS OF COMMISSION 27

I. The problem of the *General Catalogue of Variable Stars*.

As a result of numerous answers to the first memorandum, of 31 December 1952, a number of suggestions concerning the improvement of the form and contents of the *General Catalogue of Variable Stars* were received. A detailed discussion of all the suggestions by the author, P. P. Parenago, P. N. Kholopov and J. I. Efremov, together with a number of other astronomers, made it possible to prepare a new form of tables for the catalogue (part of the two sides of a page of the catalogue are given below).

Left-hand side of a page

(1) Star*	(2) Co-ordinates* 1900.0		(3) Precession* 1900.0		(4) Galactic* co-ordinates	(5) Bibliographie* reference	
	Grus		Gru		Grus*		
R	21 ^h 42 ^m 05 ^s	-47° 22'6"	+3 ^s .89	+0'275	318°3	-50°5	001,002
S	22 19 56 ^s	-48 56.4	+3.72	+0.303	312.4	-56.0	001,002
T	22 19 50	-38 04.4	+3.52	+0.303	331.8	-59.2	001,017
U	21 25 18	-45 29.1	+3.92	+0.261	321.9	-48.0	003,CoD
V	21 45 40	-42 50.5	+3.76	+0.278	325.2	-52.0	004,CoD
W	22 35 26	-44 21.7	+3.54	+0.312	318.2	-60.3	004,CoD
X	23 13 58	-56 09.5	+3.47	+0.327	292.6	-57.9	004,CoD
Y	22 41 23	-48 26.5	+3.58	+0.315	310.5	-59.3	005,CoD
π^1	22 16 37	-46 27.1	+3.69	+0.301	316.9	-56.4	006,CoD,007

Right-hand side of a page

(1) Star*	(2) Type*	(3) Magnitude* Max. Min.		(4)	(5) Epoch*	(6) Period*	(7) <i>M-m</i> or <i>D</i>	(8) Spectrum*
	Grus				Gru		Grus*	
R	M	8 ^m .7	16 ^m .9	<i>p</i>	34684	332 ^d .45	0 ^p .39	M5e
S	M	7.3	15.8	<i>p</i>	34559	400.98	0.41	M6e
T	M	9.3	13.0	<i>p</i>	34693	136.63	0.48	M0e
U*	EA	11.0	14.0*	<i>p</i>	11202.754	1.88048	0.15*	A5
V*	EA	9.64	9.85*	<i>p</i>	29966.725	4.4942942	0.15	F5
W*	EA	9.44	10.00*	<i>p</i>	30132.156	1.4842609	0.23	F5
X*	EA	10.52	12.68*	<i>p</i>	30113.191	2.1236124	0.14	A0:
Y	EA	10.4	12.1	<i>p</i>	27987.535	1.716944	0.12	
π^1	I	5.8	6.4	<i>v</i>	—	—	—	Se

* Will be printed in Russian.

Data for every variable star are given in two adjacent pages. The left-hand side of a page contains the following columns:

1. Name of the star.
2. Equatorial co-ordinates for the equinox 1900.0.
3. Precession for the equinox 1900.0.
4. Galactic co-ordinates (according to Ohlson's tables).
5. Reference showing the corresponding number in the list of references. Three figures can be contained in a column. The first refers to the study on the basis of which the type, epoch, period, and often also the other catalogue data are given; second number shows the paper, in which a chart of surroundings is contained and the third, the study containing a more or less detailed investigation of the spectrum.

The right-hand side of the page contains the following columns:

1. Name of the star.
2. Type of variability (classification is somewhat changed as compared with the first edition).
3. Stellar magnitude in maximum and minimum. Stellar magnitude in the second minimum is indicated in the remarks. The value of stellar magnitude in minimum is accompanied in this case by an asterisk.
4. The character of the stellar magnitude.
5. Epoch in Julian days.

6. Period in days.
7. Duration of the rise of brightness ($M - m$) for physical variable stars and the duration of eclipse (D) for eclipsing stars, in fractions of a period. Duration of total eclipse is mentioned in the remarks. The value D is accompanied in such cases by an asterisk.
8. Spectral class.

An asterisk beside the name of the star shows that there is a remark for that star. The asterisk is repeated in all columns of the table to which the remarks are related.

The catalogue will contain two volumes. Vol. I will include the first catalogue table only. Vol. II the list of references—the remarks, auxiliary summaries and the lists of abbreviations.

2. The question concerning *Geschichte und Literatur der Veränderlichen Sterne*.

H. Schneller makes the following recommendations in respect to further publication of the *Geschichte und Literatur der veränderlichen Sterne*.

Daneben ist vorgesehen in etwa drei- bis fünfjährigen Abständen Nachträge folgen zu lassen, die einmal die neubenannten Sterne und zum anderen die nach den jeweils letzten Ausgaben erschienene Literatur der bereits früher benannten Sterne enthalten sollen. Einjährigen Ausgaben erschweren die Benutzung, da sich die Literatur eines Sternes schon nach wenigen Jahren über viele Bände erstrecken würde. Will man unbedingt bei jährlichen Ausgaben bleiben, dann wäre es besser sie in Kartenform zu drucken, die zum Versand seitenweise zusammenhängen und dann vom Benutzer zerschnitten und kartenmässig geordnet werden können. Da aber die Mitteilungen über die einzelnen Sterne meist sehr kurz sind, werden die meisten Zettel nur mit wenigen Zeilen bedruckt sein, was diese Art der Veröffentlichung wenig ökonomisch erscheinen lässt.

Wahrscheinlich ist eine Beibehaltung der alten Form und eine drei- bis fünfjährige Erscheinungsweise das Vorteilhafteste, zumal für die Zwischenzeiten der Astronomische Jahresberichte (Heidelberg) oder das sowjetische Referatenblatt (Moskau) oder das *Bulletin Analytique* (Paris) zu Rate gezogen werden können.

My personal view is in favour of preparation and publication of volumes of *Geschichte und Literatur* once in every few years, for instance simultaneously with the issue of a new edition of the *General Catalogue*. The same was suggested by L. Plaut (Groningen).

3. Discussion of recommendations about a co-ordination of work of the observatories of the northern hemisphere in which 'sky patrol' is available.

4. Discussion of the question of restoration of the 'sky patrol' in the southern hemisphere.

5. Discussion of the question concerning a co-ordination of studies of faint variable stars in selected areas (jointly with Commission 33).

6. Discussion of the question of an organization of a sub-commission for variable star studies in globular clusters.

7. Discussion of questions of the programme of work of the sub-commission for studies of the structure of the Galaxy and of adjacent galaxies by means of variable star investigations (jointly with Commission 33).

8. Discussion of the suggestions about the programme of photo-electric observations of the physical (intrinsic) variable stars.

9. Discussion of the question concerning programmes of spectroscopic studies of variable stars (jointly with Commission 29).

10. Discussion of the question of the programme of studies of the proper motions and radial velocities of variable stars (jointly with Commission 33).

11. Discussion of the question of the improvement of the programmes of the Associations of Variable Star Observers, or of corresponding sections of astronomical societies.

12. Discussion of the question concerning data, the publication of which is necessary for studies of the variations of brightness.

13. Studies of short-period cepheids in different longitudes.

14. Discussion of the question of a morphological peculiarity of long-period cepheids in the flat and spherical components of our Galaxy.
15. Discussion of the questions of publication of specialized catalogues and references for amateur astronomers.

B. V. KUKARKIN
President of the Commission

REFERENCES

- (1) R. Prager, *Ann. Harv. Coll. Obs.* **111**, 1941.
- (2) F. B. Wood, *Pennsylvania Publ. Astr. Ser.* **8**, 1953.
- (3) C. H. Payne Gaposchkin and S. Gaposchkin, *Ann. Harv. Coll. Obs.* **115**, 1946; **118**, 1953.
- (4) S. Gaposchkin, *Ann. Harv. Coll. Obs.* **113**, no. 2, 1953.
- (5) See *Astr. Circ. U.S.S.R.* nos. 148, 149, 151, 155.
- (6) See *M.V.S.*
- (7) P. P. Parenago, *Publ. Sternberg State Astr. Inst.* **25**, 1954.
- (8) O. Eggen, *Ap. J.* **113**, 367, 1951.
- (9) M. F. Walker, *Publ. Astr. Soc. Pacif.* **66**, 230, 1954.
- (10) See, for example, G. Herbig, *Ap. J.* **119**, 315, 1954.
- (11) A. Joy, *Ap. J. Suppl.* no. 2, 1954.
- (12) H. A. Pels-Kluyver, *B.A.N.* **12**, 151, 1954.
- (13) A. Joy, *Ap. J.* **120**, no. 2, 1954.
- (14) W. Iwanowska, *Torun Bull.* no. 11, 1953.
- (15) See, for example, *Astr. Circ. U.S.S.R.* no. 155, 1955.
- (16) A. Blaauw, *B.A.N.* **12**, 95, 1954.
- (17) A. Filin, *Stalinabad Bull.* no. 10, 1954.
- (18) P. P. Parenago, *Variable Stars*, **10**, no. 4, 1944.
- (19) S. A. Zhevakin, *Astr. J. U.S.S.R.* **30**, 161, 1953; **31**, 335, 1954.
- (20) D. A. Franck-Kamenezky, *C.R. Acad. Sci. U.R.S.S.* 1954.
- (21) *I.A.U. Symposium*, no. 1.
- (22) *Publications of the Fourth Conference on Cosmogony (Moscow, 1955)*.
- (23) *Astr. J. U.S.S.R.* **31**, 489, 1954.
- (24) P. P. Parenago, *Publ. Sternb. State Astr. Inst.* **25**, 1954.
- (25) I. M. Kopylov, *Astr. J. U.S.S.R.* **32**, 48, 1955.

Report of the Meeting. 30 August 1955

PRESIDENT: Prof. B. V. Kukarkin.

SECRETARY: Miss R. Canavaggia.

TRANSLATORS: Dr S. Gaposchkin and Prof. E. K. Kharadze.

The Chairman expresses his satisfaction with the lively activity of Commission 27, activity which manifested itself by an active correspondence between the members and the President.

DISCUSSION OF THE DRAFT REPORT

The discussion is based on the mimeographed text distributed by Prof. Kukarkin, and not on the text of the Draft Report itself. The following comments are recorded:

Photographic observations of Variable Stars. Prof. Menzel has written that some details in the Draft Report concerning the activity of the Harvard Observatory were not quite exact. Prof. Kukarkin suggests that the required corrections should be proposed in written form.

Visual observations of Variable Stars. Dr Lindley reports that the Variable Star Section of the British Astronomical Association maintained its activity during the last three years, though the absence of publication is to be regretted.

Spectral investigations of Variable Stars. Miss Underhill suggests that the name of Dr R. M. Petrie be mentioned on p. 25, para. 2. Prof. Kukarkin accepts the suggestion.

DISCUSSION CONCERNING THE 'GENERAL CATALOGUE OF VARIABLE STARS'

Prof. Kukarkin mentions a letter from Prof. Keenan, who wishes that, for Mira stars, the maximum magnitude be given for medium maximum, instead of maximum maximum light. Prof. Kukarkin objects that this would break the uniformity of the Catalogue, because the available medium maximum is known only for about 400 Mira stars. Prof. Kukarkin says that information for medium maximum (in cases when these are known) will be given in the remarks to the General Catalogue.

The following suggestions are then made:

Prof. Nassau: Could α and δ be given for 1855 (BD) and 1875 (CoD)? Prof. Kukarkin answers that there is no room.

Prof. Nassau: Would it be possible to indicate whether the given spectrum refers to maximum light?

Prof. Kukarkin thinks that it would be possible to give such indications.

Mrs Mayall thinks that the observed range of spectrum would be a valuable information.

Prof. Kukarkin answers that it will be given.

Dr Plaut: Would it be possible to indicate whether the star belongs to population I or II?

Prof. Kukarkin would prefer such a notation as, for instance, for cepheids the notation C δ , CW, for cepheids belonging to the flat and the spherical systems respectively, and C for the non-classified cepheids.

Mrs Payne Gaposchkin asks how the designation of variable stars is being made now. Who designates the variables?

Prof. Kukarkin answers that, as it is useless to duplicate the lists of designations (as a separate issue and in the Supplements to the General Catalogue), it was decided to discontinue the issue of special lists of designations. This decision was taken at the preceding Assembly in Rome. In connexion with this decision the designation of variable stars is made by a group which prepares the Supplements to the Catalogue of Variable Stars for print.

Mrs Payne Gaposchkin then asks for information regarding the changes that are to be made in the notation of the types of variability.

Prof. Kukarkin answers this point:

The notation 'Long-Period Variable' will disappear and give place to the notation M and SR a, b, c. New types of variables will be introduced, such as α^2 CVn, δ Sct.

Mrs Payne Gaposchkin asks if a published position is a necessary condition for a newly discovered variable to receive a name. In crowded regions, newly discovered variables are often announced by means of a chart. Will such stars receive a name in the Catalogue?

Prof. Kukarkin thinks that the question needs consideration.

Dr O'Connell asks what will be the delay, in the future, for a variable star, between the announcement of discovery and the publication in the supplements of the Catalogue.

Prof. Kukarkin answers that the delay will depend on the time at which the announcement is received.

Miss Harwood asks at what time of the year it is most convenient that the announcement should be made?

Prof. Kukarkin answers that it should be made in early spring, February or March, for publication to result in the same year.

DISCUSSION OF THE PRELIMINARY RESOLUTIONS

- (1) No objections.
- (2) Dr O'Connell remarks that the text of the resolutions seems to imply that the publication of each subsequent volume will require a considerable amount of work. Dr Hoffmeister proposes that the word 'complete' be omitted. The suggestion is accepted.
- (3) No objections.

(4) Concerning the requested sub-commission, the personal opinion of Prof. Kukarkin is that it should be headed by Mrs Helen Sawyer Hogg, who has done much work on the variables in globular clusters. The following text of recommendation is passed:

Much work has been done lately on variables in globular clusters. Such studies, which throw light on the peculiarities of cluster variables in relation to the properties of the cluster in which they are contained, have a great bearing on the cosmological and evolutionary aspects of the globular clusters, and therefore have a claim to special interest. For this reason, Commission 27 requests the formation of a sub-commission on cluster-variables. It is proposed that the sub-commission should be headed by Dr Helen Sawyer Hogg, who has done extensive work in this field.

(5) A written suggestion of Dr Nielsen has been accepted.

Dr Huffer wishes that attention be called to the interest of observing in three colours. Prof. Kukarkin agrees that the point should be mentioned.

(6) Dr Ashbrook has written a letter expressing doubt that the American Association of Variable Stars will be able to fulfil the task assigned to its members. Prof. Kukarkin asks for the opinion of Mrs Mayall.

Mrs Mayall thinks that the task is difficult. Good sequences of standard stars will be required. Moreover, Mrs Mayall and Dr Lindley point out that there are objections to assigning a particular type of star to a particular association. The observation of fast-changing variables, for instance, requires constant co-operation of observers in different longitudes.

Prof. Kukarkin draws attention to the necessity of observing long-neglected stars, as for instance S Hor, neglected since 1905 (Mrs Mayall protests that she has observations; Prof. Kukarkin is not convinced!).

(7) A text of Dr Nielsen has been accepted.

(8) Mr van Woerden remarks that the Leiden Observatory cannot make an important contribution to observations because of its climate.

(9) Dr Ashbrook has expressed by letter two desiderata. Prof. Kukarkin does not agree with the first of these.

Dr Bidelman expresses a wish concerning charts. He points out that he has found many cases where charts are wanting. Observers do publish charts now, but at one time they did not; therefore for many stars discovered some time ago no chart is available. Would it be possible to fill in the gaps?

Prof. Kukarkin agrees that the question needs consideration.

Resolutions taken at the Meeting of Commission 27 in Dublin

1. The Commission approves the new scheme for the 'General Catalogue of Variable Stars' (2nd edition).

2. The Commission points out with satisfaction the extensive work connected with the preparation of the bibliography of variable stars carried out by Dr H. Schneller, and recommends the publication of additional volumes of *Geschichte und Literatur der veränderlichen Sterne* once every 5–7 years. Every subsequent volume must contain a bibliography of all the variables discovered previously, as well as of all the stars designated since the last volume.

3. The Commission recommends to the observatories of the Northern Hemisphere participating in the 'sky-patrol' to co-ordinate in the very near future their plans to utilize the rich plate collections. It is desirable that the plans of the Sonneberg, Stalinabad and Odessa observatories include joint studies of all non-investigated variables brighter than 12^m (pg) in maximum, and the carrying out of systematic examinations of Mira Ceti type stars for determination of new epochs of maxima. The Commission requests the Harvard College Observatory to continue extensive use of the plate library with the above purposes. Observa-

tories doing systematic photography of selected regions of the sky by means of small cameras are requested to take an active part in the above-mentioned work.

Taking into account that the 'sky-patrol' in the Southern Hemisphere has been discontinued, the Commission believes it necessary to emphasize the extreme importance of re-establishing such work.

4. The Commission requests the Executive Committee of the I.A.U. to organize a sub-commission for the study of variables in globular clusters, under the leadership of Dr H. Sawyer Hogg.

5. The Commission draws the attention of all astronomers making variable star observations by means of photo-electric photometers to the necessity of systematic observations of the physical variables. Such undertaking will inevitably lead to the discovery of new relationships. The Commission directs the attention to the fact that, whereas the ranges of the variations in magnitude and colour of a δ Cephei star may be derived by means of a few observations, the number of observations of each series of observations should be increased, so that each part of the light curve is covered by observations, as the determination of the length of the period (and of minute variations of it) must be based upon a certain number of such series of observations distributed over a great many years.

6. The Commission recommends co-ordination of their programmes by the Associations of Variable Star Observers in order to eliminate undue repetition. It is desirable that the American Association of Variable Star observers and the Variable Star Section of the Royal New Zealand Astronomical Society should enlarge their observing programmes to include *all* Mira Ceti type stars brighter than 10^m in maximum (vis.). The Commission requests all the other Associations of variable star observers to turn their attention to the existence of numerous types of variables, for which no systematic observations are being carried out, but which are of extreme importance (RW Aurigae and T Tauri type stars, semi-regular variables, flare stars, etc.).

7. The Commission requests the authors of variable star studies to publish their material in such a way as to permit subsequent investigators to use it most fruitfully. Observations of stars with a regular variation should be published according to the following scheme: Information for identification of each comparison star and the magnitude of these stars; the number of observations; the interval of time covered by observations and the mean value of the times of observation; the formula used for the computation of the phases of the observations; the co-ordinates of the normal points of the mean light curve and the number of single observations included in each normal point.

8. The Commission recommends observatories located in various longitudes to organize joint observations of the RR Lyrae type stars by means of photo-electric photometers in order to obtain uninterrupted light curves. The participation of the observatories of U.S.A., South Africa, Tokyo, Mount Stromlo, Budapest and Leiden is particularly desirable.

9. The Commission recommends that the Associations of Variable Star Observers prepare and publish special reference books, lists and catalogues of variable stars, to enlarge the skill and to extend the scientific horizon of the amateur astronomers. The reference-books should contain maps of the regions of a small number of variable stars, the observations of which above all are recommended by the Commission (e.g. the variable SS Cygni and similar stars).