COMMISSION 20: POSITIONS AND MOTIONS OF MINOR PLANETS, COMETS AND SATELLITES (POSITIONS ET MOUVEMENTS DES PETITES PLANÈTES, DES COMÈTES ET DES SATELLITES)

Report of Meetings, 19 and 26 August 1970

PRESIDENT: G. A. Chebotarev.
SECRETARY: L. Kresák.

The meeting was opened by G. A. Chebotarev, who asked F. K. Edmondson to act as the associate chairman of the session. Silent tribute was paid to the memory of the former Vice-President and very active member of the Commission, Professor S. G. Makover.

Since the printed Report of the Commission was not distributed until shortly before the meeting, it was agreed to postpone the discussion on this item until the third session. It was stated, with regret, that due to an unexpected mail delay several members of the Commission received the circular letter of the President so belatedly that their replies could not be included. The following statements are to be added to the printed report:

"I. I. Shapiro has analyzed more than 400 photographic observations of 1566 Icarus. These observations appear to be of little or no value for estimating the mass of Mercury, since the uncertainty of about 5×10^5 (in the reciprocal) is far inferior to that obtained from the analysis of the interplanetary radar data. K. Strand reported that bright minor planets, suitable for a redetermination of the mass of Jupiter, have been observed with the 15-in. astrograph of the U.S. Naval Observatory, Washington. The close approach of 1566 Icarus in 1968 and the opposition of 1620 Geographos in 1969 were observed with the 61-in. astrometric reflector at Flagstaff. Photoelectric observations of the brightness variations of some minor planets were obtained by P. Tempesti with the 40-cm refractor of the Teramo Observatory, Italy."

Mimeographed copies of the Report of the Working Group on Orbits and Ephemerides of Comets, compiled by E. Roemer, were distributed among all members of the Commission present. It was felt advisable to have this report published in full, as a supplement to the Report of Commission 20 which appeared in *IAU Transactions* **XIVA**.

F. K. Edmondson read a letter by P. Herget, who was unfortunately prevented from attending the meeting. In addition to a brief account of the recent work of the Minor Planet Center at the Cincinnati Observatory, this letter presented a number of suggestions for future observing practices in general and a summary of the types of objects the positions of which are most desirable. The proposals by Dr Herget were discussed and incorporated into the resolutions to be approved in their final form at the closing session. Further comments and suggestions were presented by S. Herrick, T. Gehrels, Z. Sekanina, T. Kiang, H. G. Hertz, P. Wild, B. G. Marsden and A. Schmitt.

The secretary read the list of Commission members proposed by the President for the next triennium. In the Working Group on Orbits and Ephemerides of Comets, E. Roemer has been proposed as Chairman, and M. P. Candy, E. I. Kazimirchak-Polonskaya, Y. Kozai, L. Kresák, B. G. Marsden and G. Sitarski as members. These proposals were unanimously approved by the Commission.

The organization and programme of future scientific meetings to be sponsored by the Commission was discussed. It was recommended that the following two IAU Colloquia be held before the next General Assembly:

1. IAU Colloquium 'Physical Studies of Minor Planets'. Date: March 8–10, 1971; place: Tucson, Arizona, U.S.A; chairman of the Organizing Committee: T. Gehrels.

2. IAU Colloquium 'Asteroids, Comets and Interplanetary Matter'. Date: April 4–6, 1972; Nice, France; chairman of the Organizing Committee: B. L. Milet.

It was approved to ask the IAU for a subvention of $ 2000 for the continued work of the Minor

Planet Center, Cincinnati, for the period 1971–73, and subventions of $ 500 each for travel grants towards participation in the two colloquia mentioned above.

Second Meeting

CHAIRMAN: E. Roemer.
SECRETARY: L. Kresák.
INTERPRETER: J. Kovalevsky.

The second meeting was devoted to comets. E. Roemer, Chairman of the Working Group on Orbits and Ephemerides of Comets, presided.

The report of the Working Group, distributed in advance, was unanimously approved. The access of comet observers to large telescopes was discussed as an imperative problem, because there are too few opportunities where such telescopes can be used for the extremely important observations of comets at large distances from the Sun. All efforts should be made to ensure an improvement in the assignments of telescope time at suitable observatories.

B. G. Marsden, the chairman of the Cometography Committee formed at the last IAU meeting, presented the report on the work of the Committee and read letters by G. Sitarski and S. K. Vsehsvjatskij, who were unable to attend. The recommendations of the Committee were approved by the Commission. It was felt that greater emphasis should be laid at present on the improvement of orbits, with nongravitation effects properly accounted for, than on the collection of general descriptions and physical observations.

The situation with regard to the repository of cometary positions in machine-readable form, which is an important preliminary to the definitive correction of orbits, was thoroughly discussed. At present there are four places where extensive, but incomplete, data of this type are available: Cambridge, Mass., Cincinnati, Leningrad, and Warsaw. It appears highly desirable to have a central repository for positional observations of comets, analogous to the Minor Planet Center at Cincinnati, but in the absence of substantial external financial aid there was no proposal for establishing one. On the motion of E. Everhart, seconded by H. G. Hertz, it was approved to transfer the study of the practical aspects of this problem to a special committee, which will prepare its recommendations for the next IAU General Assembly. P. Herget is asked to serve as chairman, with members G. A. Chebotarev, B. G. Marsden, and G. Sitarski.

B. A. Lindblad submitted an informal request from workers interested in different aspects of cometary statistics (such as the relations between meteor streams and comets) for the publication of a new supplement to Porter's catalogue of cometary orbits, or at least a new edition of the material in the appendices. The present state of orbit computations was outlined by B. G. Marsden. He explained that about 250 new or improved orbits have been calculated since the publication of the first supplement to the catalogue, and they could be easily assembled into a second supplement, provided that the necessary financial assistance would be available for its publication. At the same time, however, he pointed out reasons why the compilation of a new fundamental catalogue, or a new supplement, appears premature at the moment. Suggestions for future improvements in the form of the catalogue were made by B. G. Marsden (inclusion of osculating dates), Z. Sekanina (coincidence of these dates with the nearest 40-day standard Julian dates), L. Kresák (information on the number of observations used for the least-square solution, and the length of the arc, in days, covered by these observations) and G. Guigay (information on the brightness and aspect of the comets). It was felt premature to publish a new fundamental catalogue of cometary orbits until further study has been made on some standard way of accounting for nongravitational effects and until the orbits of many more of the older comets have been determined anew. Meanwhile, the orbit lists in the annual comet reports in the *Quarterly Journal of the RAS* can and should be regarded as supplements to the *BAA Comet Catalogue*, and it is suggested that the 1970 report should include a revision of the appendices to the *Catalogue*. For the same reason it is agreed to postpone the com-

pilation of the new *Cometography* (with an emphasis on ephemerides for all comets ever observed) and to disband the Cometography Committee appointed at the Prague meeting. Meanwhile, current cometographical sources (Vsehsvjatskij's catalogue and its supplements, *RAS comet reports*) should be maintained, and a conscious effort should be made to locate and correct errors that have been propagated in such sources in the past.

Since most of the recent results had been reported earlier in the month at *IAU Symposium* No. 45 in Leningrad, in the scientific part of the meeting only two papers were presented. B. G. Marsden gave a brief survey of the manner in which he allows for nongravitational effects on comet motion; in general his procedure predicts the motions of short-period comets rather successfully, but there is evidence for sudden, unpredictable changes in the nongravitational effects in a few cases. Z. Sekanina spoke on the secular variations in the comet deactivation mechanism, particularly with respect to P/Ecke; in addition he gave an interpretation of the coefficients of the nongravitational terms in Marsden's equations and made an application to P/Faye.

Third Meeting

PRESIDENT: G. A. Chebotarev.
SECRETARY: L. Kresák.
INTERPRETER: J. Kovalevsky.

The Report of the Commission, with the amendments passed at the first meeting, was unanimously approved. Then the secretary read the resolutions compiled from the recommendations put forward by G. A Chebotarev, F. K. Edmondson, T. Gehrels, P. Herget, B. G. Marsden, E. Rabe, E. Roemer, Z. Sekanina, and S. K. Vsehsvjatskij. All but one of these resolutions, which are given in full at the end of this report, were carried unanimously. Only the proposal by S. K. Vsehsvjatskij concerning the change in the name of P/Wolf to P/Wolf-Kamieński, was tabled. Although the Commission highly appreciated the splendid work of Professor Kamieński on the evolution of the orbit of this comet, it was felt that the renaming would be at variance with the practice generally adopted and might represent an undesirable precedent for the future.

In the scientific part of the session three papers were presented and discussed. P. Lacroute spoke on the mean errors of star positions in the catalogues AGK2, AGK3, and SAO. C. J. Van Houten reported on the results of the Palomar-Leiden survey of faint asteroids, with an emphasis on the implications for the structure of the Trojan clouds. T. Gehrels gave a brief review of recent physical studies of minor planets.

At the end of the meeting President Chebotarev relinquished the Chair to the incoming President, F. K. Edmondson, who announced his suggestion to assign the name 'Herget' to the minor planet No. 1751 = 1955 OC, discovered at the Goethe Link Observatory. This proposal, acknowledging Dr. Herget's enormous contributions to minor planet research, was greeted with unanimous applause.

RESOLUTIONS

A. *Minor Planets*

1. Observations are encouraged for objects of special interest or unusual circumstances, such as the Earth-approaching asteroids, asteroids with cometary orbits, and librating asteroids. There will always be an enduring interest in fast-moving objects which are found on any plates.

2. Observations are encouraged for those numbered planets whose ephemerides do not yield reasonably small residuals, say less than $1^m.0$ and $15'$.

3. It must be reiterated to the observers that positive identification of a moving object is impossible unless there are confirming observations from two to four weeks later.

4. Observations of selected minor planets for the purpose of establishing the equinox, and equator

and systematic corrections to star catalogues are encouraged until these programmes are completed.

5. Any systematic observing programme, especially with meridian circles, of the bright minor planets for the purpose of supplementing the observations of the Sun, Moon, and major planets should be encouraged.

6. Observers with sufficiently powerful telescopes are urged to further observe the two 'clouds' of Trojans associated with the Lagrangian points L4 and L5.

7. Determination of approximate positions of minor planets has generally lost its importance. It is sufficient to give the approximate position only if there is a reasonable expectation that accurate measures can be provided to satisfy the request of any orbit computer in the years to come.

8. The accurate measures of moving objects should be reduced with AGK3 comparison stars or corrected to the FK4 system whenever possible, and this should be clearly stated.

9. The changes in the form of the *Ephemerides of Minor Planets* published in Leningrad, in particular the extension of the ephemeris intervals around the opposition, are accepted with satisfaction. The recent practice of including extended ephemerides for Earth-approaching asteroids is much to be encouraged. It is hoped that the number of planets given this special treatment will be increased so that the list includes eventually all those with highly eccentric orbits and not necessarily best observable around opposition.

10. As the very limited field of large reflectors imposes strict requirements on the accuracy of the ephemerides of the minor planet, it is desirable to print with each ephemeris a reference to the elements on which the ephemeris is based, or at least the year of the 'Ephemerides' in which the elements were introduced.

11. The present photometric system of asteroids should be revised to conform with the UBV photometric system. The new values are 0.10 magnitude fainter, nearly the same difference for all asteroids; a new list of photoelectric magnitudes referred to the UBV system has been prepared by T. Gehrels (list published in *Surfaces and Interiors of Planets and Satellites*, A. Dollfus, ed., Academic Press, 1970).

B. *Comets*

12. Recognizing that the most important function of large telescopes is the observation of very faint objects, Commission 20 calls attention to the astrophysical importance of observing faint comets. Directors of observatories with large telescopes are urged to include the observation of faint comets in their assignments of telescope time.

13. Further experiments to investigate appropriate methods for allowing for nongravitational effects in the computation of the orbits of comets (particularly short-period comets) are encouraged.

14. It is recommended that, whenever perturbations are taken into account, the published osculating elements of a comet should be referred, in general, to the 40-day standard Julian date nearest the time of perihelion passage.

15. In order to ensure reliable predictions on the observability of comets in different types of telescopes, it is recommended that the notation m_1 be used for the 'total' magnitude of a comet and m_2 for the 'nuclear' magnitude in the publication of both observations and ephemerides. The subscripts are consistent with the code used for the telegraphic reporting of observations.