

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

Report of Meetings, 21, 23, and 27 November 1985

PRESIDENT: E Roemer

SECRETARIES: M P Candy, J Hers

21 November 1985

ADMINISTRATION I

The President noted with pleasure the number of members of the Commission present. M P Candy and J Hers were confirmed as secretaries without objection. All present stood for a moment in remembrance of members, or former members, of the Commission who had died during the triennium: Gerald E Merton (1893-1983), S K Vsekhsvyatskij (1905-1984), Harley W Wood (1911-1984).

The President then reported that C J Van Houten, currently the Vice President, felt not in a position to accept nomination as President, and that Y Kozai, in addition to serving as chairman of the Working Group on Satellites for a number of years, had served earlier as President of Commission 7. Approval was given to nominations of Kozai to be President, and of Yu V Batrakov to be Vice President for the triennium 1985-88. Kozai had proposed J-E Arlot as new chairman of the Working Group on Satellites, and the President proposed that R L Millis succeed Gordon Taylor, who was retiring as chairman of the Working Group on the Prediction of Occultations by Minor Planets and Satellites. Both recommendations were made after considerable correspondence with members of the Working Groups, and both were then approved.

B G Marsden would continue as Director of the Minor Planet Center, but Ľ Kresák, who was to be President of Commission 15, wished to be replaced as chairman of the Working Group on Comets. It was agreed that Roemer would replace him. It was also agreed that K Aksnes, who would continue as chairman of the Satellite Nomenclature Liaison Committee (SNLC) and representative of Commission 20 on the Working Group on Planetary System Nomenclature (WGPSN), would become a member of the Organizing Committee. The membership of the Organizing Committee was then confirmed: Aksnes, Arlot, Candy, Kresák, L K Kristensen, Marsden, Millis, Roemer, D K Yeomans, and Y-Z Zhang.

A number of new members of the Commission were approved. Since some additional members were also approved later, the complete list, and that of consultants for 1985-88, is given below in the report of the administrative session on 27 November.

The President then reported on the status of resolutions. A request had been made for a subvention of SwF5000 per year for the triennium 1986-88 to help support the work of the Minor Planet Center. [Only SwF3100 was included in the proposed IAU budget. Roemer and Marsden met with the Finance Committee and the General Secretary to discuss alternative forms of IAU support for the Center.] Approval of permanent designations for several satellites had been recommended by SNLC; these would be presented and voted upon during the session on satellites. The new protocol for magnitude ephemerides of minor planets recommended by the *ad hoc* committee, a proposal concerning names for minor planets, and a recommendation about cometary nomenclature would be presented and discussed during the sessions on minor planets and comets, respectively. Votes would be deferred until the second administrative session.

SCIENTIFIC SESSION: MINOR PLANETS

Marsden took the chair and reported first on progress during the triennium.

Among the points touched upon were the desirability of sending positions to the Minor Planet Center in machine-readable form, the availability of a new edition of the observation tape, and the extreme competitiveness of the work on identifications. Minor planets have been numbered up to 3330, but six of the numbered planets are still lost. There are problems with the publication of observations. Some journals won't accept them, and the volume in the *MPCs* is very large. Could publication in printed form be discontinued? Elements and ephemerides are available through the phone-in service, but overseas users encounter difficulties in using the system.

The matter of the transition from the reference frame B1950.0 to J2000.0 was discussed next. Though the system J2000.0 is much more accurate than B1950.0, star catalogs on the new system do not yet exist. P K Seidelmann noted that the best instructions for the transformation are those in the *Astronomical Almanac* and by Aoki et al. in *Astr Astrophys* 128, 263 (1983). But attention has to be given to the reference frame used for the observations, and some uncertainties will remain until the FK5 catalog is available. The consensus was that positions determined on the basis of star catalogs in the B1950.0 system should be reported in that system, but that there would be a gradual introduction of the J2000.0 system for the most accurate new observations.

E Bowell presented the report of the *ad hoc* Committee on Magnitude Ephemerides for Minor Planets. A two-parameter system for calculating minor planet magnitude ephemerides had been developed. One of the parameters is the reduced magnitude H at zero phase angle. The second, termed the slope parameter G , is a measure of the gradient of a minor planet's phase curve. A wide spectrum of observational data, from the steep phase curves of low-albedo minor planets to the flatter phase curves of icy satellites, is well fitted. The system reproduces the observed opposition surge and the non-linear drop-off in brightness at large phase angles, and is valid for phase angles $0^\circ < \alpha \leq 120^\circ$.

A Harris then reported on behalf of E F Tedesco on the photometric data base. Absolute magnitudes H and slope parameters G have been derived for all numbered minor planets through 3318 using the Lumme-Bowell-Harris phase function. The data base includes 10 234 magnitude records from 147 different references. Updated lists of H and G will be provided annually for publication in a suitable place, probably *Efemeridy Mal'yxh Planet (EMP)*. The observation data set, detailed tabulations of H and G , including error bars and the phase angle statistics, and a complete description of the methodology employed, are a part of the IRAS data base and will be published soon by Tedesco.

L K Kristensen discussed extensive photometric work on 51 Nemausa done by himself and P Gammelgaard, particularly as it pertained to the proposed new magnitude formulae and parameters. He expressed the opinion that the proposed system is based on too few observations, especially at zero phase, to allow the general extrapolation to zero phase required to obtain H . Such extrapolation would not preserve the true accuracy of observations. The zero point and scale of the slope parameter G are not defined. To obtain a stable system of magnitudes, with fundamental parameters defined with an accuracy comparable to the mean errors of photoelectric observations, he proposed that H and G be transformed to quantities that would specify the straight line that best approximates the phase curve in the interval of observation. Outside the range of the opposition effect, but in the range of most observations, this line approximates phase curves within ± 0.02 mag. Only for unusual planets would the error in magnitudes predicted this way occasionally exceed 0.1 mag.

A straw vote taken following extensive discussion showed that a substantial number of people were undecided on the relative merits of the two points of view. A special study session was arranged to consider the matter further.

B Morando reported on HIPPARCOS and minor planets. Sixty-three minor planets

have been proposed for observations by HIPPARCOS, but some of them might prove too faint. The conditions of observation are such that the minor planets will be observed 43° from quadrature, the phase angle lying roughly between 15° and 21° . The problem, if one wants to reach the few milliarcseconds nominal accuracy of HIPPARCOS, is to determine the position of the photocenter to that accuracy. Data are being gathered covering semiaxes of figure, the scattering law, position of the pole, and rotation. It is hoped that the HIPPARCOS observations will lead to improved knowledge of these quantities.

L V Morrison told of observations of minor planets with the Carlsberg Automatic Meridian Circle on La Palma. Some 664 observations of position and magnitude of 14 minor planets were obtained in the interval May–December 1984. The list is to be increased to include most of the minor planets on the HIPPARCOS program. The instrument is fully automated, with a photoelectric scanning slit micrometer. The magnitude limit is $m_v = 13.0$, and some 850 objects can be observed each night. Comparison of positions of minor planets with numerical integrations supplied by Bec-Borsenberger show considerable differences, especially in the case of Flora. Residuals of $2''$ for that object would be too large to permit observation by HIPPARCOS.

Marsden remarked that with the implementation of computer-controlled typesetting, the Institute for Theoretical Astronomy had invited suggestions for revisions in the form and contents of the *EMP*. Several suggestions were made, including listing of Δ , r , and β for each date of the opposition ephemerides, as is now done in the extended ephemerides for bright planets. It was also suggested that the positions of the antisun and Moon be put in a header line along with the dates of opposition included on each page. L E Doggett invited suggestions for revisions in the form of the minor planet data published in the *Astronomical Almanac*.

Names suggested for minor planets are currently subject to review by a small committee. Some recent proposals have led to a recommendation to prohibit names glorifying individuals or events known principally for recent political or military activities or implications. Gehrels cited the recent appearance in the *MPCs* of a citation for a minor planet named for a highly respected and recently deceased member of the staff of the Kitt Peak Observatory, immediately followed by one for a cat. He thought that minor planets should not be named for animals. And who is to judge what is politics? He proposed abolishing the committee and leaving the matter to the discretion of the Director of the Minor Planet Center. But there should be the possibility of appeal in case of an adverse decision on a proposed name. Since this topic, too, generated animated discussion, the President suggested that decisions be deferred until the second administrative session, to give time for exchange of views.

Marsden then explained the background of a question that had arisen concerning the proper spelling of the name of the planet 1148. Erroneous transliteration (from French to Russian to German) caused the name to be spelled incorrectly when it was introduced in the *A.N.* as well as in recent editions of the *EMP* and other standard references. The explanation of the name in *The Names of the Minor Planets* (Cincinnati 1955, 1968) is correct, and it was agreed that henceforth the original French spelling, Rarahu (rather than Raraju), should be used.

23 November 1985

The President presented a resolution that arose from Joint Discussion I, Reference Frames, calling for Presidents of interested IAU Commissions to form a Working Group to study a number of problems related to reference frames and make recommendations to the XXth General Assembly in 1988. The resolution had been acted upon by Commissions 4 and 7 and was being considered by other Commissions that co-sponsored the Joint Discussion. After some discussion, the resolution was approved except for a point concerning possible restructuring of IAU Commissions, which was regarded as

outside the purview of Commission 20. A slightly revised version appears as Resolution C2: Reference System in the report of the XIXth IAU General Assembly.

SCIENTIFIC SESSION: COMETS

Ľ Kresák remarked, in taking the chair, about the effectiveness of the international cooperation that had been organized for observations of P/Halley. He hoped that it would continue after the Halley campaign was over. Marsden confirmed that much interest in astrometry had been aroused by the campaigns on P/Giacobini-Zinner and P/Halley, but as many as half of the observations are of too poor quality to be useful, apparently as a result of lack of experience. There are also many gross errors in times. The MPCs have been overcrowded with observations of these two comets. On the other hand, very few observations were made of two rather bright comets that were discovered in the field with P/Halley. There is need to encourage observations of *all* comets, but especially the bright ones, for which accurate ephemerides are needed for radio observations. Astrophysicists don't understand how difficult it is to provide reliable ephemerides with insufficient data. Marsden noted that S Nakano had given particularly valuable help in reporting promptly the positions measured by Japanese observers.

Marsden then presented the report of the Comet Nomenclature Committee. A recommendation was made concerning provisional designations if more than 26 comet discoveries or recoveries are made in a calendar year, and for names of comets discovered from spacecraft. Comets discovered with the Infrared Astronomy Satellite had received the name IRAS, but those discovered with the UK Schmidt had been named for the people involved. The question arose as to when a discoverer should be credited and when a corporation. The times of perihelion of the several sungrazing comets discovered from the SOLWIND spacecraft were well defined even though the observations extended over only a few hours and were reduced some considerable time after they were made. These, and some other observations, as of P/Gunn in 1954, P/Schwassmann-Wachmann 1 in 1908, and an observation of P/Smirnova-Chernykh in 1967, one of several observations of comets recognized by Nakano, can be interpolated into the Roman numeral sequence. In some other cases, in which there are only isolated observations, there is a problem in distinguishing which objects are real, let alone in calculating an orbit. Some images of possible comets are found months after the plates were taken. Those reports that seem to refer to real objects are mentioned on the *IAU Circulars* and in the annual reports in the *QJRAS*. It was generally agreed that nothing further should be done about unconfirmed reports when there were too few observations for an orbit. However, observers should be encouraged to make enough observations to secure their discoveries.

T Gehrels then reported on his astrometric work with a charge coupled device (CCD) in the scanning mode. The 91-cm Newtonian f/5 reflector, modified to f/3.8 with a relay lens, of the Steward Observatory on Kitt Peak, is now in operation as a dedicated telescope for comets and minor planets. With drive off and the CCD charges transferred at sidereal rate, an average of six minor planets and six SAO stars are observed per set of three scans covering 1.2 square degrees, which takes 1½ hours to complete. Follow-up astrometry is done for objects with high inclination and other interesting features. Since the drive is off, the method has the advantages of a transit instrument. The precision of positions published in the MPCs is about $\pm 0''.8$. Additional information will appear in a paper by Gehrels, Marsden and Scotti in the *Astron J* in 1986.

Marsden congratulated Gehrels on recoveries of periodic comets, that of P/Shajn-Schaldach not having been expected at all. In response to a question about the magnitude limit, Gehrels stated that all known minor planets in the fields scanned were found; most discoveries are of new objects. For comets there is not a direct correlation between magnitudes from CCD scanning and the "nuclear" magnitudes from long-focus photography, as by Roemer. Marsden noted that $m_2(\text{TG}) 17 \approx m_2(\text{ER}) 19$.

Cl. Froeschlé described work he had done with H Scholl on the dynamical evolution of meteor streams in resonance with Jupiter. They had investigated numerically the dynamical evolution of particle ring systems orbiting the Sun in a 2/1 mean motion resonance with Jupiter. Only the main forces, the gravitational forces exerted by the Sun and Jupiter, were taken into account. Highly inclined rings located at resonance centers may give rise to the formation of arcs of rings. These arcs evolve separately due to the different possible modes for the motions of the ring particles' nodal lines, regression or progression. The mechanism may also explain the recently discovered arcs of a ring around Neptune. The paper will appear soon in *Astron Astrophys*.

SCIENTIFIC SESSION: SATELLITES

Kozai opened the session by summarizing and updating the report of the Working Group on Satellites, which had been included in the Report of Commission 20 in *Trans IAU XIXA*. He noted in particular a paper by Ferraz-Mello in *Celestial Mechanics* in which updated elements of many of the satellites were presented. The Bureau des Longitudes has introduced a new series of books containing ephemerides for the satellites of Jupiter, Saturn, and Uranus, and of phenomena and configurations of the brighter satellites of Jupiter and Saturn. V Abalakin provided information about some of the work in progress on satellite theories in the USSR and offered assistance in obtaining copies of publications.

On behalf of Aksnes, Seidelmann then presented the report of SNLC. The purpose of the committee, which was created during the IAU General Assembly in Patras in 1982, is to investigate and provide documentation on the orbits of newly discovered satellites and to give advice on when the orbits are sufficiently well known to warrant assignment of permanent designations (Roman numerals) and names to the satellites by Commission 20 and WGPSN, respectively. Documentation should include the measured satellite positions and residuals, and a complete set of orbital elements.

During the triennium SNLC investigated the orbits of 12 satellites: 1979 J1, 1979 J2, 1979 J3; 1980 S1, 1980 S3, 1980 S6, 1980 S13, 1980 S25, 1980 S26, 1980 S27, 1980 S28; and 1978 P1. Nomenclature for 1979 J2, 1980 S1, 1980 S3, 1980 S6, 1980 S13 and 1980 S25 was approved at the Patras meeting and later endorsed by the IAU Executive Committee, even though orbital parameters for some of these satellites are still incomplete. Following receipt of further data from S P Synnott, SNLC in July 1983 recommended approval of permanent designations, as well as names recommended by WGPSN, for 1979 J1, 1979 J3 and 1980 S28. These recommendations received IAU endorsement in September 1983. More recently SNLC has reviewed the orbital information on 1980 S26, 1980 S27 and 1978 P1. Additional data on the first two satellites were provided by Synnott in 1983 and 1984, and the breakthrough on Pluto's satellite came with the successful observation in January and February 1985 of the long awaited occultations and transits between Pluto and its satellite. Further, a new, quite satisfactory, orbit has been derived by D J Tholen (*Astron J* 90, 2353, 1985) from 19 speckle interferometric observations. The committee therefore recommends adoption of permanent designations as follows:

Saturn XVI	=	1980 S27
Saturn XVII	=	1980 S26
Pluto I	=	1978 P1

This recommendation was then put to a vote of the Commission and received unanimous approval.

It was noted further that Aksnes had reviewed the orbital status of the recently discovered faint Jovian and Saturnian satellites in a paper published in *Stability of the Solar System and Its Minor Natural and Artificial Bodies*, ed V G Szebehely (Dordrecht: Reidel) 1985. WGPSN has decided to publish an annual gazetteer of planetary and satellite nomenclature. A soft-cover edition is to be produced under the direction of H Masursky at the U S Geological Survey in Flagstaff in the fall of

1985. P Millman is working on a more elaborate hard-cover version, to be published in 1986 and at intervals of 6-12 years thereafter.

Seidelmann then described techniques for observations of faint satellites with a CCD. Both short (1^s) and long (30^s-1^m) exposures are made to extend the dynamic range. Positions of faint satellites can then be measured with respect to brighter ones. Orientation is calibrated from star trails and the scale from star fields. Objects observed include several of the Jovian satellites, Nereid, and the Uranian system, including Miranda, in preparation for the Voyager encounter. Reductions made by fitting to a 3-dimensional surface yield an external precision, determined by comparison with JPL orbits, of $\pm 0''.10$ in x and $\pm 0''.16$ in y . Plans for observations with the Space Telescope include both positions and colors of Pluto's satellite, a search for additional faint satellites of the major planets and for possible satellites of minor planets as well as observations of the rings of Jupiter, Saturn, Uranus, and Neptune in search for shepherding satellites. In response to questions, Seidelmann stated that CCDs may be better suited to observation of the Jovian and Saturnian satellites than to the satellites of Uranus, but that they had not succeeded in observing the co-orbital satellites in spite of repeated attempts. Observation of satellites librating around the Lagrangian points was recognized as of great importance.

Seidelmann called attention, on behalf of Tedesco, to the opportunity for observation of mutual events in the Pluto-Charon system. Predictions for 1986 events and observing suggestions have been given by Tholen (*Astron J* 90, 2639, 1985).

Arlot spoke next, on behalf also of Morando and W Thuillot, to report on the campaign PHEMU 85 to observe mutual phenomena of the Galilean satellites. More than 300 events were observable around the world in a series that began in July 1985 and extends into early 1986. Jupiter was near opposition during the early part of the series, with events best observable from the Southern Hemisphere. Photoelectric timing of events gives satellite positions of significantly higher accuracy than can be obtained from direct photographic observations. Complementary campaigns were also organized by the Hydrographic Office and the Tokyo Astronomical Observatory in Japan and at the Perth Observatory. In addition, Aksnes used telescopes at Cerro Tololo and on La Palma.

Chr. Veillet reported on his researches concerning masses of the Uranian satellites. Various authors have pointed out that it is not possible to derive the mass of these satellites from their pericenter motions as determined using constant eccentricities. But the Laplacian quasi-commensurability between the mean motions of the three inner satellites and the high inclination (4°) of Miranda's orbit, permits the evaluation of the masses of Ariel and Umbriel in a way only slightly dependent on the mass of the outer satellites. Determination of Miranda's nodal precession motion and of the resonance effects on the longitudes by Veillet (1983) and Jacobson (1985, JPL pre-Voyager ephemeris) yield densities of 1.03 ± 0.36 (0.94) for Ariel and 1.33 ± 0.45 (1.46) for Umbriel, assuming density 1 (respectively 2) for Titania and Oberon. The mass of Miranda is found as $(0.24 \pm 0.06) 10^{-5}$ Uranus mass, yielding a radius 346 ± 85 km. Only this latter mass could be improved from the Voyager flyby. Further improvements for the other satellites need a complete redetermination of the orbital elements, including varying eccentricities, combined with Voyager radius measurements.

27 November 1985

SCIENTIFIC SESSION: OCCULTATIONS

The President presented a report on behalf of G E Taylor, retiring chairman of the Working Group. Taylor had chaired the Group since its formation at Grenoble in 1976. His retirement as chairman was occasioned by his retirement from the Royal Greenwich Observatory. He thought it might be time for a new leader, and he

supported the proposal for extension of the activities of the Working Group to include coordination of observations in addition to identification of possible events and improvement of predictions. He endorsed the nomination of Millis as the new chairman.

Considerable progress has been made in the prediction and observation of occultations by minor planets and satellites in the nine years of activity. Among the results have been the discovery of the rings of Uranus, the confirmation of the satellite of Pluto, and enormous improvement in our knowledge of the sizes of some of the minor planets.

The major obstacle to the improvement of the observational success rate lies in obtaining accurate last-minute astrometry, followed by rapid reduction and updating of predictions. There are not enough observatories doing this work. It will be some time before we can hope to get digitized data from an astrometric telescope in space, but what a step forward that would be, with no need to worry about cloud cover and no need for taking, developing, and measuring plates. Although the astrographic telescope at RGO will no longer be used for last minute astrometry, Taylor hoped that other observers would get involved and that the new chairman would receive support in that aspect of the work. Taylor retains his personal interest, and hopes to see himself an occultation of a star by a minor planet. Those present gave enthusiastic support to the President's suggestion that she convey greetings and appreciation to Taylor for his dedicated service.

Bowell then gave an overview on behalf of Millis of plans for the Working Group. It is proposed that the Working Group identify those occultations that warrant a serious prediction refinement effort, orchestrate that effort, and serve as a conduit through which prediction updates can be quickly disseminated to observers around the world. Selection of events would be guided by knowledge of which objects are intrinsically more interesting on physical grounds. Many members of the Working Group would serve as regional coordinators in various parts of the world, both for dissemination of information and for coordination of arrangements for observations. The group at Lowell Observatory has been involved for a number of years in the identification of events, and they expect to continue that work. With the new 18-inch astrograph, they are now in a good position to contribute also to the refinement of predictions.

A list of potential members of the Working Group was compiled by so selecting among individuals who had been active previously in identifying, refining predictions for, or observing events as to obtain the best possible geographical coverage. Several new contacts developed at the General Assembly are expected to lead to extension of the network to additional areas. The Commission agreed to the President's proposal that Millis be allowed flexibility in defining the formal membership of the Working Group and in appointing regional coordinators.

ADMINISTRATION II

Several additional new members of the Commission were approved. The complete list was then: J-E Arlot, M E Bailey, Z C Chol, J Churms, G De Sanctis, A Dollfus, G Forti (reinstatement), J B Gibson, H F Haupt, J Henrard, J-L Heudier, V Ivanova, T P Kisseleva, L E da Silva Machado, H S Mahra, A Mrkos, C D Murray, S Nakano, H J Reitsema, H J Schober, V G Shkodrov, I Stellmacher, J Svoreň, S P Synnott, D B Taylor, G B Valsecchi, C Veillet, R Vieira Martins, H Wroblewski, and S A Yabushita. J A Bruwer and J Kovalevsky have resigned from the Commission.

The following were approved as Consultants to the Commission for 1985-88: C M Bardwell, K I Churyumov, R W Farquhar, W Ferreri, E I Kazimirchak-Polonskaya, Z M Pereyra, V Protitch-Benishek, N Samojlova-Yakhontova, T Seki, and A L Whipple.

Composition of Working Groups was then confirmed as follows:

Comets: N A Belyaev, M P Candy, A Gilmore, Ľ Kresák, B G Marsden, S Nakano, H Rickman, E Roemer (chm), G Sitarski, R M West, P Wild, D K Yeomans.

Satellites: K Aksnes, J-E Arlot (chm), S Ferraz-Mello, P Ianna, J Lieske, T Nakamura, D Pascu, M Rapaport, P K Seidelmann, V Shor, D B Taylor.

Marsden reported that near-unanimous agreement on a new protocol for magnitude ephemerides of minor planets had eventually been reached at the study session, which had been attended by 10-15 of those most seriously interested. There had also been further discussion of possible changes in the contents and format of the *EMP*, in particular the section that contains the standard opposition ephemerides.

Bowell then presented a slightly revised version of the resolution for formal consideration by the Commission. In the course of discussion, the idea grew that it might be advisable to switch from the B to the V photometric system along with the introduction of the new protocol for magnitude ephemerides. Though photographic magnitudes probably would continue to dominate for another ten years, V magnitudes are more appropriate for CCD observations. Much of the primary photoelectric data is in the V system. Gehrels and Harris agreed that it should be possible for Tedesco to furnish V absolute magnitudes. The proposed resolution was then put to a vote and approved nearly unanimously as follows:

(1) Commission 20 recommends that the minor planet magnitude system put forward by the *ad hoc* Committee on Magnitude Ephemerides be adopted for use in publications that conform with the policies of the Commission. A formula for the prediction of the apparent magnitude of a minor planet is

$$V = 5 \log r \Delta + H - 2.5 \log \left[(1 - G)\Phi_1 + G \Phi_2 \right],$$

where r and Δ are, respectively, the heliocentric and geocentric distances (in AU), H is the absolute magnitude (in the V band unless otherwise specified) at solar phase angle $\alpha = 0^\circ$, G is termed the slope parameter, and Φ_1 and Φ_2 are two phase functions approximated by

$$\Phi_i = \exp \left[-A_i (\tan \frac{1}{2} \alpha)^{B_i} \right]; \quad i = 1, 2$$

$$A_1 = 3.33 \quad A_2 = 1.87 \quad B_1 = 0.63 \quad B_2 = 1.22$$

(2) It is recommended that, for numbered minor planets, values of H and G be published annually in the *Efemeridy Mal'yxh Planet*, that files of photometric data be maintained and frequently updated, and that the files be overseen and approved for publication by a standing committee.

(3) If G cannot be satisfactorily determined, and in the absence of albedo or taxonomic class, it is sufficient to adopt the value $G = 0.25$. If further sophistication is desired, it is appropriate to adopt instead $G = 0.15$ if the minor planet appears (even in the absence of available proper elements) to belong to the Nysa family or to have semi-major axis > 2.50 AU (unless it is an Apollo object), or $G = 0.40$ if it appears to belong to Williams family 190.

It was noted that the combined effect of the new definition of absolute magnitude and the conversion from B to V is that $H \approx B(1,0) - 1.0$. Further, it was suggested that it would be useful to flag objects that are known to have large light variations due to rotation or aspect effects, and that a summary table and references to more detailed information might usefully be included in the *EMP*. It was also agreed that the membership of the standing committee to oversee publication of photometric data for minor planets should consist of the President of the Commission, the Director of the Minor Planet Center, and a liaison to the keepers of the photometric files. Membership for 1985-88 would then be Kozai, Marsden, and Bowell.

Discussion then turned to further suggestions that had arisen in the study session concerning the contents and format of the *EMP*. A list was made of the ideas that had substantial support, and the President was instructed to communicate them to the ITA as a response to their invitation for suggestions.

Some refinements were made in the wording of a resolution concerning names for minor planets, and the resolution was then approved as follows:

Names proposed for minor planets will not be accepted if, in the opinion of the Minor Planet Names Committee, they are too nearly similar to those of other minor or major planets or natural satellites, or are in questionable taste. Names should be pronounceable, preferably expressible as a single word, and no more than sixteen characters long. Names glorifying individuals or events principally known for their political or military activities or implications are considered unsuitable unless at least one hundred years have elapsed since the individuals died or the events concerned took place. Objects involved with the Jovian triangular libration points should be named in accordance with the tradition of honoring heroes of the Trojan War. In a disputed case, the proposer may appeal the committee's decision at a general meeting of Commission 20, provided that due written notice is given to the President of the Commission.

It was agreed that edited citations should be referred back to the discoverer before they appear in the *MPCs*. The Minor Planet Names Committee is composed of the President and Vice President of the Commission and the Director of the Minor Planet Center. Members for 1985-88 thus are Kozai, Batrakov and Marsden.

The following resolution on comet nomenclature, incorporating points made earlier, was then approved:

Commission 20 supports the report of the Comet Nomenclature Committee, specifically with regard to the following points:

- (1) The sequence of provisional designations should be $a, b, \dots, z, a_1, b_1, \dots, z_1, a_2, b_2, \dots$. It is acceptable to replace the subscripts with full-size Arabic numerals.
- (2) The use of appellations *IRAS*, *SOLWIND*, etc., is encouraged in cases of corporate discoveries. The inclusion of Arabic numerals, as in the *SOLWIND* case, is recognized as being inconsistent with the normal practice of supplying such numerals only for short-period comets, but is considered unavoidable.
- (3) The interpolation into the tabulation of Roman numeral designations of past comets for which adequate orbital data are available is encouraged.
- (4) The use of new provisional designations for old comets or possible comets for which orbital data are not available is not recommended. Discoverers are urged to ensure that enough accurate observations are secured for the computation of satisfactory orbits.

The Comet Nomenclature Committee is composed of the President of the Commission, the chairman of the Working Group on Comets, and the Director of the Telegram Bureau. Members for 1985-88 are then Kozai, Roemer, and Marsden.

It had been agreed after consultations that Roemer would represent Commission 20 in the Working Group to be established under the resolution that arose from Joint Discussion I, Reference Frames.

Membership of the Satellite Nomenclature Liaison Committee consists of the President and Vice President of the Commission, the Chairman of the Working Group on Satellites, and two others selected by the President from among the members of

the Working Group on Satellites. The membership for 1985-88 is: Kozai, Batrakov, Arlot, Aksnes (chm and representative to WGPSN) and Seidelmann (vice chm and alternate representative to WGPSN).

Bowell then proposed a vote of thanks to the retiring President, noting that she had served the Commission well for much of two terms. Applause followed and the meeting was closed.

Addendum:

The Fifth Edition of the *Catalogue of Cometary Orbits*, published jointly by the Central Bureau for Astronomical Telegrams and the Minor Planet Center, is now available. It contains 1187 sets of orbital elements and is complete for comets observed through 1985 December. Inquiries may be addressed to:

Minor Planet Center
Smithsonian Astrophysical Observatory
60 Garden Street
Cambridge, MA 02138
U.S.A.