

XVth General Assembly

Sydney, Australia

1973

XVe Assemblée Générale

Sydney, Australie

1973

## Resolution No. 1

The General Assembly of the International Astronomical Union resolves to adopt the following change of the Statutes: At the end of Articles 11(a) et 11(b), the following sentence is added: 'Exceptions from this rule cannot be considered unless decided by the Executive Committee.'

L'Assemblée Générale de l'Union Astronomique Internationale décide d'adopter la modification suivante des Statuts: A la fin des articles 11(a) et 11(b), la phrase suivante est ajoutée: 'Des exceptions à cette règle ne peuvent être envisagées que sur décision du Comité Exécutif.'

## Resolution No. 2

The General Assembly of the International Astronomical Union requests the Executive Committee to examine the possibility of a change in the Statutes such as to allow the three years interval between two General Assemblies to be extended to a four-year interval, if such is, after study, the opinion of the Executive Committee.

L'Assemblée Générale de l'Union Astronomique Internationale demande au Comité Exécutif d'examiner la possibilité de modifier les Statuts, de telle sorte que l'intervalle de trois ans entre deux Assemblées Générales puisse être étendu à quatre ans, si telle est, après examen, l'opinion du Comité Exécutif.

## Resolution No. 3

The General Assembly of the International Astronomical Union recognizes the scientific interest of regional meetings and recommends to their organizers to take the appropriate steps so that the dates of these meetings and their programme be such as not to constitute for the member countries an excessive financial burden.

L'Assemblée Générale de l'Union Astronomique Internationale reconnaît l'intérêt scientifique des réunions régionales et recommande à leurs organisateurs de prendre les mesures appropriées en ce qui concerne les dates de ces réunions et leur programme, de telle sorte qu'elles ne constituent pas pour les pays membres une charge financière trop lourde.

## Resolution No. 4

The General Assembly of the International Astronomical Union,  
considering

- (a) that there exist requirements for dating in a decimal sequence for various purposes in conjunction with the use of radio time signals and radio time codes,
  - (b) that it is desirable to refer such dating to 0<sup>h</sup> UT as the beginning of a day instead of 12<sup>h</sup> UT,
  - (c) that a decimal day count, the Julian Day count, has long been in established use for dating in astronomy, chronology, and related sciences,
  - (d) that it is necessary to avoid a proliferation of different dating systems,
  - (e) that a simple conversion from the above-mentioned conventional Julian Day count to a modern decimal day count will be advantageous,
  - (f) that the existing established Julian Day count which refers to a Greenwich Mean Noon as the beginning of the day needs to be maintained without discontinuity and,
  - (g) that a 'Modified Julian Day' count satisfying the above requirements is already in use,
- recommends

that the term 'Modified Julian Date' and the symbol MJD be used only for the quantity JD minus 2400000.5, MJD being equal to 0 on 1858 November 17, 0<sup>h</sup> UT.

*Note:* It is recommended that this Resolution be communicated to ISO and other concerned bodies.

L'Assemblée Générale de l'Union Astronomique Internationale,  
considérant

- (a) qu'il existe des besoins de datation selon un système décimal dans des buts divers en liaison avec l'utilisation de signaux horaires et de codes horaires transmis radioélectriquement,
  - (b) qu'il est souhaitable de rapporter une telle datation à 0<sup>h</sup> TU comme début de la journée plutôt qu'à 12<sup>h</sup> TU,
  - (c) qu'un comptage continu des jours, le système des jours de la période julienne, a été depuis longtemps établi pour la datation en astronomie, chronologie, et dans les sciences connexes,
  - (d) qu'il est nécessaire d'éviter la prolifération de systèmes différents de datation,
  - (e) qu'une simple conversion du système classique des jours juliens, ci-dessus mentionné, en un comptage décimal moderne, serait avantageux,
  - (f) que le système de comptage actuel des jours juliens, qui se réfère à un midi moyen de Greenwich comme début du jour, doit être maintenu sans discontinuité, et
  - (g) qu'un système de 'jour julien modifié' satisfaisant aux exigences ci-dessus est déjà utilisé,
- recommande

que le terme de 'jour julien modifié' et le symbole MJD soient utilisés seulement pour la quantité JD moins 2400000.5, MJD étant égal à 0 à la date du 17 novembre 1858, 0<sup>h</sup> TU.

*Note:* Il est recommandé que cette Résolution soit communiquée à l'ISO et aux autres organismes intéressés.

## Resolution No. 5

The General Assembly of the International Astronomical Union recommends, for the determination of  $z$  in the spectrum of objects of large redshifts, the use of vacuum wavelengths of lines, wherever the difference in  $\lambda_0$  is significant.

L'Assemblée Générale de l'Union Astronomique Internationale recommande, pour la détermination de  $z$  dans le spectre des objets fortement déplacés vers le rouge, l'utilisation des longueurs d'onde des raies dans le vide, lorsque la différence en  $\lambda_0$  est significative.

## Resolution No. 6

The General Assembly of the International Astronomical Union,

*recognizing*

that the second of the Système International can be realized in practice with a precision of better than 2 parts in  $10^{13}$ ,

that distances on Earth and in space are measured by times of travel of electromagnetic radiation, and

that the IAU System of Astronomical Constants will be revised within the next three years,

*considers*

that a common value of the speed of propagation of electromagnetic radiation should be used when expressing in metres the results of the most precise measurements of distance, and

*recommends*

that when the most precise value of the speed of propagation of electromagnetic radiation in vacuum is required, the value proposed by the Comité Consultatif pour la Définition du Mètre at their meeting in 1973 June, namely

$$c = 299\,792\,458 \text{ metres per second,}$$

should be used,

that this value of the speed of propagation of electromagnetic radiation should be incorporated in the next revision of the IAU System of Astronomical Constants, and

that the Comité International des Poids et Mesures should maintain this value in any re-definition of the metre.

L'Assemblée Générale de l'Union Astronomique Internationale,

*reconnaissant*

que la seconde du Système International peut être réalisée en pratique avec une précision meilleure que 2 sur  $10^{13}$ ,

que les distances sur Terre et dans l'espace sont mesurées par le temps de parcours de rayonnement électromagnétique, et

que le Système des Constantes Astronomiques de l'UAI sera révisé dans le cours des trois années à venir,

*considère*

qu'une valeur unique de la vitesse de propagation du rayonnement électromagnétique devrait être utilisée lorsque l'on exprime en mètres les résultats des mesures de distance les plus précises, et

*recommande*

que, lorsque la valeur la plus précise de la vitesse de propagation du rayonnement électromagnétique dans le vide est nécessaire, la valeur proposée par le Comité Consultatif pour la Définition du Mètre à sa réunion de juin 1973, c'est-à-dire:

$$c = 299\,792\,458 \text{ mètres par seconde,}$$

soit utilisée,

que cette valeur de la vitesse de propagation du rayonnement électromagnétique soit incorporée dans la révision prochaine du Système des Constantes Astronomiques de l'UAI, et

que le Comité International des Poids et Mesures maintienne cette valeur dans toute éventuelle définition du Mètre.

Resolution No. 7

*Proposed by the Resolutions Committee*

*Proposée par le Comité des Résolutions*

*On the resolutions adopted by Commissions*

Considering the impracticability of giving individual attention to every resolution adopted by each of its Commissions, and having full confidence in its Commissions, this General Assembly wishes to give its endorsement to the Resolutions adopted by its individual Commissions, recommends that astronomers give effect to these Resolutions in so far as they are able, and asks the Executive Committee to insure, inasmuch as possible, the compatibility of the resolutions and to put them into effect.

*Sur les résolutions adoptées par les Commissions*

Considérant qu'il lui est pratiquement impossible d'accorder une attention particulière à chaque résolution adoptée par chacune de ses diverses Commissions et ayant une confiance entière en ses Commissions, cette Assemblée Générale désire exprimer son approbation des Résolutions adoptées par ses différentes Commissions, recommande aux astronomes de les mettre en application dans la limite de leurs possibilités, et demande au Comité Exécutif de veiller, autant que possible, à la compatibilité de ces résolutions et à leur application.

## Commission 4 (Ephemerides/Ephémérides)

'Noting that the ephemerides of most of the natural satellites are based on observations made long ago, and that recent efforts to improve these ephemerides have been greatly hampered by the extreme paucity of recent observations;

Acknowledging that much higher accuracy in the ephemerides of these objects will be required in the near future, not only for earth-based studies, but also for the future exploration of the outer solar system by spacecrafts.

Commissions 4 and 20 urge that a reasonable amount of telescope time be made available for observations useful for the improvement of such ephemerides'.

Commission 4 also unanimously supported Commission's 8 resolution on the improvement of FK4, the addition of faint stars to the catalogue towards the building of FK5. It reads as follows:

'It is recommended that an improvement of FK4 and its extension to a fainter magnitude limit, resulting in a new fundamental catalogue, the FK5, be carried out at the Astronomisches Rechen-Institut, Heidelberg; that observatories throughout the world contribute to this project by providing basic observations, on punched cards if possible; and that all information pertinent to the formation of the FK5 be transmitted to the Astronomisches Rechen-Institut with the observations.'

### *Physical Ephemeris of Mars*

A proposed resolution on new parameters for the physical ephemeris of Mars has been set up. It was explained by Dr de Vaucouleurs. The period of rotation has been improved by Ashbrook in 1953, and Mariner 9 has given better knowledge of the planet. Definitive landmarks being available on the surface of the planet, time has come for a new set of parameters to be used after 1979. (Ref. G. de Vaucouleurs *et al.*, *J. Geophys. Res.* **78**, No. 20, 4395, July 1973.)

This resolution reads as follows:

'Considering that during the past three years new determinations of the elements of Mars have indicated the need for a revision of the elements currently adopted in the physical ephemeris of Mars and that a new definition of the origin of the areographic longitudes has been proposed for the Mariner 9 cartographic products (G. de Vaucouleurs, M. E. Davies and F. M. Sturms, Jr., *J. Geophys. Res.*, in press),

Commission 4 recommends:

(1) that the new elements and new definition of the origin of the areographic longitudes given below be incorporated in the physical ephemeris of Mars after 1979 or as soon as deemed practicable in the judgement of the cognizant Directors of the National Ephemeris Offices, but not before the tie between the new and current systems has been firmly established by appropriate comparisons between the ground-based and Mariner 9 coordinate systems.

The new elements are as follows:

1. Celestial coordinates of North Pole of Mars (referred to the 1950.0 equinox).

$$\begin{aligned}\alpha_0 &= 317^{\circ}32 - 0^{\circ}1011 T \\ \delta_0 &= + 52^{\circ}68 - 0^{\circ}0570 T,\end{aligned}$$

where the second terms are the Mars precession rates and  $T$  is measured in Julian centuries from JD 2433282.5 (Jan 0 1950.0) The corresponding inclination of the Mars equator to the Mars orbit is

$$I = 25^{\circ}19969 + 0^{\circ}01219T + 0^{\circ}00006 T^2,$$

2. Angle measured along the Mars equator from the ascending node on the mean 1950.0 Earth equator to the Mars *autumnal* equinox

$$\Delta_{50} = 42^{\circ}93538 - 0^{\circ}09040 T - 0^{\circ}00010 T^2.$$

(6) The recommendations made by Commission 8 at the XIV General Assembly concerning the inclusion of a number of faint stars up to the 9th magnitude (especially of FKSZ stars) into the fundamental catalogue is re-affirmed. The inclusion of FKSZ stars in fundamental observational programmes is recommended. Of special importance are absolute and differential meridian observations of the FKSZ stars together with FK4 stars in the southern sky (declinations from  $+30^\circ$  to  $-90^\circ$ ).

(7) It is recommended that the work of the Study Group on Astronomical Refraction that has been formed by Commission 8, should continue to be supported.

(8) Commission 8 re-affirms recommendations of the previous General Assemblies of the IAU on the following urgent programmes of meridian observations: 'Bright Stars' (BS), 'Double Stars' (DS), 'Latitude Stars' (LS) and 'Zodiacal Stars' (ZS). The Commission recommends also the new meridian programme: 'Reference Stars in the Areas with Galaxies of the Pulkovo Programme' (PS). The star lists for these programmes may be obtained from various observatories, as follows:

(BS), (DS), US Naval Observatory, Washington;

(LS), Sternberg Astronomical Institute in Moscow;

(ZS), Nikolajev Observatory, or, for a shorter list, Royal Greenwich Observatory, Herstmonceux.

(PS), Pulkovo Observatory.

Participation of the southern hemisphere observatories in these programmes is especially important.

(9) Commission 8 recommends the establishment of a Working Group charged with the following duties:

(i) To coordinate the various astrolabe programmes specially designed for the revision of the positions of the bright fundamental stars; and

(ii) To study the possibility of producing a homogeneous catalogue as a synthesis of existing astrolabe catalogues, to be updated each time a fresh catalogue is published.

(10) Commission 8 takes the view that the provision of a stellar reference system with one star per square degree, reaching magnitude 9.5, with positions known to 0.01 arc second, would be a major goal to reach in the future. The existence of such a reference system would have a spectacular influence on most of the astrometric programmes. Consequently the Commission recommends that detailed studies be made of all space and other astrometry projects that have the potentialities to attain this goal.

(11) The elaboration of a new international refraction table is needed. Therefore, Commission 8 concludes that the Soviet astronomers' proposals for revision of the Pulkovo Refraction Table and for active cooperation with the Commission 8 Study Group on Astronomical Refraction in this connection are very welcome, and should be accepted.

3. Angle from the Mars *vernal* equinox to the Mars prime meridian.

$$V = 148^{\circ}24 + 350^{\circ}892017 (\text{JD} - 2433282.5),$$

where the constant term is consistent with the new definition of the origin of areographic longitudes by the center of a small crater (Airy-0) and the rotation rate with a new determination of the rotation period (de Vaucouleurs *et al.*, *loc. cit.*).  $V_0$  may require a small zero point correction when the relation between coordinates in the current ephemeris and in the Mariner 9 system has been finally established (Davies and de Vaucouleurs, work in progress).

(2) that the present investigations be continued in order to establish precisely the tie between the new and the current systems, and

(3) that a recomputation of the physical ephemeris based on these new elements be prepared for the years 1800 to 1979.'

It was remarked that  $V_0 = 148^{\circ}24$  might be a provisional value and that the usual quantity  $\varphi_0$  is equal to  $\Delta_{50} + 180^{\circ}$ . It would be useful to compute the ephemeris back to the first observation of landmarks by Cassini in 1672.

The resolution was unanimously accepted after some remarks from Dr O'Handley, Dr Wilkins and Dr Mulholland from which it appeared that the change to be introduced will be less than 1/10th of a degree in longitude (5 km). It appeared also that the radar resolution is at most 10 km.

## Commission 8 (Positional Astronomy/L'Astronomie Position)

### V. RESOLUTIONS

The Commission has discussed the Resolutions submitted by IAU Colloquium No. 20 on Meridian Astronomy, held in Copenhagen, September 25-28, 1972. The President proposed a revision of some of these resolutions after consultation with members of the Commission from the Pulkovo Observatory and the U.S. Naval Observatory. Furthermore, members of the Commission proposed additional resolutions. As the result of the discussion the following resolutions were unanimously adopted:

(1) The recommendation made by Commission 8 at the XIV General Assembly concerning the development of new instrumentation and techniques is re-affirmed. In particular, the provision of a modern transit circle for the Tokyo Astronomical Observatory is strongly recommended. It is further recommended that a Study Group be established for horizontal meridian circles.

(2) It is recommended that an improvement of the FK4 and its extension to a fainter magnitude limit, resulting in a new fundamental catalogue, the FK5, be carried out at the Astronomisches Rechen-Institut, Heidelberg; that observatories throughout the world contribute to this project by providing basic observations, on punched cards if possible; and that all information pertinent to the formation of the FK5 be transmitted to the Astronomisches Rechen-Institut with the observations.

(3) It is recommended that meridian catalogues should include, in addition to the tabular magnitude on a recognised system, an indication of the screen or screens used for each star, so that the approximate magnitude at which the star appeared to the observer can be deduced.

(4) It is recommended that programmes of observations of fundamental stars, with meridian circles and astrolabes, should include members of the solar system.

(5) The recommendation made by Commission 8 at the XI General Assembly concerning the formation of catalogues of the Southern Reference Stars (in different zones) is amended in the sense that the individual observations of the whole southern sky be made available to the US Naval Observatory and that this observatory should send all basic data to the Pulkovo Observatory and, on request, to other institutions. The discussion of all observations and the compiling of the SRS catalogue for the whole southern sky may be made at the Pulkovo Observatory and at the US Naval Observatory. Concerning the best possible system of the SRS catalogue, consultations shall take place between the Astronomisches Rechen-Institut at Heidelberg, the Pulkovo Observatory and the US Naval Observatory.



# Symposium No. 61, New Problems in Astronomy

Perth, Australia, August 13-17, 1973

## Resolutions

*Resolutions of the IAU Symposium No. 61 'New Problems in Astrometry'  
endorsed by Commissions 8, 24, 33 and 40*

1. This Symposium recognises the inadequacy of the existing optical astrometric data to meet modern requirements for precision positions and proper motions. It therefore urges that the great accuracy of radio positions and the potentiality of new optical and space techniques should be fully exploited. Both absolute and differential observations are necessary, and it is particularly important that observations in the southern hemisphere should not be allowed to lag behind the north as they do at present in both optical and radio-astrometry.

2. This Symposium urges as the first priority the compilation by 1980 of an FK5 catalogue. The new reference frame must be extended to faint stars and extragalactic objects. This requires the vigorous continuation and, in fact, completion, especially in the Southern Hemisphere, of current programmes of photographic astrometry and, in addition, the development and exploitation of new photographic, radio and space techniques.

3. This Symposium notes the existence of the Working Party established by Commission 40 to draw up a list of suitable objects for positional calibration of radio observations and urges co-operation between it and Commissions 8 and 24 to ensure as complete an integration as possible of the radio and optical astrometric fundamental programmes.

## Commission 10 (Solar Activity/L'Activite Solaire)

### SPECIAL PROGRAMS DURING THE YEARS OF SOLAR MAXIMUM

The International Astronomical Union

*noting* that the next maximum in solar activity is expected to occur in 1979,  
*urges* governmental and scientific agencies to implement special programs during the years of solar maximum to provide the data from space and ground which are necessary for studies of the active Sun.

### ABSOLUTE CALIBRATION OF SOLAR RADIO FLUX MEASUREMENTS

The International Astronomical Union

*considering*

(a) that URSI Commission V noticed in 1966 important disagreements among absolute calibrations of microwave solar radio flux made at different stations;

(b) that most of the important disagreements were successfully removed before its General Assembly in 1972, and that the technique of making absolute calibrations has been established;

(c) that regular world-wide observations with an accuracy of a few parts in 100 are practicable only through a continuing international coordination;

(d) that IAU Commission 10 has long desired improvement of homogeneity in the field of solar activity survey;

*expresses* thanks to URSI Commission V for its successful work on radio flux calibrations; and  
*decides* that Commission 10 takes over the responsibility for the continuation and future applications of the work done by URSI Commission V.

### INTERGOVERNMENTAL ORGANIZATION FOR AN INTERNATIONAL SOLAR OBSERVATORY

The International Astronomical Union

*being aware* of the explorations made by astronomers from a number of IAU member countries during the last five years to find an excellent site for solar observations;

*having been informed* of the interim results during which some 40 prospective sites have been investigated, which have led to the identification of three very promising prospective sites that will be subjected to final testing with medium-sized solar telescopes during the years 1973 and 1974;

*realizing* the far-reaching scientific importance of solar observations that would be performed from a site with really excellent seeing;

*realizing* further that a truly international solar observatory can be established only as an inter-governmental organization;

*urges* the governments of the relevant member countries to examine the possibility of establishing such an organization, if the final exploration of the sites shows at least one of them to have excellent daytime seeing;

*draws* attention to the importance of such an observatory being accessible to visitors, not only from the member states but also from other countries; and

*asks* that measures to that end be examined when establishing the final structure of the Joint Organization for Solar Observations as an intergovernmental organization.

## Commission 14 (Fundamental Spectroscopic Data/Donnée Spectroscopique fondamentales)

### IMPORTANCE OF SPECTROSCOPIC DATA

The International Astronomical Union,  
considering the great advances in astronomical observations throughout the electromagnetic spectrum from radio to X-ray frequencies, and  
recognising the crucial importance of reliable numerical values of properties of atoms and molecules, many of which are at present lacking, if the full value and understanding is to be obtained from astronomical observations  
urges all who provide financial support for astronomy to support also the measurement and calculation of relevant atomic and molecular properties.

## Commission 15 (Physical Study of Comets, Minor Planets and Meteorites/l'Etude Physique des Comètes, des Petites Planètes et des Meteorites)

### 1. *Resolution concerning Early Space Missions to Comets and Asteroids*

*Whereas* Comets, unlike planets, probably still preserve the original composition of early condensation in the solar system, possibly including complex carbon compounds;

*Whereas* the interaction of a cometary atmosphere with the solar wind constitutes a natural plasma laboratory impossible to simulate;

*Whereas* Comet observations can provide information about the solar wind in inaccessible regions of space after calibration by space probes; and

*Whereas* most Asteroids represent matter aggregated in different regions of the primordial solar nebula than the planets or the comets.

Therefore the XVth General Assembly of the International Astronomical Union strongly recommends Early Space Missions to Comets and to Asteroids in continuing programs.

### 2. *Resolution concerning Priorities in Cometary Research*

The transient and unpredictable appearance of most comets prevents cometary astronomers from scheduling time on large telescopes.

In order to overcome the deficiency in cometary data, the XVth General Assembly of the International Astronomical Union strongly recommends the priority allocation of time for cometary observations on larger telescopes.

Commission 16 (Physical Study of the Planets/L'Etude Physiques des Planètes et des Satellites)

RESOLUTION ON THE PHYSICAL EPHEMERIS OF MARS

(Adopted by Commissions 4 and 16)

Considering that recent new determinations of the rotational elements of Mars indicate the need for a revision of the elements currently adopted in the physical ephemeris of Mars, and that a new approach to the definition of the origin of areographic longitudes appears useful (G. de Vaucouleurs, M. E. Davies and F. M. Sturms, Jr, *J. Geophys. Res.* 78, 4395, 1973), Commissions 4 and 16 recommend

(1) that new elements and a new definition of the origin of the areographic longitudes, as given below, be incorporated in the physical ephemeris of Mars after 1979 or as soon as deemed practicable in the judgment of the cognizant Directors of the National Ephemeris Offices, but not before the tie between the new and current systems has been firmly established by appropriate comparisons between the ground-based and Mariner 9 coordinate systems.

The new elements are as follows:

(a) The R.A. and D of the North Pole of Mars (referred to the standard equinox and equator of 1950.0) are given by

$$\begin{aligned}\alpha_0 &= 317^{\circ}32 - 0^{\circ}1011 T \\ \delta_0 &= + 52^{\circ}68 - 0^{\circ}0570 T,\end{aligned}$$

where  $T$  is measured in Julian centuries of 36525 days from JD 2433282.5.

(b) The angle measured in the direct sense along the Mars equator from its ascending node on the standard equator of 1950.0 to the zero point of areocentric RA is given by

$$\phi_0 = 222^{\circ}93538 - 0^{\circ}09040 T - 0^{\circ}00010 T^2.$$

(c) The areocentric RA of the prime meridian of Mars is given by

$$V = V_0 + 350^{\circ}892017 (JD - 2433282.5).$$

The Julian Date is reckoned in ephemeris time. The provisionally adopted value of  $V_0$  is  $148^{\circ}24$ . The rotation rate results from a new analysis of the observations of the past century (de Vaucouleurs *et al.*, *loc. cit.*).

The following notes on the preceding statement of the elements are intended for explanatory purposes only.

(i) the linear terms in the expression for  $\alpha_0$  and  $\delta_0$  correspond to a precession of the axis of rotation about the pole of the orbit at the rate of  $0^{\circ}0837$  per century.

(ii) the corresponding inclination of the equator to the orbital plane of Mars is given by

$$I = 25^{\circ}19969 + 0^{\circ}01219 T + 0^{\circ}00006 T^2$$

(iii) the zero point of areocentric right ascension corresponds to the vernal equinox (i.e. the ascending node of the orbital plane on the equator of Mars).

(iv) the adopted prime meridian is intended to be such that the center of the small crater Airy-0 has zero areographic longitude.

(2) that the present investigations be continued in order to establish precisely the tie between the new and the current systems, and

(3) that a recomputation of the physical ephemeris based on these new elements be prepared for the years 1800 to 1979.

RESOLUTION ON SATELLITE COORDINATE SYSTEMS

For all satellites except the Moon, the origin of longitude is defined by the sub-planetary intersection of the satellite's equator and the plane containing the center of the satellite, the planet and the Sun at the first superior heliocentric conjunction of the satellite after 1950.0. The conventions for the direction of increasing longitude and for the choice of north pole shall be the same as adopted for the planets at the IAU 14th General Assembly in 1970.

## Commission 17 (The Moon/La Lune)

### Resolution on Lunar Nomenclature

“*Commission 17 recommends* for adoption the following resolutions concerning lunar nomenclature.

(1) The abundant data secured by space vehicles have made possible new programs of lunar mapping, which require a more precise and detailed system of nomenclature than the current system originated by Mädler. The revised system employs a geometrical grid of Regions and Provinces.

(2) In the new system, parallels of latitude and meridian arcs divide the lunar surface into 144 Regions, as in the NASA Lunar Aeronautical Charts (LAC), on the scale 1:1000000, Figure 1. (For details see Robert Carder, *The Moon*, IAU Symposium 14, p. 17). Each region is subdivided into sixteen Provinces, as in the NASA Lunar Topographic Orthophotomaps (LTO), on the scale 1:250000. Each Province carries a code designation, consisting of its LAC Region number, followed by a letter A, B, C, or D and a number 1, 2, 3, or 4. For example, Figure 2 illustrates the coding for Province 39 A 1.

(3) Consistent with standard cartographic practice, each Region and each Province will also bear the name of some prominent feature (preferably a crater) within it. Names of Provinces will not duplicate those of Regions.

(4) A grid system may be used for further identification of features within a given Province. Abscissae are indicated by one of the capital letters A–Z (I and O are omitted), from west to east. Ordinates are indicated by one of the lower-case letters a–z (i and o omitted), from south to north. This letter system is primarily for identification and reference and will not generally be used on the maps.

(5) The Greek letters previously indicating lunar elevations will be dropped. Craters previously designated by Roman capital letters will progressively be assigned new and distinctive names. To facilitate cross correlation between the current and the new system, the old names should be listed on the larger-scale maps. At an appropriate time a complete cross-reference table will be prepared.

(6) Elevated regions will generally require new designations. Ridges, previously unnamed, will be called Dorsum, plural Dorsa. Rimae and Rima systems will receive new and more appropriate designations. Crater chains will be designated Catena, such as Catena Davy.

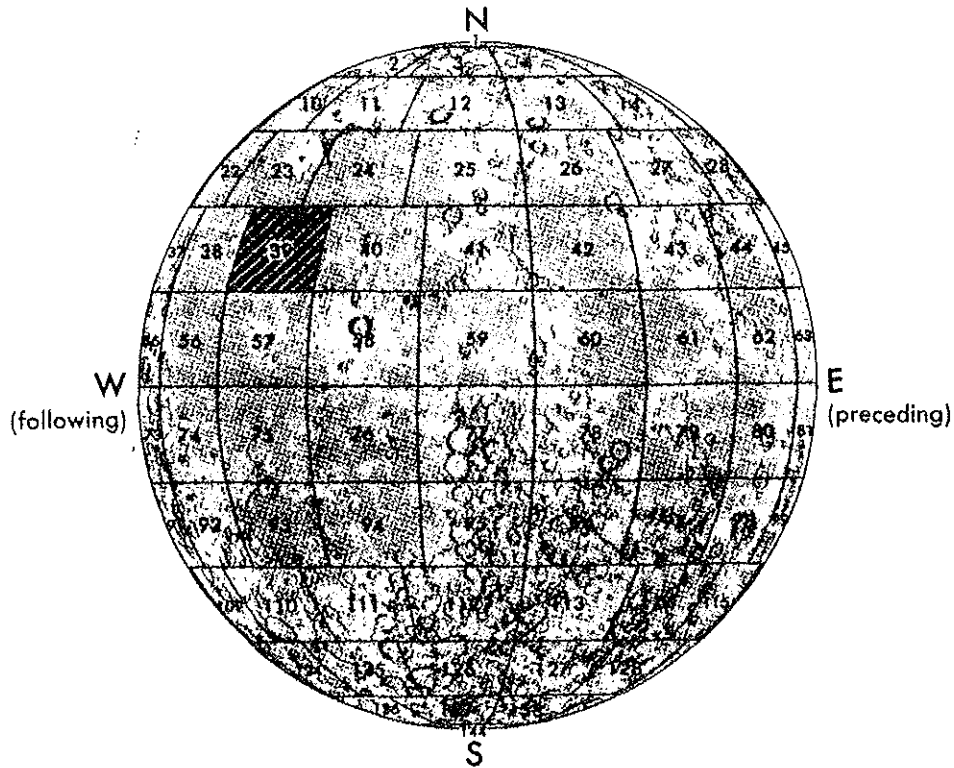
(7) Whereas previously assigned lunar names have been, with few exceptions, those of distinguished deceased scientists, future assignments may also contain the names of distinguished, deceased contributors to human culture and knowledge, such as writers, painters, musicians, etc., chosen on an international basis. Excluded, however, are political, military, and religious figures, as well as modern philosophers.

(8) Very small features requiring identification for some special reason may be assigned, with IAU approval, first names, male or female, from an international list. Excluded, however, are names having more than three syllables.

(9) For operational purposes, such as designating areas specially explored or sampled, Apollo missions have assigned names to certain features in the vicinity of the respective landing sites. The list\* was corrected and revised by the Working Group in consultation with the astronauts and Principal Investigators of the Apollo missions. The IAU requests that future lists of this type be submitted to the IAU in advance of the mission.

(10) The complete corrected list of the adopted names is published in Appendix I. The list contains the name of M. Minnaert, who died shortly after the 1970 General Assembly. It contains also the name of Abbot (C. G.), who is still living.\*\* It was assigned to honor Abbot's 100th birthday.”

# THE MOON



## EAST-WEST DIRECTION

Orientation of cardinal directions is in accordance with resolution adopted by the IAU General Assembly, 1961.

Figure 1

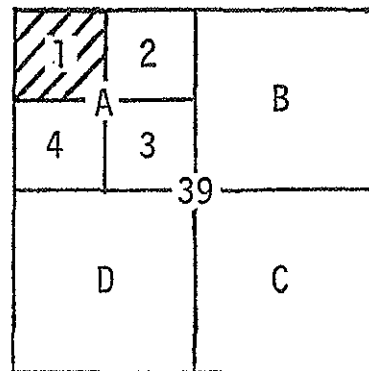


Figure 2

## ADMINISTRATIVE SESSION OF THE WHOLE COMMISSION 17

The meeting was called to order on August 28 morning by A. Dollfus, President. He presented, in French, the following agenda:

- (1) Resolution on fundamental craters.
- (2) Recommendation on scientific priorities.
- (3) Resolution on lunar nomenclature.
- (4) Composition of Commission for 1973-76.
- (5) Structure of Working Groups.

The Agenda was agreed upon.

Under Item (1) of the Agenda, the following Resolution was presented by Th. Weimer, read by G. O'Keefe, and accepted after a short discussion with unanimity.

### Priorities in the Study of the Moon (1973)

“The *International Astronomical Union* and the *Inter-Union Commission for Lunar Studies* having, at the end of 1973, reviewed and discussed the scientific priorities to be recommended for the continuation of the study of the Moon, realize that:

– The underlying justification for lunar studies is the light which it can cast on the origin and evolution of the Solar System as a whole.

– Extensive programmes of investigation and exploration have been developed over the past few years, including: six manned lunar missions; the operation of instrumentation on the lunar surface, aboard both fixed and mobile automatic stations; remote sensing by lunar orbiters; ground-based optical, radio, radar and laser techniques; and the analysis of lunar samples returned to Earth. Coordination of many of these programmes has been particularly well developed.

– As a result of this intensive effort, very basic progress has been made in elucidating fundamental problems such as the origin of the Moon, the ages of various surface features, the effects of meteoroidal bombardment, the Moon’s thermal history, the formation of a thick lithosphere, processes of melting and magmatic differentiation, etc.

– Because of gaps which remain, both in the data presently available and in our theoretical understanding, a number of important questions about the nature of the Moon cannot yet be answered.

– In connection with these studies of the Moon, research on other Solar System bodies is likewise being directed toward laying bare the overall structure and history of the Solar System.

This research includes coordinated fly-by, orbiting or landing missions for all planets out to and including Saturn, as well as the study of some of their satellites; it will be accomplished in parallel with ground-based operations and theoretical studies. Work on asteroids, comets, meteorites and the interplanetary medium will be intensified.

– These studies will permit major advances in our knowledge of planetary processes, and will enhance the value of the lunar work; at the same time, they will be dependent on lunar studies for clarification of many points in the overall history of the Solar System, such as accretion processes, cosmochemistry, bombardment histories, etc.

From these considerations it is clear that the study of the Moon should be pursued at an intense level during the next coming decade. The *International Astronomical Union* and the *Inter-Union Commission for Lunar Studies* recommend the following further objectives for the study of the Moon.

(1) Data concerning the shape, orbital motion and dynamics of the Moon need to be improved. For this purpose both a continued extensive ground-based observational programme and high-precision tracking of lunar orbiters are required.

(2) A programme of in-situ lunar surface studies should be continued. The importance of remotely controlled roving vehicles is stressed; these offer the possibility of reaching lunar terrains of different types, of returning samples and of carrying sophisticated geophysical, chemical and imaging instrumentation.

(3) Physical and chemical parameters relating to the lunar surface and interior, having been evaluated in detail at landing sites and to a lesser degree but more widespread extent by orbiting vehicles, should now be extended to achieve whole-Moon coverage and to include new techniques. This task could be undertaken by high-inclination orbiting vehicles, supported by ground-based research.

(4) Increased activity should be fostered at an international level and on a pluridisciplinary basis, both with regard to the interpretation of available lunar data and to the mutual interaction with results from other Solar System objects. Special importance should be attached to the safeguarding, processing and wide dissemination of the body of material acquired.

It is anticipated that, with this basic minimum programme for the Moon, combined with the simultaneous studies of the other bodies of the Solar System, the fundamental problem of the origin of the Solar System could be greatly clarified during the next decade.”

## Commission 19 (Rotation of the Earth/Rotation de la Terre)

### Resolution Adopted by Commission 19:

*whereas* new methods have been developed for determining the angular position of the Earth by long baseline radio interferometry and by laser range measurements to the Moon and to artificial satellites; and

*whereas* the accuracy expected from these techniques for determining polar motion, UT1, and crustal movements is very high; and

*whereas* more accurate determination of these quantities is expected to give valuable information on earthquake mechanisms, on the transfer of angular momentum between the atmosphere and the Earth, and on interaction between the core and the mantle; and

*whereas* the importance of some of this information is great for practical applications as well as for scientific purposes;

*it is therefore recommended that:* preliminary multi-national and global networks of stations to determine polar motion and Earth rotation by these techniques be established; and

*that* these global networks be operated for a long enough time to permit both an evaluation of the accuracies achievable by these techniques and a comparison of the results with those obtained by other methods; and

*that* additional technical developments be undertaken to improve further the accuracy of these methods.

## Commission 20 (Minor Planets, Comets and Satellites/Petites Planètes, Comètes et Satellites)

### Resolutions

(1) Noting that the statistics of the minor planets are complete only to a mean opposition magnitude of about 15, and that many of the families of minor planets therefore contain very few known members;

recognizing that certain classes of unusual minor planets (Apollo and Amor objects, objects with high orbital inclinations, objects whose motions are commensurable with that of Jupiter, etc.) appear to be underrepresented among the numbered objects and in minor-planet surveys;

Commission 20 urges observers to search for and to report unusual objects.

The Commission points out that it is still scientifically useful to discover and follow up main-belt objects.

(2) Observers of positions of comets are urged also to note and report physical characteristics whenever possible. Of particular interest are:

Brightness, distinguishing between 'total' ( $m_1$ ) and 'nuclear' ( $m_2$ ) magnitudes;

Dimensions and any distinctive properties of the coma, such as asymmetries or other unusual brightness distribution;

Length, orientation and structural characteristics of the tail, if any.

Notice of unusual activity should be communicated by telegram or airmail letter to the IAU Central Telegram Bureau.

(3) Noting that the ephemerides of most of the natural satellites are based on observations made long ago, and that efforts to improve the ephemerides have been hampered by the paucity of recent observations;

acknowledging that much higher accuracy in the ephemerides of these objects will soon be required, particularly for the exploration of the outer solar system by spacecraft;

Commission 20 urges that a reasonable amount of telescope time be made available for observations useful for the improvement of satellite ephemerides. (This resolution was endorsed by Commission 4.)



## Commission 24 (Photographic Astrometry/Astrométrie Photographique)

The following resolutions were proposed and carried unanimously; a preliminary text of Resolution No. 1 had previously been endorsed by a joint meeting of Commissions 8, 24, 33 and 40 which was held on 25 August.

1. Commission 24, taking note of Resolutions No. 1 and 2 of IAU Symposium No. 61, emphasises

(a) the extreme importance to fundamental and stellar astronomy of the Yale-Columbia programme for the determination of proper motions relative to extra-galactic objects in the southern hemisphere; it therefore urges that the full programme of first epoch photography in two colours should be completed as soon as possible, and arrangements made to ensure that second epoch photography should start within the next five years.

(b) the potential value of new optical, radio and space techniques for astrometry, and supports programmes for the measurement of proper motions and parallaxes which may be devised for the Large Space Telescope and other space projects.

2. Commission 24 urges that regular and continuing allocation of observing time on suitable large telescopes be made for programmes of trigonometric parallaxes and proper motions of faint stars.

3. Commission 24, noting the extremely favourable position close to the Equator of the new observatory in Venezuela and the urgent need for basic astrometric data in the southern sky, recommends as highly desirable fields of work

(a) trigonometric parallax observations, especially of stars in the southern hemisphere

(b) positional observations in the equatorial zone between declinations  $+30^\circ$  and  $-30^\circ$ , with specially high priority for the portion between  $0^\circ$  and  $-30^\circ$ .

4. Commission 24, noting the key role played by astrometric data in the solution of many of the most important problems of astrophysics, urges that the methods and achievements of astrometry should be regarded as an integral part of the education of young astronomers.

5. Commission 24 notes with admiration the speed, accuracy and adaptability of the automatic plate scanning and measuring machine developed for the Palomar Schmidt Proper Motion Survey and its great potential for other astronomical problems. It therefore urges that this machine be kept in commission and made available to qualified investigators after the termination of the present project.

## Commission 26 (Double Stars/Etoiles Doubles)

### 6. PUBLICATION DES MESURES

Le Président rend compte de sa négociation avec les éditeurs de *Astronomy and Astrophysics* destinée à résoudre les problèmes que la publication des mesures avait fait surgir à une certaine époque. Il a été convenu que celles-ci seraient généralement publiées—ainsi que la plupart des orbites—dans les Supplement Series, pour des raisons d'ordre pratique et budgétaire et qu'il serait tenu compte des recommandations de la commission en cette matière. L'accord conclu avec les éditeurs de la revue a fait l'objet d'une publication dans la Circulaire d'Information No. 58—annexe (nov. 1972) de la Commission, éditée par P. Muller. Il prévoit également un groupement, dans la mesure du possible, des séries de mesures et des calculs d'orbites dans un minimum de fascicules.

De tels accords pourraient être passés avec d'autres grandes revues astronomiques où sont publiées des mesures d'étoiles doubles et des orbites, afin d'assurer la régularité de leur publication mais aussi le respect des recommandations de la Commission (rappelées dans la circulaire citée).

La Commission approuve cette suggestion. J. Dommanget est chargé de poursuivre sa tâche auprès de *Astronomy and Astrophysics*, cette revue ayant demandé que la Commission désigne officiellement son représentant. Le nouveau Président, S. L. Lippincott pourrait jouer un rôle identique auprès des grandes revues astronomiques américaines.

## 7. RECOMMANDATIONS (voir *Transactions XVA*, p. 309)

### (a) *Publication des Mesures*

Voir ci-dessus: 6.

#### (a) *Publication des mesures*

Vu les difficultés rencontrées dans plusieurs pays par les observateurs d'étoiles doubles visuelles dans la publication de leurs mesures, plusieurs membres de la Commission ont demandé qu'une action soit entreprise en vue de régler d'urgence ce problème.

Le Président propose qu'à l'instar de ce qui a été conclu avec *Astronomy & Astrophysics*, un accord soit recherché entre la Commission elle-même et les éditeurs des diverses revues concernées, par l'intermédiaire d'un représentant national ou régional, choisi par la Commission.

A cette occasion, remarquons que de nombreux voeux et recommandations ont été émis dans le passé par la Commission, mais ne sont pas toujours suivis, particulièrement en ce qui concerne précisément les publications.

Aussi, le Président de la Commission a profité de l'accord avec la revue *Astronomy & Astrophysics*, pour les rappeler (voir: *Circulaire d'Information*, No. 58, Annexe). Il propose qu'il en soit fait de même à l'occasion des accords pouvant intervenir avec les autres revues.

#### (b) *Révision de l'Index Catalogue*

La Commission marque un vif intérêt au projet de C. E. Worley d'une révision de l'Index Catalogue, consistant dans l'adjonction des couples nouveaux et dans la recherche systématique des erreurs qu'il contient. P. C. Couteau estime particulièrement satisfaisant, le délai de cinq ans proposé pour l'achèvement du travail, le survey qu'il poursuit en collaboration avec P. Muller devant alors toucher à sa fin.

Comme proposé dans une récente lettre par C. E. Worley, la Commission décide de ne pas entamer dès maintenant une discussion approfondie des modalités d'exécution de ce travail, mais de procéder par lettre-circulaire, pour connaître les suggestions de chacun.

Le Président félicite C. E. Worley pour le travail déjà accompli (la recherche des erreurs et leur correction a porté sur les  $\frac{2}{3}$  du travail et a nécessité le traitement de quelque 300000 cartes). Il remercie le U.S. Naval Observatory et son directeur, K. Aa. Strand de mettre à la disposition de C. E. Worley, le personnel et les moyens nécessaires à sa tâche.

#### (b) *Nouvelle édition de l'Index Catalogue*

Étant donné le nombre impressionnant de découvertes de couples nouveaux et le nombre de corrections à apporter à ce catalogue, C. E. Worley pose la question de savoir si une nouvelle édition de celui-ci ne devrait pas être prévue dans un assez proche avenir (5 ans peut-être). Dans ce cas, un agenda devrait être établi dès à présent et les propositions éventuelles, être discutées.

#### (c) *Diffusion des Publications*

La Commission adopte le voeu de J. Dommanget de voir chacun de ses membres adresser, dans la mesure du possible, des tirés-à-part de ses travaux à tous ses collègues de la Commission.

#### (c) *Diffusion des publications des membres de la Commission*

J. Dommanget propose la recommandation suivante:

La Commission des Étoiles Doubles souhaite que chacun de ses membres adresse régulièrement, autant que possible à tous les autres membres, des tirés-à-part (reprints) de ses publications.

(d) *Terminologie Relative à la Parallaxe Dynamique*

Parmi les réponses reçues des membres absents au sujet de cette recommandation, certaines expriment des remarques ou objections qu'il y aurait lieu de discuter devant une assemblée plus vaste. Aussi, sur proposition de l'auteur même de la recommandation, la Commission décide d'en reporter l'examen à la prochaine Assemblée Générale

J. Dommanget profite toutefois de l'occasion pour rappeler que sa proposition porte principalement sur la distinction essentielle à faire entre les parallaxes dynamiques orbitales et non-orbitales, sous peine de voir le crédit accordé aux parallaxes dynamiques, très sérieusement affecté. Trop d'astronomes ne connaissent pas cette distinction et portent dès lors un jugement regrettable sur la qualité des parallaxes orbitales car ils les confondent avec celles données par exemple par H. N. Russell et C. E. Moore dans le tableau 53 de 'The Masses of the Stars'. Ces dernières sont en effet non-orbitales, c'est-à-dire calculées sur une base statistique tenant compte seulement du mouvement relatif des composantes en un point de la trajectoire, en l'absence d'orbite connue.

(d) *Terminologie relative à la parallaxe dynamique*

A la suite d'un exposé fait par J. Dommanget lors du *Colloque UAI*, No. 18 (Swarthmore) sur la parallaxe dynamique, le problème de la terminologie dans ce domaine, est apparu, sur proposition de W. Heintz, comme devant faire l'objet d'une décision de la Commission des Étoiles Doubles (voir: IX a, du présent Rapport).

De cet exposé, dont un manuscrit détaillé est en cours de publication, on retiendra la proposition suivante:

*La parallaxe dynamique*, au sens large, se calcule comme étant la solution de l'une quelconque des relations dynamiques caractérisant le mouvement relatif de deux corps (expressions de la constante des aires, de la vitesse ou de l'accélération; loi harmonique) dans laquelle on introduit une valeur ou expression de la masse.

Aussi, la parallaxe dynamique est dite '*orbitale*' lorsque l'on se sert de la loi harmonique, seul cas où les éléments orbitaux sont exigés, tandis qu'elle est dite '*non orbitale*' lorsqu'on se sert des autres relations.

Par ailleurs, si la masse totale est posée égale à la masse solaire, on a affaire à la '*parallaxe (dynamique) théorique*', laquelle joue un rôle dans certains développements théoriques;

si la masse totale est posée égale à 2 masses solaires, on a affaire à la '*parallaxe (dynamique) hypothétique*', liée à la valeur moyenne la plus probable de la masse totale d'un couple;

si la masse totale est exprimée à l'aide de la relation masse-luminosité, on a affaire à la '*parallaxe dynamique*' au sens habituel, mais restreint.

Encore faut-il préciser *chaque fois*, s'il s'agit d'une parallaxe orbitale ou non-orbitale.

## Commission 28 (Galaxies/Galaxies)

### RECOMMENDATION

Commission 28 recommends that a co-ordinate numbering system be adopted for all future catalogues of radio sources, X-ray sources, QSOs, galaxies, clusters of galaxies, etc. For general purpose catalogues of the order of  $10^5$  objects the present 8-digit Parkes system is recommended. The first four digits give the hours and minutes of R. A., the fifth the sign of the declination and the remaining three the degrees and truncated tenths of a degree of declination for the mean equator and equinox of 1950. For special purposes such as occur in dense clusters of galaxies, it is recommended that the eight-digit system be extended as necessary.

## Commission 31 (Time/L'Heure)

### RESOLUTION NO. 1 BY COMMISSIONS 4 AND 31

(Adopted 25 August 1973)

*Considering:*

- (a) that a single worldwide coordinated clock time scale based upon the SI second is desirable,
- (b) that the Coordinated Universal Time system (UTC) makes the International Atomic Time (TAI), which is based on the SI second, generally available, and
- (c) that the UTC system provides mean solar time directly to a precision that is needed for navigation and surveying,

*Recommend:*

the adoption of the UTC system as the basis for the dissemination of standard time (heure normale) in all countries.

### RESOLUTION NO. 2 BY COMMISSIONS 4 AND 31

(Adopted 29 August 1973)

*Considering:*

- (a) that TAI equalled UT2 (nominally) when UT2 was 1958 January 1<sup>d</sup>, 0<sup>h</sup> 0<sup>m</sup> 0<sup>s</sup>,
- (b) the necessity of maintaining all conventional calendrical and time designations,
- (c) the desirability of bringing into accordance ET and TAI, which differ by about 32s;

*Recommend:*

- (1) that a change be introduced in the TAI as soon as practicable so that TAI (new) equals TAI (old) plus 32 seconds precisely,
- (2) that DTA (DAT) be defined by TAI minus UTC, where DTA is an integral number of seconds,
- (3) that the CCDS be invited to take the necessary action.

*Explanation:*

- (1) TAI is not affected by leap seconds but UTC is.
- (2) The value of DTA is determined and announced by the BIH.
- (3) UTC is the basis of standard time, the time in common (civil) use, as disseminated by radio time signals.

### RESOLUTION NO. 3 BY COMMISSIONS 4 AND 31

(Adopted 29 August 1973)

This was adopted by the General Assembly specifically because of its wide importance (Resolution No. 4).

### RESOLUTION NO. 4 BY COMMISSIONS 4 AND 31

(Adopted 29 August 1973)

*Considering:*

- (a) that present procedures governing the insertion of leap seconds have been variously interpreted and,
- (b) that if the present trend of the rotation of the earth continues, it will become impossible to maintain UTC within the present limits by the insertion of leap seconds on two preferred dates only and,
- (c) that it is important for many users to have UT1 minus UTC remain within a *fixed* limit;

*Recommend:*

- (1) that the *maximum limit* of UT1 minus UTC be set at  $\pm 0.950$  seconds,
- (2) that the maximum deviation of UT1 from UTC plus DUT1 be  $\pm 0.100$  s,
- (3) that, when necessary, leap seconds may be introduced at the end of any month, but that first preference be given to the end of June and December, and second preference be given to the end of March and September.

## Commission 40 (Radio Astronomy/Radioastronomie)

### 8. POLARIZATION DEFINITIONS

A working Group chaired by Westerhout was convened to discuss the definition of polarization brightness temperatures used in the description of polarized extended objects and the galactic background. The following resolution was adopted by Commissions 25 and 40: 'RESOLVED, that the frame of reference for the Stokes parameters is that of Right Ascension and Declination with the position angle of electric-vector maximum,  $\theta$ , starting from North and increasing through East. Elliptical polarization is defined in conformity with the definitions of the Institute of Electrical and Electronics Engineers (IEEE Standard 211, 1969). This means that the polarization of incoming radiation, for which the position angle,  $\theta$ , of the electric vector, measured at a fixed point in space, increases with time, is described as right-handed and positive.'

## Commission 46 (Teaching of Astronomy/Enseignement de l'Astronomie)

*Resolution 1:* 'Considering the effort made by Australian teachers to improve the teaching of Astronomy, the IAU Commission No. 46 on Teaching of Astronomy earnestly recommends to the XVth General Assembly of the IAU that the Australian National Committee on Astronomy be requested to seek funds from the Australian Government to further the teaching of Astronomy in Australian Primary and Secondary Schools, through continuing the development of Curriculum Materials in Astronomy and the extension of in-service training in Astronomy for Australian Teachers.'

*Resolution 2:* 'The IAU Commission 46 (Teaching of Astronomy) earnestly recommends that the appropriate authorities in the various adhering countries be requested to actively support the efforts of teachers endeavouring to introduce curricular developments in astronomy.'

*Recommendation:* 'In order to support some of its educational projects Commission No. 46 requests from the IAU the following financial aid (in order of priority):

1. For the International Schools for Young Astronomers and/or for Astronomy Courses for Science Teachers in developing countries the sum of \$20000.— over three years.
2. For the Visiting Lecturers' Project the sum of \$6000.— over three years.'

'Commission 46 recommends to its national delegates that they (or their national adhering organisations) support local and national competitions by making available information on how successful competitions are run, by helping science fairs find astronomers to judge astronomical entries, etc.'

'the Commission recommends that institutions which may have surplus equipment, which they are willing to donate or give on loan, prepare such lists and send these to the IAU Secretariat for publication in the IAU Information Bulletin. It should be stressed, however, that the receiving institutions must be in charge of all the custom, packing and shipping formalities.'