

## THE UNIVERSE AT LARGE

# What, and Why, is the International Astronomical Union?

by VIRGINIA TRIMBLE

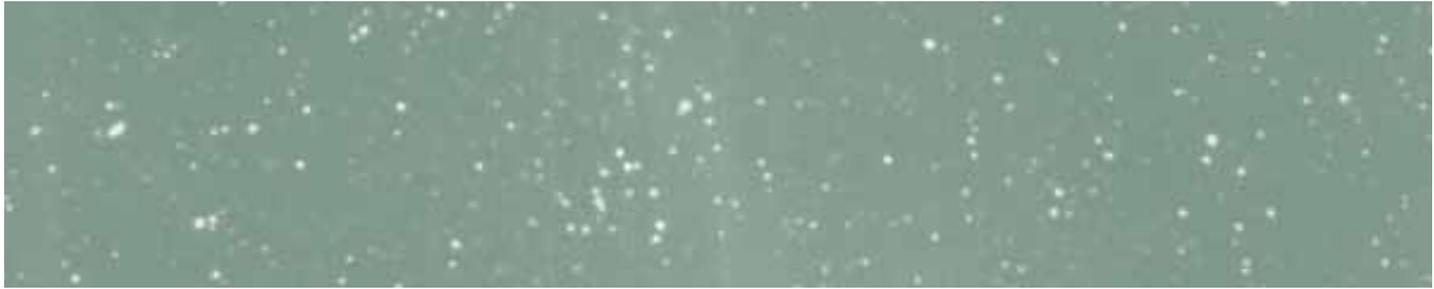
*“...it is desirable that the nations at war with the Central Powers withdraw from the existing conventions relating to International Scientific Associations. . .as soon as circumstances permit. . .and that new associations, deemed to be useful to the progress of science and its applications, be established without delay by the nations at war with the Central Powers with the eventual co-operation of neutral nations.”*

Resolutions of the Conference of London, October 1918

**E**RATOSTHENES (something BC) is supposed to have measured the circumference of the earth by noting that the sun, which cast a seven degree shadow at Alexandria, simultaneously shone straight down a vertical well at Cyrene. We suspect he must have had a long-distance collaborator.\* Moving briskly through the Middle Ages and out the other end, we find Kepler in Prague using observations by Tycho Brahe of Denmark to trace out the laws of planetary motion, Galle in Berlin discovering Neptune on the basis of calculations made by Leverrier in France, and so forth.

Indeed, many of the uses and aims of astronomy absolutely demand world-wide cooperation. Unless everybody has the same, accurate, almanacs and clocks that keep the same time, you are likely to find your ship in St. Paul's Cathedral rather than the English Channel or your radio telescope (and this is a real case) apparently in the Black Sea, rather than Crimea. Thus astronomically-based time keeping and navigation have long involved exchanges of observations, results of calculations, and time signals among friendly, and sometimes unfriendly, countries. From a less practical, astronomical point of view, if you want to catalog all the objects of some sort in the sky, you will need cataloguers at several latitudes (owing to the earth being round). Continuous monitoring of the brightness of variable stars means finding collaborators at other longitudes (owing to the sun, unless it is the sun you are monitoring, in which case the other stars get in the way).

*\*Just how long a distance is not entirely clear, for while the answer they found is generally regarded as having been quite accurate, it was given in Roman stadia, and nobody knows quite how long a stadium was in those days.*



Transits of the sun by Mercury and Venus (historically important in determining the size scale of the solar system), occultations of stars by planets, moons, and asteroids (which calibrate both precise positions and precise sizes), and eclipses of the sun (with their rare opportunities to see the chromosphere and corona and the gravitational deflection of light) also all require being in more than one place at a time or having friends in distant places. All of these activities remain the concern of members of the International Astronomical Union, along with a good many others that would never have occurred to Kepler or Galle, or perhaps even you (but keep tuned). Contrast, by the way, the situation in physics and chemistry where obviously it is often desirable to have the same experiment done by two independent laboratories, exchanging information about their methods and results, but where there is no need for the times of the experiments to be precisely correlated in advance.

#### THE CARTE DU CIEL AND ITS CONTEMPORARIES

The compiling of catalogues (meaning tables) and atlases (meaning pictures) of stellar positions and brightnesses is one of the most ancient of professional astronomical activities, pioneered by Hipparchus (something else BC) and Ptolemy (moderately AD). Each was able to document about 1000 stars in the part of the sky he could see. Chinese astronomers in the 12th century and the last of the naked eye observers (Tycho again, and Helvelius in 1660) could do no better. The application of small refracting telescopes increased our reach enormously, and the 1689 and 1797 catalogues of Flamsteed and Bradley contained about 10,000 stars each.

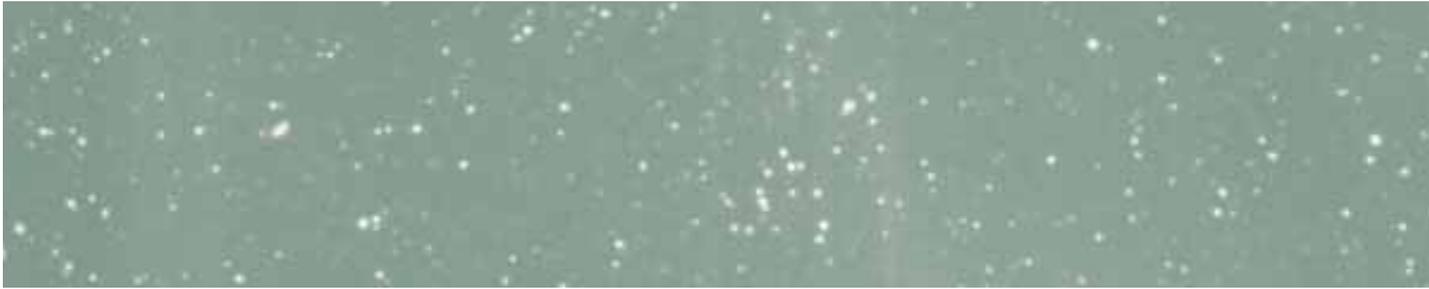
The advent of dry photographic emulsions toward the end of the 19th century presented an opportunity to expand catalogues and atlases by another large factor, as well as to improve accuracy and repeatability. And, in Paris in 1889, a group of astronomers representing more than a dozen countries agreed to divide the sky into zones and produce a “map of the sky” that would have images in its atlas of all stars to 14th magnitude (one ten-thousandth the brightness of faint stars you can see from

cities) and positions in its catalogue of all stars to 12th magnitude. At the urging of David Gill of the U.K. and Admiral Mouchez (director of the Paris Observatory), about 20 observatories agreed to participate. This meant that they would acquire identical telescopes (called astrographs), blanket their parts of the sky with 2 degree  $\times$  2 degree photographic plates, and undertake to publish their portions of the atlas and catalog. Some of the observatories you have probably heard of—Greenwich, Paris, Potsdam, Sydney. . . Others will be less familiar—Hyderabad, Tacubaya, Algiers, San Fernando. . . Potsdam happened to be the only location within the countries that would eventually lose World War I.

No American observatories were involved, and, in retrospect, we were very lucky. Even without overlap between the images, it takes more than 10,000  $2 \times 2^\circ$  plates to cover the sky. Most of them were eventually taken, but, 35 years after the project began, only four of the 20 zones had been completely measured, printed, and distributed (those of Greenwich, Oxford, Perth, and the zone Hyderabad had originally agreed to do, they took on another later). The Carte du Ciel was, in retrospect, a target at which you threw not only money\* but also the irreplaceable time of gifted scientists.

Two other turn-of-the-century international projects deserve mention. Astronomers had gradually become more and more interested in how stars are distributed through space in our galaxy (then widely believed to be the entire universe). Thus they had diligently been counting stars as a function of apparent and real brightness, color, motion on the plane of the sky, velocity along the line of sight, and so forth, picking out whichever bits of sky appealed to them. Jacobus Kapteyn of Holland pointed out in 1906 that everybody would get along faster if they all looked at the same bits of sky, rather than getting radial velocities for one field, colors for another, and so forth. He suggested about 200 “selected areas,” distributed so as to probe what then seemed to be the salient features of the galaxy, and naturally, an international

*\*I think this was originally a description of a golf course: 18 small holes down which you throw money.*



committee was appointed (in 1910) to oversee the coordination. It included Kapteyn (succeeded in due course by van Rhijn, a younger Dutchman), four Anglo-Saxons, and Kustner, director of the Bonn Observatory. Other German astronomers were among the most active in providing data pertinent to the selected areas (which, incidentally, are still used for studies of galactic structure).

Finally we come to the International Union for Cooperation in Solar Research, in which George Ellery Hale (founder of Yerkes, Mt. Wilson, and Palomar Observatories) was the prime mover. They met at least once, at Mt. Wilson in 1910, discussing, among other issues, how to standardize measurements of solar rotation made from different sites, so that real variations across the sun and with time could be identified. That a strong tradition of international solar astronomy had been established is clear from the early structure of the IAU.

### THE WAKE OF THE GREAT WAR (MOSTLY POLITICAL)

George Ellery Hale was a man not easily discouraged. With his IUCSR dissolved by the London Conference, he was at the lead in urging the United States to become one of the founders of the International Research Council, whose name bears a curious resemblance to that of the National Research Council, in whose 1916 founding he also had a hand. Representatives of 16 victorious nations met in Brussels in July, 1919, and adopted a set of statutes including the goal of “initiating the formation of international Associations or Unions deemed to be useful to the progress of science.”

The organizational meeting for the International Astronomical Union took place at the same time, and of course Hale was there. An additional 16 nations were declared eligible for IRC membership over the next few years, an important constraint on the IAU, since no country could join it, or even, initially, send people to its meetings, without acquiring IRC membership first. Thus the International Astronomers began as a Union of nine countries at their first official General Assembly in Rome in 1922 and had expanded to 22 by end of the second

GA in Cambridge (U.K.) in 1925. The IRC eventually became ICSU, the International Council of Scientific Unions, and you may very well belong indirectly, because both the U.S. National Academy of Sciences and IUPAP (the International Union of Pure and Applied Physics) are, in different ways, member organizations; I am not prepared to explain exactly what they do.

Additional countries were declared eligible for Union (or having already been so decided to join up) through

#### FOUNDING MEMBERS INTERNATIONAL RESEARCH COUNCIL

Belgium	Brazil	United States of America
France	Greece	United Kingdom of Great Britain
Italy	Japan	Australia
Poland	Portugal	Canada
Rumania	Serbia	New Zealand
		South Africa

#### COUNTRIES DECLARED ELIGIBLE THROUGH 1922

China	Siam	Czecho-Slovakia
Chili	Denmark	the Argentine Republic
Spain	Mexico	Monoco
Norway	Holland	Sweden
		Switzerland

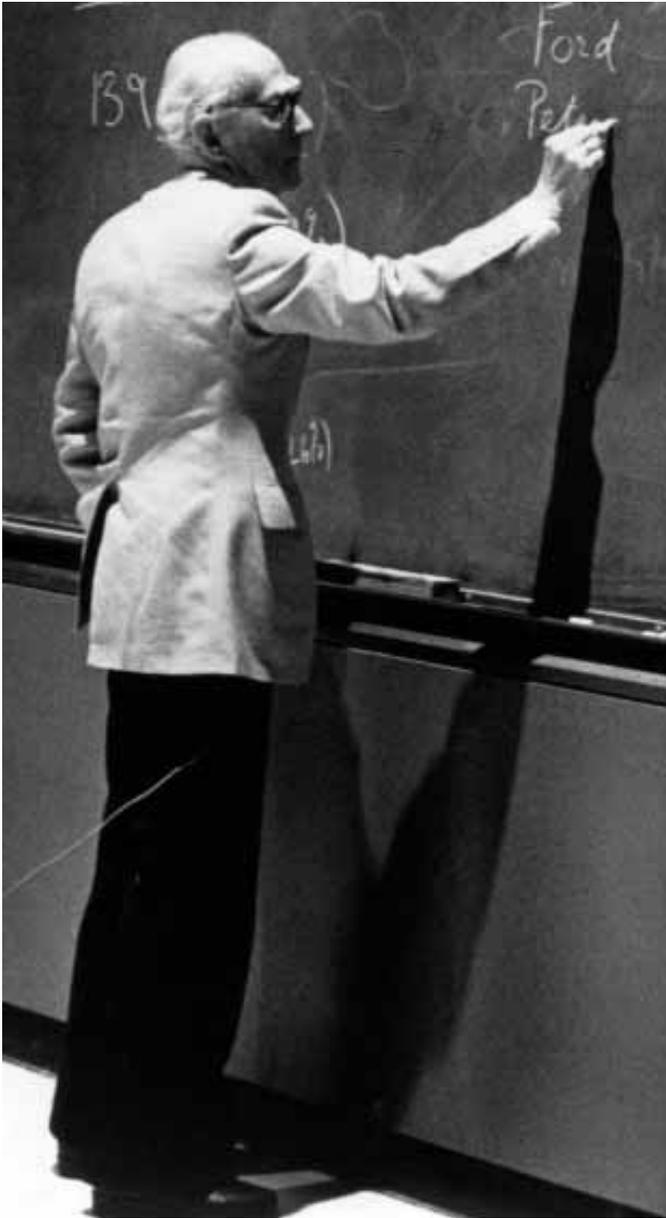
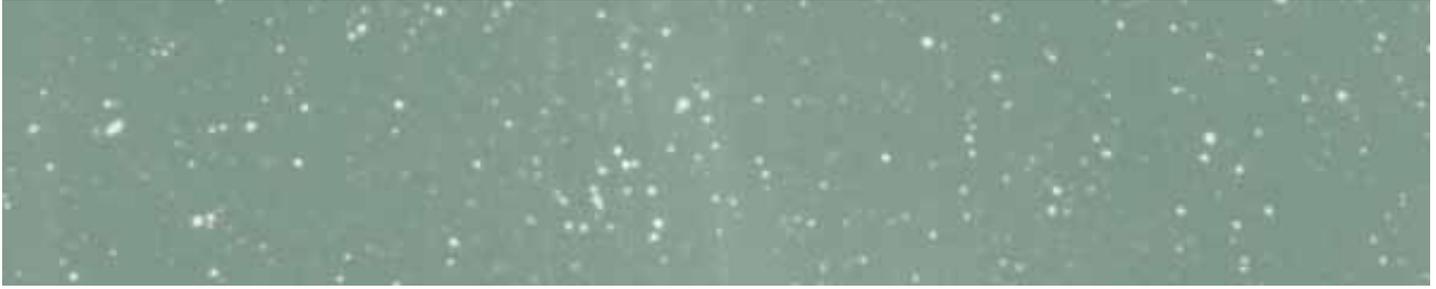
#### FOUNDING MEMBERS OF THE IAU

Belgium	Canada	Great Britain
France	Greece	Italy
Japan	Mexico	United States

#### ADDITIONAL IAU MEMBERS TO 1925

Australia	Brazil	Czecho-Slovakia
Denmark	Holland	South Africa
Norway	Poland	Portugal
Roumania	Spain	Sweden
		Switzerland

<sup>a</sup>Names of countries are as given in original IAU documents.



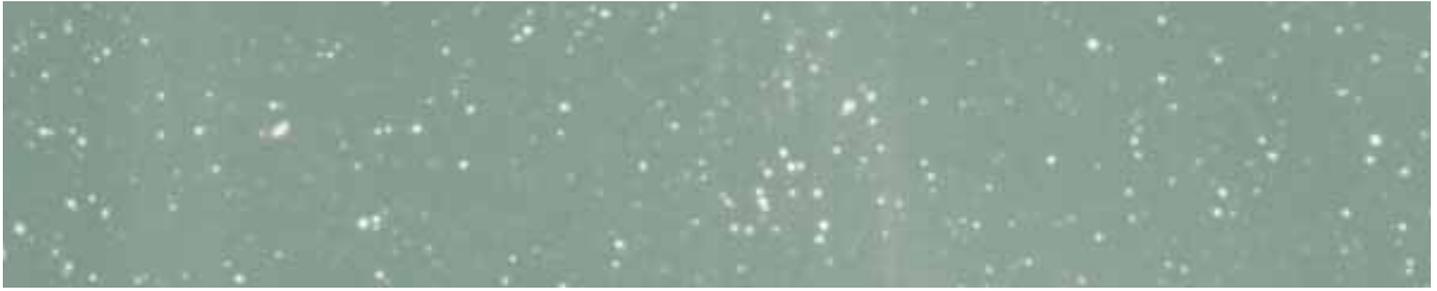
*Jan H. Oort, elected to the IAU in 1925, served as both general secretary and president, and was the last person to have been present in Rome in 1922 (though not a registered participant) and to have attended every General Assembly thereafter, through 1982. (Courtesy Astronomical Society of the Pacific)*

1939, most notably China and the Soviet Union. Germany, Austria, Hungary, Bulgaria, and Turkey were *patriae non gratae* until after the Second World War. The current list of adhering countries stands at about 60. Recent additions include entities that were formerly part of the Soviet Union, Czechoslovakia, and Yugoslavia (entitled to share their parent countries' memberships as soon as they join ICSU and start paying IAU dues). Expressions of interest from Bolivia, Macedonia, and Central America were considered at the 1997 General Assembly in Kyoto. Departures from the Union, both early and recent, most often reflect non-payment of dues for many years, frequently by small, poor countries. Recent or threatened losses include Cuba, North Korea, Azerbaijan, Morocco, and Uruguay. Rumania apparently holds a record, having been admitted three times. It is currently in good standing.

Traditions established early and still in effect include cycling the triennial meetings among as many different countries as are willing and able to host them and choosing officers and Commission Presidents (of which more shortly) from many and varying countries. Thus we have met of late in Patras (Greece), New Delhi, Baltimore, Buenos Aires, The Hague, and Kyoto, and the last six Union presidents have come from India (Vainu Bappu), Australia (Hanbury Brown), Japan (Yoshihide Kozai), USSR/Russia (Alexander Boyarchuk), Holland (Lodewijk Woltjer), and the U.S. (Robert Kraft). My immediate predecessors and successors as President of Commission 28 (Galaxies)\* have been from Holland, Switzerland, Armenia, Italy, and Japan.

This is perhaps as good a place as any to mention that the IAU has never had a woman president, though there have been women members almost from the beginning. The first three were English speaking (Margaret Harwood, M. A. Blagg, and the redoubtable Annie Jump Cannon), though at present the French, Italian, and Latin

*\*If you are saying, "Oh yes. You were elected to this position for your well-known work on galaxies?" you are not the first. In fact it was a result of starting up a Supernova Working Group (something to which I have contributed a bit) which came under Comm. 28 for arcane historical reasons.*



Colonel F. J. M. Stratton, General Secretary of the IAU before World War II and president for the “long term” of 1938–1948. Stratton, a founding member, was apparently the last person who could say he had attended every general assembly. He was instrumental in keeping some international contacts alive during the war period when General Assemblies were impossible and correspondence difficult. (Courtesy Royal Astronomical Society Library, Presidential Portrait 48)

American delegations have proportionately far more women members than the U.K. or the U.S. There have been two women who served as General Secretary and a number of female Commission Presidents. I believe Comm. 28 is the first to have had three, Margaret Burbidge and Vera Rubin having been among my much more distinguished predecessors.

The IAU differs from virtually all other scientific unions organized under ICSU in having individual members. The numbers have increased from fewer than 200 at foundation to nearly 8000 after the Kyoto General Assembly, where about 700 people, most relatively young (but including Charles H. Townes) were elected, and the necrology included about 100 names.

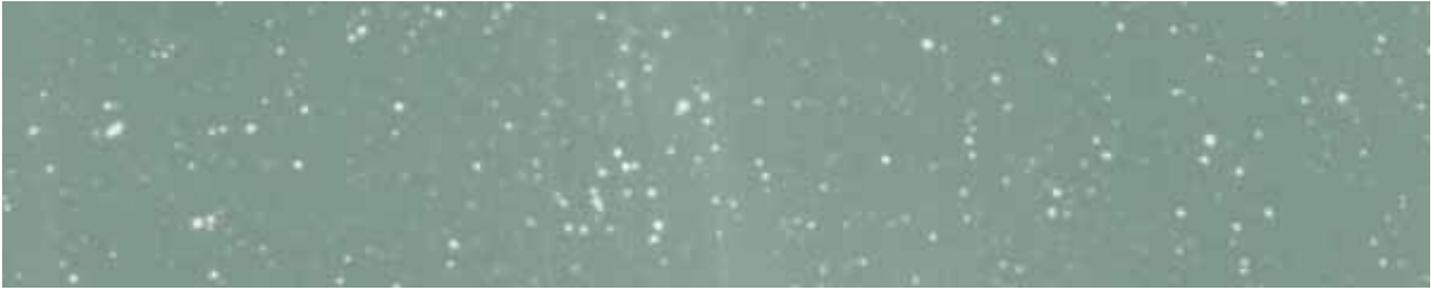
## THE WORK OF THE UNION—THEN

The formal structure evolved in Brussels and signed into effect in Rome consisted of Standing Committees “for the study of various branches of astronomy, encouragement of collective investigations, and discussion of questions requiring international agreement or standardization.” The word in the French version of the Statutes (to this day the official text) was “Commissions,” which eventually won out over Standing Committees even in English, perhaps because so many other things were called Committees (nominating, finance, resolutions, . . .). Each was to consist of a President and a number of members, originally no two from the same institution. Most Commissions began with 5–20 members, but, being entitled to co-opt additional members, most grew steadily, meaning that the effective number of individual members of the Union also grew monotonically.

Thirty commissions started out in Rome. A few, connected with drafting the statutes and choosing the first cohort of officers, immediately self-destructed. Solar Radiation (Comm. 10) chose almost immediately to merge with Solar Physics (Comm. 12), leaving the set shown in the table at the time of the 1925 General Assembly, where two more, dealing with the structure of the Milky Way and diffuse matter in space were formed. Much of what the Commissions did in the early days was not just useful but essential in making astronomical research and publications self-consistent and readable throughout the world. That, on the whole, astronomers have done more or less what the IAU told them to do about most of these matters over the intervening 70 plus years is perhaps remarkable. Herewith some examples.

*Notations (Comm. 3):* The choice of three-letter abbreviations for the names of constellations, the use of *m* and *M* for apparent and absolute magnitude, astronomical units and parsecs as the units of distance in and out of the solar system, and *a* for the semi-major axes of a binary star orbit are decisions that still stand.

*Ephemerides (Comm. 4):* All issuers of national almanacs were persuaded to have their days start at



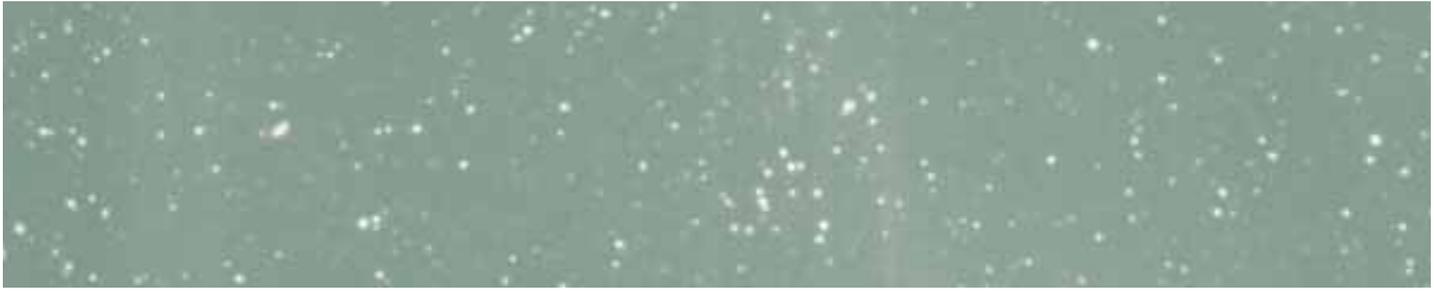
## COMMISSIONS THEN AND NOW

### 1925

- 1 Relativity
- 3 Notation
- 4 Ephemerides
- 5 Bibliography
- 6 Telegrams
- 7 Dynamical Astronomy
- 8 Meridian Astronomy
- 9 Astronomical Instruments
- 10 Solar Photosphere
- 12 Solar Physics
- 14 Standard Wave-lengths
- 15 Solar Rotation
- 16 Planets etc. (Physical)
- 17 Lunar Nomenclature
- 18 Longitude by Wireless
- 19 Variation of Latitude
- 20 Minor Planets etc. (Ephemerides)
- 21 Disbanded before 1925
- 22 Shooting Stars
- 23 Carte du Ciel
- 24 Stellar Parallax
- 25 Stellar Photometry
- 26 Double Stars
- 27 Variable Stars
- 28 Nebulae (& many name changes)
- 29 Spectral Classification
- 30 Radial Velocities
- 31 Time
- 32 (Selected Areas, briefly)
- 33 founded in 1925
- 34 founded in 1925

### 1990s

- Disbanded
- Disbanded
- Ephemerides
- Documentation and Astronomical Data
- Telegrams
- Celestial Mechanics
- Positional Astronomy
- Instruments & Techniques
- (Merged with 12); reborn as Solar Activity
- Solar Radiation & Structure
- Atomic & Molecular Data
- Physical Study of Comets, Minor Planets, & Meteorites
- Physical Study of Planets and Satellites
- (now done by working group)
- Disbanded
- Rotation of the Earth
- Positions & Motions of Minor planets, Comets, and Satellites
- Light of the Night Sky
- Meteors & Interplanetary Dust
- Merged with 24, 1970
- Photographic Astrometry
- Stellar Photometry & Polarimetry
- Double & Multiple Stars
- Variable Stars
- Galaxies
- Stellar Spectra
- Radial Velocities
- Time
- Structure & Dynamics of the Galactic System
- Interstellar Matter
- 35 Stellar Constitution
- 36 Theory of Stellar Atmospheres
- 37 Star Clusters & Associations
- 38 Exchange of Astronomers
- 40 Radio Astronomy
- 41 History of Astronomy
- 42 Close Binary Stars
- 44 Astronomy from Space (absorbed 48 in 1994)
- 45 Stellar Classification
- 46 Teaching of Astronomy
- 47 Cosmology (founded 1970)
- 48 High Energy Astrophysics (founded 1970)
- 49 The Interplanetary Plasma & Heliosphere
- 50 Protection of Existing & Potential Observatory Sites
- 51 Bioastronomy: Search for Extraterrestrial Life



midnight, like the civil day (though Julian days were to continue to start at noon, a decision endorsed yet again this year) and to adopt a standard set of positions for 1054 bright stars used in navigation.

*Astronomical Telegrams (Comm. 6)*: These announced new astronomical discoveries, observations, and calculations, and astronomers agreed to release things this way first (even before the *New York Times*). The Bureau, originally located in Copenhagen, is now at the Center for Astrophysics in Cambridge, Massachusetts. Early discoveries were most often comets and asteroids and their orbits, with an occasional nova. These days we get supernovae, gamma-ray bursts, gravitational lensing events, and much else. Postcards are still available, but the main distribution is, of course, electronic.

*Standard Wavelengths (Comm. 14)*: This sounds silly. Don't you just go into the laboratory and measure them with as much accuracy as you need for element identification, radial velocity measurements, or whatever? No, for several reasons. First, many strong nebular emission lines are forbidden transitions and cannot be measured in the lab at all. Second, even at high spectral resolution, many stellar absorption features are actually blends of transitions in several elements. Third, even laboratory values may disagree and must be reduced to some standard (a red cadmium line at 6438.4696 Å in those days).

*Lunar Nomenclature (Comm. 17, and later commissions and working groups on planetary nomenclature, etc)*: Every time a better image reveals a new crater, moon, or other namable entity, lots of people want to name it. Someone must adjudicate. Rather impressively, cooperation in this area survived the USA and USSR both photographing the moon up close and wanting to name what they saw for their own assorted heroes.

*Meridian Astronomy (Comm. 8), Time (Comm. 31), Variation of Latitude (Comm. 19) and their successors*. These dealt with the long-standing problem of establishing the variations in the rotation of the earth and the location of its poles, which feed directly into any accurate system you want to have either for measuring astronomical positions or for finding yourself on the earth's surface, right on down to the GPS.

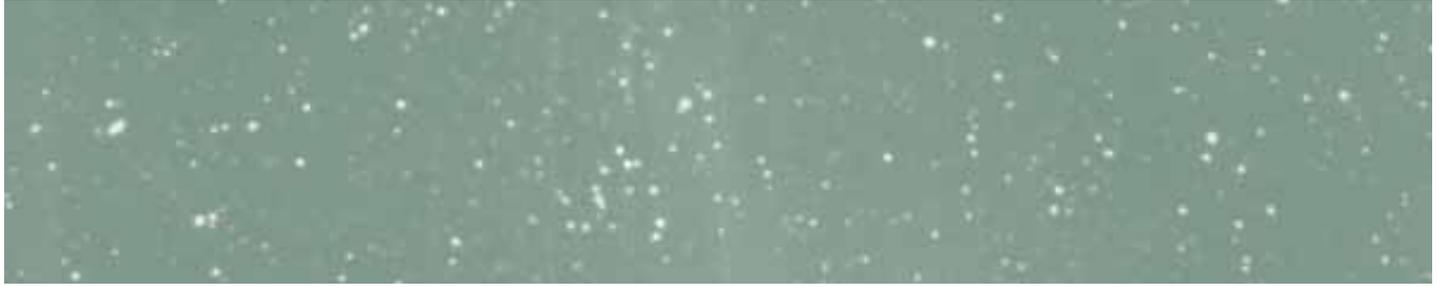
*Solar Rotation (Comm. 15)*: This was, of course, the replacement for part of Hale's solar union.

*Carte du Ciel (Comm. 23)*: Of the three international projects mentioned in the last section, this is the one the IAU embraced mostly closely, in part because only one of the co-operating observatories happened to be located in a Central Powers country, but also partly because the project had built up an enormous constituency within the community. By 1925, the Commission was discussing what else could be done with the plates, especially their use as the first epoch in a very-long-term proper motion survey (this is just now beginning to happen). The Commission finally declared itself out of existence and merged with 24 (by then Parallax and Proper Motion) at the 1970 General Assembly in Brighton, the first one I attended. IAU "adoption" of the Selected Areas program was also discussed from the beginning, but postponed because many of the active participants were German, and they opposed a structure that would exclude them from any decision-making. The problem resolved by the fifth General Assembly in 1935 and Selected Areas became Commission 32 (later merging with 33, Milky Way).

*Variable Stars (Comm. 27)*: The members provided a list of stars that, because of having periods very long, very short, or nearly commensurate with 24 hours, needed international attention to pin down their properties. Some of the ones listed, like R CrB and SS Cyg, are still rather a puzzle (though astrophysically rather than temporally).

## THE WORK OF THE IAU—NOW

According to my notes from Kyoto, the IAU now has 39 Commissions and four independent Working Groups. Some of them still deal with issues that go back to the beginning: Planetary System Nomenclature (a working group), Astronomical Telegrams (Comm. 6), Atomic and Molecular Data (Comm. 14, dealing with standardized wavelengths but also transition probabilities and other useful numbers), Rotation of the Earth (Comm. 19), Ephemerides (Comm. 4), and Documentation and Astronomical Data (Comm. 5, which these days includes



non-paper archiving). A few commissions still have only 20–40 members. Others (including Galaxies, Radio Astronomy, and Astronomy from Space) exceed 600. A good many have been renamed, and some numbers have been recycled. But the commissions are still telling us what to do, including, for instance, the need for a more accurate description of the rotation of the earth, a standardized way of correcting times of astronomical observations for effects of general relativity, and the Julian Day (it still starts at noon, but the Modified Julian Date starts at midnight, and PLEASE be sure to tell us which you are using!). Yet another resolution dealt with making the new coordinate system established by the Hipparcos satellite nest properly with ground-based optical and radio coordinates. This last matters even for ordinary science; if you want to know whether the radio and optical knots in the jet of a quasar are correlated or anti-correlated on sub-arcsecond scales, you had better be able to line up the two sets of data to 0.1 arcsec or thereabouts.

The Union and its Commissions have, however, also moved strongly in three directions not envisaged by the founders. The first consists of things about which one can say, with old Ben Franklin, that if we do not hang together, we will all hang separately. The entities called Protection of Existing and Potential Observing Sites (Comm. 50), Future Large Scale Facilities, Encouraging the International Development of Antarctic Astronomy (Working Groups), and the part of Radio Astronomy (Comm. 40) that fights for protected frequencies come under this heading. Second, the IAU has become much more active in promoting astronomy in developing countries. It puts money into three activities along these lines:

1. Exchange of Astronomers (Comm. 38), which administers travel grants for astronomers working under difficult circumstances to pay 3–12 month visits to larger observatories and universities. A few grants also go to people from prosperous places going to less prosperous ones primarily to bring their host organizations into main stream activities. We also send a good many free books.

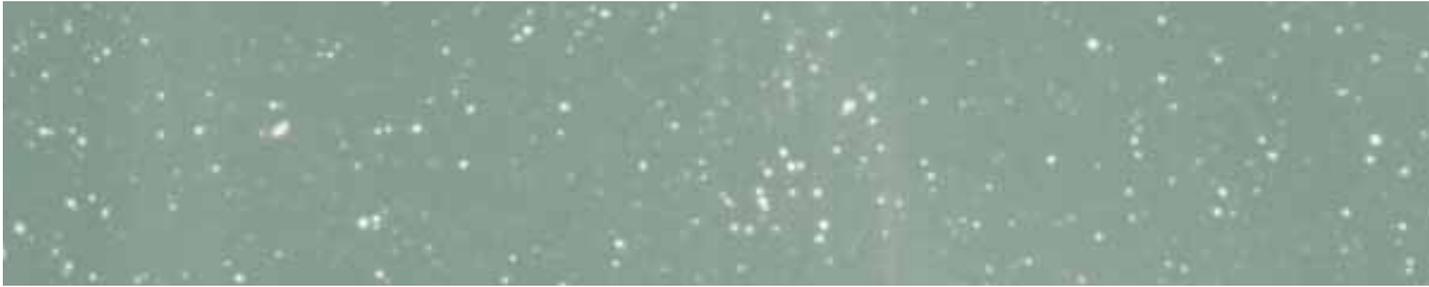
2. An on-going series of both regional meetings (normally in Latin America and in the Asia-Pacific areas) and

international schools for young astronomers from regions centered around the host country—most recently Iran and China.

3. Teaching of Astronomy (Comm. 46) again focuses on developing countries and has coordinated recent workshops for teachers in Vietnam and Central America, with ones in Sri Lanka and Morocco contemplated if funding can be found. This Commission also addresses the problem of teaching astronomy to interested students, uninterested students, and the general public in developed countries.

Third is the great increase in the amount of science presented and discussed at the General Assemblies and at IAU-sponsored symposia and colloquia in non-GA years. Proposals can come from anyone in the astronomical community, but must be endorsed and evaluated by the Commissions most relevant to the topics. The number of proposals typically exceeds the 5–6 symposia and 5–6 colloquia that can be funded each year by a factor of about two. The winners have several things in common. One is scientific merit. But, in addition, the proposals must have broad international representation on their scientific organizing committees and among the invited speakers; organizers must agree to use some of the IAU money for travel grants for young astronomers and those from less developed countries; and the host country must agree to admit participants from every country. The sites are widely scattered. Events scheduled in 1998 will occur in Canada, Spain, Armenia, France, South Africa, Mexico, China, Germany, and probably a couple of other places. And topics include the full range of solar system, stars, galaxies, and the universe.

The most recent General Assembly in August 1997 in Kyoto had a program with six symposia of about four days each (on topics from helioseismology to cosmology), 23 joint discussions of a day or so (ranging from the New International Celestial Reference Frame to The Megamaser-Active Galaxy Connection), brief business meetings of most of the divisions, commissions, and working groups, special sessions on Comet Hale-Bopp, early results from the Infrared Space Observatory (a largely European satellite), and some other entities whose



acronyms I cannot decode, plus a countably infinite number of committee meetings. Maximal packing occurred on Monday, August 25, with 14 simultaneous activities.

About 2000 people participated in these festivities, roughly 700 from the host country and a smaller number from the U.S. (the second largest delegation). That most genuinely participated shows in the number of posters presented (1600 in four three-day shifts of 400 each) and talks (about 900, all the way from hour-long reviews of black holes at galactic centers and convection in stars to 10-minute news flashes on rapid evolution of a particular binary star and X-ray after-glow from gamma ray bursts). The American participants did their fair share, but probably not more: in the three joint discussions I participated in, there were 5 American speakers out of 21 (stellar evolution on short time scales), 3 of 20 (early results from the Hipparcos astrometric satellite), and 9 of 25 (high energy transient sources).

## FINANCES

Sums of money from the past always sound ridiculously small. The early IAU accounts were kept in British pounds (though legally assessed in French francs), so the proper comparison is with the £100 a year on which a single woman could live comfortably and “£10,000 a Year,” the title of a book supposed to describe riches beyond the dreams of middle class avarice in about 1920. Thus it was that the Union had an average annual income of £1500 between 1922 and 1925, nearly all of it the contributions from member countries. These, like the dues for the International Research Council, were assessed in proportion to the populations of the nations, with cuts at 5, 10, 15, and 20 million. The U.S. population in 1920 was 108 million, and, in the first few years, we contributed 11 percent of the budget, while making up 24 percent of the membership.

One aspect of this has changed hardly at all. American membership is still pretty close to 25 percent of the total; and our 1997 assessed dues are 86,400 Swiss francs in a total of 716,280, or 12 percent. Expected contributions are now more nearly proportional to



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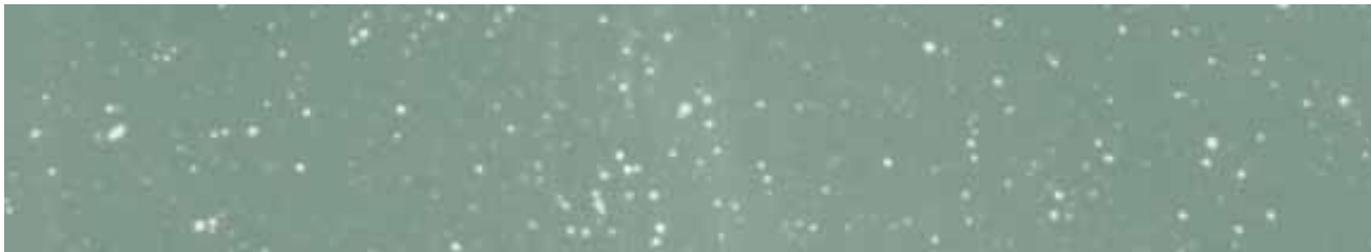
*Lodewijk Woltjer, IAU president 1994–1997 bids farewell to participants at the Kyoto General Assembly during the closing ceremonies. His father, Jan Woltjer, was a founding member of Commission 7 (Dynamical Astronomy)*

numbers of astronomers in the countries than to total populations, and there is some additional income from publications and other sources. Sporadic special contributions, primarily from the U.S., have added about 200,000 Sfr each triennium, but are earmarked to pay for travel by people from the contributing country.

Where did the money go? In the early days, mostly to subsidize the practical activities of time keeping, monitoring of latitude, and so forth; to support publications;\* and to operate the office of the general secretary, who in 1923 took a 10s 8p train ride, had a £26 1s 9p part-time secretary, and bought £8s 9p worth of postage stamps.

Where does the money go? Now, very considerably for science. In the 1994–96 triennium, total outgo was 2,526,601 Swiss francs, somewhere between \$1.6 and \$2.2

\*The *Carte du Ciel* was a bottomless fiscal hole for the IAU as well as for the participating observatories, swallowing £100 here and £47 there several times a year to publish bits and pieces of the catalog.



million at any given moment, owing to wildly variable exchange rates. Of this, 45 percent directly supported scientific meetings involving astronomers from all over the world (primarily as travel grants). Another 11 percent was for activities aimed specifically at developing countries—schools, regional meetings, free copies of IAU symposium proceedings, etc. About 12 percent was widely scattered over dues to ICSU and other umbrella organizations, distribution of information to members, archiving, and the traditional support of the telegram bureau, variable star catalogues, and so forth, now down to 1 percent of expenditures. The Carte du Ciel did not get a penny.

Finally (and quite typical for scientific societies), the last third of the budget paid for the secretariat, officers' meetings, bank charges, and such. More than half is salaries, and, of course, the people involved spend nearly all their time coordinating astronomical symposia, publications, activities in developing countries, and all the rest. And, for better or for worse, the share of travel grants going to American astronomers is, on average, slightly larger than the fraction of the income we contribute.



## MORE ABOUT THE IAU PAST AND PRESENT

Lankford, John 1997. *American Astronomy: Community, Careers, and Power, 1859–1940*, University of Chicago Press, notes how we benefited from not contributing to the Carte du Ciel.

Blaauw, Adriaan 1994. *History of the IAU* (Dordrecht: Kluwer), is the definitive source, especially on the early days and on how the Union survived the very awkward issues involving the USSR, USA, and two Chinas during the cold war.

IAU Publications: These all appeared under the Reidel (later Kluwer) label for many years, but will be published by the Astronomical Society of the Pacific beginning in 1998. *Symposia* are the usual sorts of conference proceedings. *Highlights* include the science from the General Assemblies. And *Transactions A* are triennial compilations of the highlights of research in the fields of each of the Commissions, assembled by the Commission officers.