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HISTORY OF ASTRONOMY
HISTOIRE DE L'ASTRONOMIE

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HISTORY OF ASTRONOMY UNDER THE AUSPICES OF THE IAU

1. Introduction

International Astronomical Union was formed after the First World War although it became truly international only after the Second World War. Its Commission 41 on History of Astronomy (C41) was set up in 1948 and in a few years established itself as an active and influential unit. It has the distinction of being a joint Commission, the other partner being International Union of History and Philosophy of Science and Technology (IUHPS). Since IAU is an internationally respected body of professional astronomers, its support for history of astronomy enhances the credibility of the discipline in the eyes of scientists as well as science establishments of individual countries. C41 is committed to advancing objective and rigorous world history of astronomy taking into account all its aspects.

2. International cooperation

Collaboration and cooperation are inbuilt into astronomy. It is remarkable that to know our position on the Earth, we must take the help of the sky. While an observer can determine their location, north or south of equator, through a personal arrangement with the sky, the east-west coordinate must be defined with respect to a terrestrial collaborator located elsewhere. An astronomical event is unrepeatable and each observation of it is unique. No observatory, no matter how well equipped or capably staffed, can have access to the whole celestial sphere nor can it replicate what others are doing.

An early systematic initiative in international cooperation in the 19th century was the establishment of a central bureau for astronomical telegrams at Kiel, in 1882, put in place in time for the great comet of that year.[1] 'The development of photographic methods had led a number of astronomers to think that the time had come for securing as complete a map as possible of the whole heavens'.[2] Accordingly, at a meeting held in Paris in 1887, a Permanent Commission was set up to carry forward the project of the *Carte du Ciel* (of which USA was not a part). George Ellery Hale in USA in 1904, working under the auspices of US Academy of Sciences, took the lead in establishing the

International Union for Cooperation in Solar Research.[3] In a more focused manner, in 1906, Jacobus Cornelius Kapteyn launched an enormous project, involving 40 different observatories, for studying the distribution of stars in the Milky Way Galaxy, which at the time was presumed to be the whole Universe.[4]

The outbreak of the First World War in 1914 put a stop to these international initiatives. 'Even when the war was over, the bitter feelings it left behind precluded in many cases easy co-operation for some years between those of the opposing sides.' [5]

3. The IAU

Immediately after the First World War, three meetings of the leading men of science of the allied countries were held at London, Paris and Brussels during 1918-1919 to 'set in motion, so far as they could, the wheels of international co-operation'[5], the word international being used in a restrictive sense because the original membership was meant only for allied countries. An International Research Council along with its various constituent unions, including International Astronomical Union (IAU), was formed at Brussels in July 1919.[5,7,8]

Neutral countries were invited to join the Union which they did at the first General Assembly held at Rome in 1922. 'After some years of hesitation, limitations to the membership were removed in 1926 and invitations for co-operation were addressed to Germany, Austria, and Hungary.'[8] However it was only in 1947 that Hungary became a member while Germany and Austria joined five years later, in 1952. With a view to accommodating astronomers from what were officially dubbed enemy countries, IAU introduced the concept of individual members as distinct from country members. IAU remains unique among international bodies on this count. Table 1 lists all the General Assemblies held or scheduled so far.

After the Second World War, the Cold War weighed heavily on everybody's mind as can be seen from Harlow Shapley's account of the 1948 Zürich Assembly published in the American journal *Science*.[9] Shapley began by mentioning 'the difficulties of communication and cooperation' between the Soviet Bloc on the one hand and Western Europe and North America on the other. Shapley assured the readers that though the Soviet and East European astronomers took an 'active' part in the week-long activities, it was 'by no means dominating'. Self-consciously and laboriously, Shapley emphasized the role assigned to Soviet Bloc astronomers even at the Commission and Working Group level. Of course, a true highlight at Zürich was the election of the Russian astrophysicist, Viktor Amasapovich Ambartsumian, as one of the Vice-Presidents. He would serve as Vice-President for two terms, from 1948 till 1955, and take over as President in 1961 for a three-year term.

The next Assembly got caught up in Cold War. It was decided to hold it in Leningrad at the invitation of the USSR Academy of Sciences, but the meeting was cancelled because of the outbreak of the Korean War in 1950. The 8th Assembly was finally held in 1952 at Rome. It goes to the credit of Soviet astronomers that, taking an extended view of things, they decided not to over-react to the cancellation. Moscow came to host the 10th General Assembly in 1958. This well-organized meeting was diplomatically significant also. It came 'at the start of the replacement of an era of confrontation with an era of cooperation known as Khrushchev's Thaw'. As Adriaan Blaauw later put it, astronomers' hospitality prevailed over political hostility.[10]

Table 1. Date and Place of IAU General Assemblies, 1922-2018

No.	Year	Place of General Assembly
1	1922	Rome, Italy
2	1925	Cambridge, UK
3	1928	Leiden, Netherlands
4	1932	Cambridge, USA
5	1935	Paris, France
6	1938	Stockholm, Sweden
7	1948	Zürich, Switzerland
8	1952	Rome, Italy
9	1955	Dublin, Ireland
10	1958	Moscow, USSR
11	1961	Berkeley, USA
12	1964	Hamburg, West Germany
13	1967	Prague, Czech Republic
14	1970	Brighton, UK
15(*)	1973	Sydney, Australia
16	1976	Grenoble, France
17	1979	Montreal, Canada
18	1982	Patras, Greece
19	1985	New Delhi, India
20	1988	Baltimore, USA
21	1991	Buenos Aires, Argentina
22	1994	The Hague, Netherlands
23	1997	Kyoto, Japan
24	2000	Manchester, UK
25	2003	Sydney, Australia
26	2006	Prague, Czech Republic
27	2009	Rio de Janeiro, Brazil
28	2012	Beijing, China
29	2015	Honolulu, USA
30	2018	Vienna, Austria

(*) An Extraordinary General Assembly was held in Warsaw, Poland, in commemoration of Copernicus' 500th birth anniversary.

4. History of Astronomy: Early years

IAU took note of history of astronomy three decades after its formation. As early as 1927 an International Academy of the History of Science had come into existence. It was however a rather elitist group 'whose members were mostly scholars focused on history'. [11] In 1947, UNESCO set up International Union of History of Science and affiliated it to International Council of Scientific Union (ICSU). IUHS was merged into an enlarged IUHPS in 1955. Commission 41 for History of Science was formed in 1948. The IUHS and C41 played a major role in establishing the credentials of history of science (including astronomy) as science rather than as history. C41 was the first international entity devoted exclusively to the history of astronomical sciences. In a divisive world marred by confrontations and suspicions, joint European astronomical heritage would

provide a welcome refuge to all. The nascent Commission did face a threat, but curiously it came from within. Otto Neugebauer who was elected the first President was of the strong and repeatedly articulated opinion that an organized international forum like Commission 41 had ‘no positive function’. He finally resigned and the IAU Executive Committee appointed Herbert Dingle as the Acting President in preparation for the 1922 Rome General Assembly. Dingle went on to lead the Commission as its regular President for two consecutive terms from 1952 to 1958. Dingle was succeeded by the Soviet astronomer, P. G. Kulikovskiy, who also served for two terms, 1958-1964. Kulikovskiy was an internationalist and a capable organizer. He played a leading role in organizing the 1958 Moscow General Assembly, and before that set up a national Commission for History of Science within USSR Academy of Sciences of which he remained the chairman. Table 2 lists all Commission 41 Presidents from 1948 till 2015.

Table 2. Presidents of IAU Commission 41: History of Astronomy, 1948-2015

Period	C41 President	Country
1948-1952	Otto Neugebauer	USA
1952-1955	Herbert Dingle	UK
1955-1958	Herbert Dingle	UK
1958-1961	Piotr Grigorevich Kulikovskiy	USSR
1961-1964	Piotr Grigorevich Kulikovskiy	USSR
1964-1967	Eugeniusz Rybka	Poland
1967-1970	Eugeniusz Rybka	Poland
1970-1973	Owen Gingerich	USA
1973-1976	Owen Gingerich	USA
1976-1979	Jerzy Dobrzycki	Poland
1976-1982	Michael Hoskin	UK
1982-1985	Olaf Pedersen	Denmark
1985-1988	John A. Eddy	USA
1988-1991	John North	UK
1991-1994	Suzanne Débarbat	France
1994-1997	S. M. Razaullah Ansari	India
1997-2000	Steven J. Dick	USA
2000-2003	F. Richard Stephenson	UK
2003-2006	Alexander Gurshtein	Russia
2006-2009	Nha Il-Seong	Korea (Rep. of)
2009-2012	Clive Ruggles	UK
2012-2015	Rajesh Kochhar	India
2015-2018	Xiaochun Sun	China Nanjing

Neugebauer’s persistent opposition served a useful purpose. It compelled astronomers and historians ‘to define the scope of the Commission and to determine the nature of its activities’[12]. There was complete unanimity in rejecting his contentions. Every one recognized the special nature of C41 and spoke in favour of its continuance. After the first four years of uncertainty, C41 stabilized itself and would go from strength to strength in the years to come.

Commission members were conscious of the fact that there were many historians of astronomy and other interested scholars who not being practising astronomers were not members of IAU and therefore of C41. They were co-opted as consulting members. In

1976, for example, the Commission comprised 65 regular members and 35 consulting members. In 1973, two historians (Eric Gray Forbes, UK, and Olaf Pedersen, Denmark) were made members of IAU on the basis of their attainments in history of astronomy.[13] Throughout its existence C41 maintained very close relationship with IUHS/IUHPS. ICSU Year book for 1994 (p. 104) mistakenly refers to C41 as a joint IAU-IUHPS Commission.[14] C41 acquired this formal status only in 2001.

C41, which really began working at the 1952 General Assembly, had its priorities defined from day one. Overcoming language barriers, contemporary Western scholarship should be integrated and the archival material (including correspondence between astronomers) residing in Russia made accessible to all. Carrying out translations and the preparation of bibliographies were taken up in right earnest. Indeed, in the early years, the activities of C41 were summarized through bibliographies. It was not merely pooling of resources but also integration of frameworks. Because of its Communist ideology, USSR emphasized social history of science. It was interested 'in the problems of the development of science in connection with the evolution of human society'.[15] Also, since the Soviet Union comprised a vast spread in geography, ethnicity and culture, its histories of astronomies were broad-based. In contrast, Western Europe for its own reasons was at the time primarily concerned with modern astronomy and its European antecedents.

It would have come as a surprise to many that even during the troubled war time, USSR found time to commemorate in 1942-1943 the 300th/400th birth/death anniversaries of Copernicus, Galileo and Newton in a scholarly manner and bring out publications. In 1948, Naum Ilich Idelson edited letters from Laplace, Gauss and Bessel to I. Shubert, member of the Petersburg Academy of Sciences, in the first volume of a work titled *Scientific Inheritance*. [16] The same year saw the publication of a study on ancient Armenian calendar.

In 1955, an editorial board led by Kulikovskii initiated an ambitious and eminently successful programme for bringing out an annual issue of collection of papers titled *Istoricо-астрономическiе Исследования* [IAI]. The collection included original papers and investigations as well as archives, documents, correspondence of scientists and memoirs. Each issue ended with an annotated bibliography of selected sources of world literature. Starting with the fourth issue (1958), English version of contents and editorial preface was also included. The first eight annual issues covering the period 1955-1962 ran into as many as 3786 pages. IAI contents formed an important part of the bibliography included in the proceedings of C41. Their importance can be gauged from the fact that the newly started *British Journal of History of Science*, in its first two volumes (1963 and 1964), asked Kulikovskii to summarize the contents of all issues of IAI published to date.[17,18]

Much of the work on history of astronomy done in the Soviet Bloc falls in three broad categories.

(i) First, there was the new interpretation of the works of such well-known names as Copernicus and Humboldt. When Dingle's 1956 lecture on Edmond Halley was translated into Russian, some editorial remarks were added.

(ii) Second, the area of history of European astronomy was broadened and deepened. Interaction of instrument makers like James Short and J. Bird and of W. Herschel with Russia was discussed on the basis of primary source material not taken into account so far and their correspondence with Russians brought to the notice of scholars for the first time. Anniversaries associated with individuals and institutions provided a pretext for initiating or intensifying historical researches. The 350th birth anniversary of Jan Hevelius, 200th birth anniversary of the Polish scientist Jan Sniadetski, 150th anniversary of Tartu Observatory, and 125th anniversary of Pulkovo Observatory all resulted in publication of useful material.

(iii) Third, because of the presence of Central Asian Republics in USSR and for other reasons, attention was paid to astronomy in the Muslim culture zone. Star catalogues of al-Biruni (973-1048), Omar Hajam(1040-1123) and al-Tusi (1201-1274) were published in Russian for the first time under the guidance of Professor B. A. Rosenfeld. G. At the same time notice was taken of the state of astronomical knowledge and cosmological ideas in medieval India as contained in al-Biruni's book *Indica*. [19]

It was not sufficient to make Russian-language archival material available in English. Even English material had to be made more easily accessible. C41 and IUHPS took the initiative in asking the Royal Greenwich Observatory to permit the microfilming of its records of the past three centuries. The 500th birth anniversary of Copernicus was celebrated in 1973 at various levels throughout the world. As Own Gingerich, President C41 explained, it 'provided an unprecedented opportunity for the recognition of the history of astronomy as a serious discipline'. [20]

Earlier, at the 13th General Assembly held at Prague in 1967, a resolution was passed recognizing 'the importance and usefulness of preparing an international history of astronomy, based on original research'. The general editorship of the proposed General History of Astronomy, to be brought out under the auspices of IAU (through C41) and IUHPS was entrusted to Michael Hoskin, who founded the *Journal for the History of Astronomy* in 1970. The project hoped to cover the period from antiquity till 1950 in four volumes. Eventually only three monographs seem to have been published between 1984-1995. Volume 4A, *Astrophysics and Twentieth-Century Astrophysics* (edited by Owen Gingerich), came out in 1984. Volumes 2A and 2B, *Planetary Astronomy from the Renaissance to the Rise of Astrophysics* (edited by René Taton and Curtis Wilson), came out in 1989 and 1995. These works have stood the test of time as can be seen from the fact that they have recently been reprinted.

5. Archaeo-astronomy

In the early decades, astronomy was perceived as an entirely intellectual discipline whose history had to be extracted from an examination of archives, instruments and buildings. There is now greater appreciation of the civilizational role astronomy has played at different times in different cultures and societies. In the 1970s, a new interdisciplinary research area was emerging to which terms like archaeo-astronomy, ethno-astronomy and cultural astronomy have been applied. In December 1972, the Royal Society and British Academy organized a joint symposium in London on The Place of Astronomy in the Ancient World. [21] For USA, ancient astronomies of the Americas were of more than academic interest. In 1973, a joint USA-Mexico special session was held in Mexico on Archaeoastronomy in Pre-Columbian America. It proved out to be so successful that a second conference on this topic took place, in 1975 in USA, at Colgate University, New York. In the meantime, John Eddy, spurred by a 'one-column inch' report in the Denver Post Sunday Magazine, carried out personal field work on the Bighorn Medicine Wheel in Wyoming. In 1974, he published an epoch-making paper suggesting that the original purpose of the Wheel was astronomical and that it showed solar and stellar alignments. [22] In 1975 summer, thanks to a research grant provided by the National Geographic Society, Eddy led a small team including an archaeologist which carried out an aerial and ground survey of 20 rock structures on the plains of Alberta and Saskatchewan. [23]

IAU took notice of this emerging new field in 1976. At the General Assembly held that year in Grenoble, the C41 organized a session on 'Megalithic Astronomy: Fact or Speculation'. Not surprisingly, it attracted a large audience from other Commissions

as well.[24] Scholarship on the subject has developed to such an extent as to be assigned an IAU Symposium (No. 278) in 2011 for a full-length rigorous discussion. Alive to the role astronomy has played in human affairs, IAU and UNESCO jointly organized a Symposium (No. 260) on ‘The Role of Astronomy in Society and Culture’ at UNESCO Headquarters, Paris in January 2009. This was the first time that IAU included in its prestigious Symposium series a scientific meeting that lay outside hard science.

6. Working Groups

The commission created working groups (WGs) on specific topics which called for focused attention. Thus in recent times, a number of such groups were active: ‘*Archives*’, ‘*Historical Instruments*’, ‘*Johannes Kepler*’, ‘*Astronomy and World Heritage*’. An event-bound WG on ‘*Transits of Venus*’ was recently terminated. Another one on *Archaeo-astronomy, cultural and ethno-astronomy* has been created. A related working group is on ‘*Historic Radio Astronomy*’ which was placed under Commission 40.

Preserving, safeguarding and expanding the archives are essential tasks for carrying out and promoting research in history of astronomy. Established in 1991, the WG on *Archives* is entrusted with this duty. An important ongoing project deals with the archival materials related to the establishment of IAU in founder countries. The WG on *Historical Instruments* was set up in 2000. Its recent work includes the design of a permanent exhibition at the Anhui Provincial Museum on a group of astronomical instruments unearthed from the tomb of Marquis Ruyin of the Han Dynasty in China (165 BCE), as well as a co-operative effort with *InFocusAsia* in filming a documentary on the history of time measurement and keeping in ancient China. The WG on Kepler is busy editing a volume titled ‘*Reading the Mind of God: Johannes Kepler and the Reform of Astronomy*’, containing chapters by the world’s leading Kepler specialists.

The WG on *Astronomy and World Heritage* arose as a consequence of the creation of the Astronomy and World Heritage Initiative in 2004 by UNESCO’s World Heritage Centre. In October 2008, UNESCO signed a Memorandum of Understanding (MoU) with the IAU, ‘as a result of which the IAU has become integrally involved in the process of advancing the initiative’. The IAU in turn entrusted the responsibility of fulfilling its obligations under the MoU to C41, which responded by setting up a Working Group on Astronomy and World Heritage. Working with ICOMOS (International Council on Monuments and Sites), this group produced the ‘*Thematic Study on the Heritage Sites of Astronomy*’ in 2010, and helped create the portal, which was launched publicly during the Beijing General Assembly (<http://www2.astronomicalheritage.net/>).

The Working Group has since been raised to the status of a full-fledged Commission. The UNESCO website defines astronomical heritage in a comprehensive manner, making a distinction between four categories :[25]

- The tangible fixed heritage of astronomy: monuments and sites;
- The tangible movable heritage of astronomy: instruments, artifacts, archives;
- The intangible heritage of astronomy: knowledge and ideas;
- Natural heritage relating to astronomy (visible landscape, dark night sky).

Astronomy today is at the cutting edge of intellectual enquiry, and, at its most glamorous, a child of high technology. But it is more than a branch of modern science. It is a symbol of the collectivity and continuity of humankind’s cultural heritage. This mixture of science and culture is astronomy’s strength as well as dilemma. Strength, because

support for astronomy transcends all boundaries: dilemma, because this support transcends science also. For promoting astronomy worldwide, especially in developing countries with memories of past contributions to science, scientific astronomy and cultural astronomy need to be placed in a composite context. Even more importantly, modern (post-Copernican) astronomy, or modern science in general, itself needs to be repositioned in a more extended evolutionary sequence. In this framework, science (including astronomy) is perceived as a multi-stage cultural cumulus where each stage builds on the knowledge gained in the previous stages and in turn leads to the next. Modern astronomy is then the latest stage in continuum which for historical reasons developed in Europe.[26] A world history of astronomy is thus not only an instructive exercise in itself but also a means of developing modern astronomy worldwide.

As Goethe put it, 'The history of science is science itself'. This is certainly true of astronomy.

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