

TRANSACTIONS OF THE  
INTERNATIONAL ASTRONOMICAL UNION  
VOL. XIXB

**PROCEEDINGS  
OF THE NINETEENTH  
GENERAL ASSEMBLY**

**DELHI 1985**

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OF THE  
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VOLUME XIXB

PROCEEDINGS OF THE NINETEENTH  
GENERAL ASSEMBLY

DELHI 1985

*Edited by*

JEAN-PIERRE SWINGS

*General Secretary of the Union*



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## Preface

The XIXth General Assembly of the International Astronomical Union was held in New Delhi, India, from November 19 to 28, 1985. It was dedicated to the memory of a former IAU President, Professor M.K.V. Bappu, who tragically passed away on August 19, 1982. On the occasion of the Delhi General Assembly, the IAU Minor Planet Center announced that Minor Planet (asteroid) No. 2596 henceforth will carry the name Vainu Bappu. The full text of the announcement reads :

"(2596) VAINU BAPPU = 1979 KN (diameter about 8 kilometers, period 5 years 4 months, mean distance from the Sun around 450 million kilometers)

Discovered 1979, May 19, by R.M. West at the European Southern Observatory.

Named in memory of Manali Kallat Vainu Bappu (1927-1982), famous Indian Astrophysicist and a dear friend of the discoverer. Educated at Harvard and Caltech, he established, under difficult circumstances, the first modern Indian observatory at Naini Tal during the 1950s. Appointed director of the Kodaikanal Observatory in 1960, he subsequently founded and directed the Indian Institute of Astrophysics in Bangalore. He was the initiator and driving force of many projects, among them the 2.3-m Kavalur telescope, entirely designed and built in India. In the multiple roles of brilliant scientist, teacher and administrator, he contributed decisively to the high level of astronomy and astrophysics in India today. He served as Vice-President (1967-1973) and President (1979-1982) of the IAU and as chairman of the editorial board of the Indian Journal of Astronomy and Astrophysics".

During the Inaugural Ceremony, on November 19, a very special date since it corresponded to the birthday of the late Mrs. Indira Gandhi, a one-rupee stamp representing Halley's comet was issued in the presence of India's Prime Minister, Rajiv Gandhi, and of the Minister of Posts and Telegraphs Sri Ram Niwas Mirdha.

The scientific programme of excellent quality, as can be seen from the reports included in this book and from the 900 pages of the "Highlights of Astronomy", Volume 7, was organized by the Presidents of the 40 IAU Commissions and coordinated by the IAU General Secretary (1982-1985), Dr. R.M. West. The local arrangements were taken care of by numerous hard workers from Delhi and from Bangalore, under the supervision of Prof. M.G.K. Menon (Chairman of the National Organizing Committee), and of Prof. A.P. Mitra (Chairman of the Local Organizing Committee).

The present volume, IAU Transactions XIX B, summarizes the work of the XIXth General Assembly. The discourses given during the Inaugural Ceremony, held at Siri Fort Auditorium, are reproduced in Chapter I. The proceedings of the two sessions of the General Assembly are found in Chapter II, which includes the Resolutions and other aspects of the administration of the Union : they provide the official record of the business of the General Assembly, and, together with the Executive Committee report (Chapter III), constitute the permanent record for the Union in the period 1982-1985.

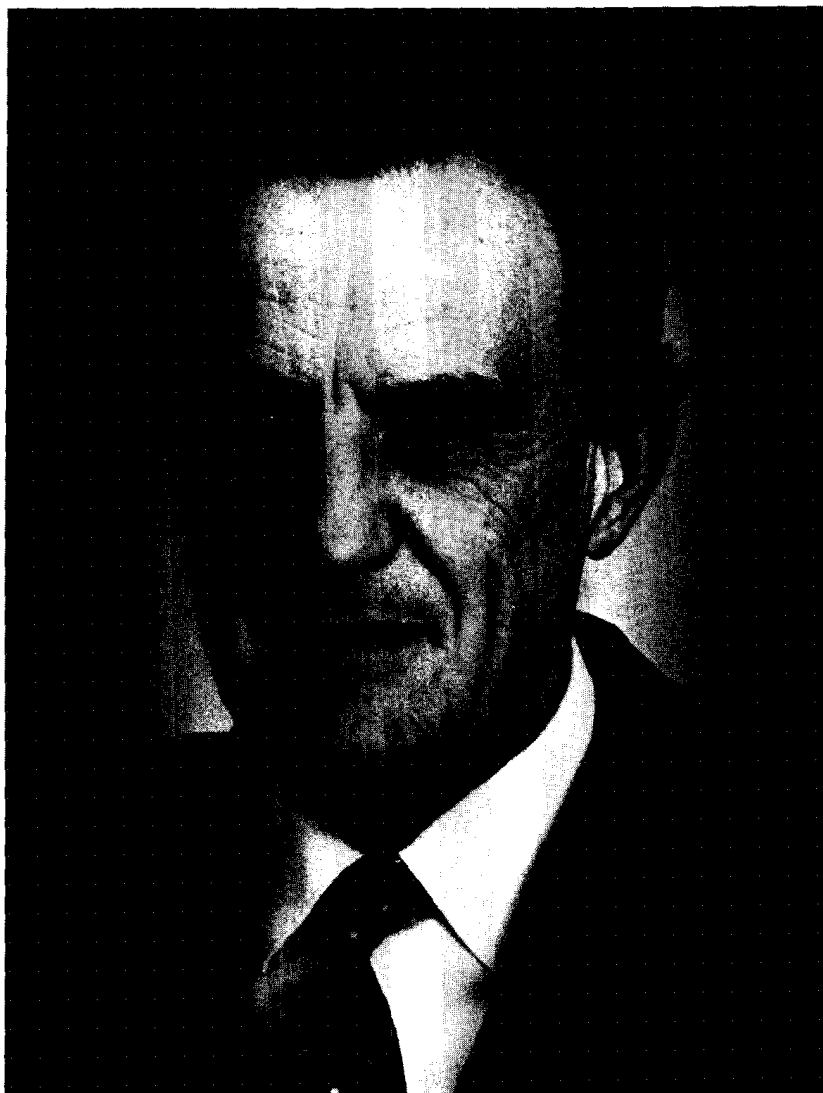
In addition, this volume contains the Commission Reports from Delhi, compiled by the Presidents of the Commissions (Chapter IV). Pending re-edition of a complete Astronomer's Handbook, which is in preparation, Chapter V gives some information about a few activities of the Union, as well as its Statutes and By laws. Finally, Chapter VI, "Membership", contains the list of countries adhering to the Union, member lists of IAU Commissions, and also an

alphabetical list of the more than 6000 individual members of the IAU (with addresses, phone and telex numbers, affiliation to commission(s)). This list will also be published separately and updated every year.

In order to make the information contained in this volume available at the earliest possible date, a tight production schedule was imposed. This would not have been possible without the efficient cooperation of the members of the Resolutions' Committee, and in particular of Drs. McCarthy and Morton, and of the Commission Presidents who provided the camera-ready manuscripts for Chapter IV. I am in addition most grateful to Mrs. B. Manning and to Miss D. Lours from the Paris IAU Secretariat for their expert help in typing, preparing and assembling the documents for publication : this was indeed a tremendous job. Furthermore I acknowledge with thanks Mrs. Manning, Miss Lours, Dr. R. Ferlet, and some French speaking Commission Presidents or Vice-Presidents for their help in putting together a (hopefully) correct English to French translation of the numerous Resolutions.

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Jean-Pierre Swings  
General Secretary, IAU  
May 15, 1986



PRESIDENT DE L'UNION ASTRONOMIQUE INTERNATIONALE

ROBERT HANBURY BROWN

PRESIDENT OF THE INTERNATIONAL ASTRONOMICAL UNION

1982-1985

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## CHAPTER I

### INAUGURAL CEREMONY

19th November 1985

The Inaugural Ceremony was held at Siri Fort Auditorium, Delhi, with distinguished representatives from the Government of India, the City of Delhi, the University of Delhi, and the Indian National Science Academy.

Prime Minister Rajiv Gandhi was the Chief Guest. Shri Ram Niwas Mirdha represented the Ministry of Posts and Telegraphs of India, Prof. C.N.R. Rao represented the Indian National Science Academy, Prof. M.G.K. Menon was the representative of the National Organizing Committee.

The chair was taken by Prof. A.P. Mitra, Chairman of the Local Organizing Committee, Director of the National Physical Laboratory, in Delhi.

The musical interludes were performed by Gandharva Mahavidyalaya. The group consisted of the Principal of Shri Vinaya Chandra Maudgalya College and of his students. They sang the Indian National Anthem and one invocation song.

All the addresses were taped during the Inaugural Ceremony, and typed in Paris. The editor and the IAU staff apologize for the errors or misinterpretations that might have occurred during this process ; Mr. Sahu nevertheless provided quite a useful input in deciphering the tape.

After some words of welcome from Prof. Rao, Prof. Mitra introduced Prof. M.G.K. Menon, Chairman of the National Organizing Committee.

#### **Address by Prof. M.G.K. Menon, President of the National Organizing Committee**

Professor R.H. Brown was born in the Nilgiris at Aruvankadu and he was just mentioning standing outside, that his mother used to play golf where the large cylindrical radio telescope built by the Tata Institute of Fundamental Research is located at Ootacamund. Of course, Hanbury Brown has also been a visitor to India particularly as a Raman Professor of the Indian Academy of Sciences. A very special welcome to you Hanbury. The International Astronomical Union has a special character and perhaps it is worth just mentioning it briefly. It is a Union in which there is individual membership. That is very important. It is also a Union which supports on a significant basis young scientists. And indeed there are about three hundred young astronomers attending this meeting including about a hundred from India ; and this is part of the programme of IAU and it is certainly a programme which augures well for the future.

Mr. Prime Minister, you have practically in every address you have given, since you took over as Prime Minister a little over a year ago, referred to the modernization of India, referred to the great role of science and technology, and we have been aware of the fullest support which science and technology have received in India as Prof. C.N.R. Rao mentioned. First, at the hands of our first Prime Minister Pandit Jawaharlal Nehru, and thereafter in the hands of Srmt. Indira Gandhi, our Prime Minister for a period of almost eighteen years. This

particular General Assembly takes place today on the 19th of November, the birth anniversary of Indiraji. In fact, we had quite intentionally kept it so. She had graciously consented, when I had spoken to her, to inaugurate this General Assembly. We had all hoped to welcome her here on a very auspicious day in her life, her birthday. But, alas, that was not to be, and I certainly hope that this very large meeting of scientists coming from all parts of the world, in an area which received the fullest support from her : international understanding, cooperation, and inter-dependence that exist in the world today, that this meeting, will indeed be a fitting tribute to the memory of that great lady who stood for peace, secularism, social justice, human understanding and the broadest holistic concept of culture to which very brief reference was made this morning, Mr. Prime Minister, in the function when the Indira Gandhi National Center was opened by you.

India has had a long and distinguished tradition in science from its earliest days. And in this tradition were recorded the great contributions of Indian astronomy covering mathematical aspects such as the decimal place value system, the Aryabhaṭīya written by the great astronomer mathematician Ārybhata, the trigonometric system which is characteristic of Hindu astronomy best known through the Sūryasiddhanta, and much else. But, in the in between period, prior to the British period, there has been a decline ; we of course have the last of the great efforts in observational astronomy, the masonry structures, the Jantar Mantars, of which those who are attending this conference will be able to see in Delhi itself, but which there are other specimens in the country. And indeed, it is from that we have the logo of this particular meeting.

We, of course, had during the British period, and prior to independence, a great deal of work arising through the setting up of the first Madras observatory, the Kodaikanal observatory, the great work of Megh Nad Saha. And indeed some of the great work on solar eclipses was done in this country, including the first observation of the element helium done in the plains of Andhra Pradesh. However, it is since independence and particularly over the past thirty years that we have had a renaissance in astronomy, with a large number of institutions, a fairly large community of astronomers, astrophysicists and cosmologists in the country, working over practically the entire spectrum. This covers new instruments such as several large optical telescopes, the latest being the 234-cm telescope which is now installed at Kavalur in the south, the large cylindrical radio telescope at Ootacamund, which I referred to, the proposal, Mr. Prime Minister, to take up in this plan a giant metre-wavelength radio telescope which will fill an important gap and which will be one of the major instruments when completed, the millimeter-wave telescope of the Raman Research Institute, the 1.2 meter infrared telescope at Gurushikar, of the Physical Research Laboratory in the Indian Space Research Organisation. There is, in addition, a considerable amount of ground-based, rocket-based, balloon-based and satellite-based astronomy, covering infrared, gamma-ray astronomy and a great deal of cosmic ray physics. And it is thus that we are now at a stage where one can say there are major new instruments that exist which offer opportunities for our scientists, particularly of the younger generation, and with the most modern techniques and technologies and electronics and so on, to work at the frontiers of this field. And, as I mentioned earlier, we have a large group here, about three hundred Indian delegates in what could be roughly about 1400 delegates in all as registered during the course of the conference, and of these, a large number are young astronomers. And we certainly, with these facilities, hope to work in this major international cooperative enterprise with our colleagues from round the world and in that sense, this particular meeting will be a milestone in the development of Indian astronomy.

We are honoured, Mr. Prime Minister, that in spite of the very heavy schedule which you have, you arrived early this morning from the Middle East, and since 6:30 or thereabouts, you have had a non-stop schedule of commitments. In spite of that, you have agreed to come here to inaugurate this meeting which your mother had so graciously agreed to earlier. We are very

happy to have you with us and would like to thank you for this interest in science, in fundamental research, and particularly, in this field which has been with man since the beginnings of human civilization, an area where we are dealing with distances, with energies, with phenomena on a scale unimaginable compared to anything that one experiences on Earth, where all of our current knowledge has been derived not by actual experimentation, as one does for example in physics, but purely through observation, analysis, building of a systematic picture which is truly magnificent. And here we see the great powers of science, of observation, analysis and building up brick by brick these capabilities, this understanding, we find these powers of science at its very best. And astronomy, as a challenging field, is one indeed through which one can develop interest in science and appreciation of the scientific methods, not only in terms of challenges and excitement that exist in it, but also in terms of the universality of this particular field, and we therefore are very happy to have this conference in India, and on behalf of the National and Local Organizing Committees, once again, a very warm welcome. We hope all of you will enjoy this meeting, and not only this meeting, but also the country you have come to, where we hope to receive you over the next ten days with hospitality, with friendship and in the great traditions of Indian culture.

Thank you very much.

**Address by Prof. R. Hanbury Brown, President of the  
International Astronomical Union**

On behalf of the International Astronomical Union, may I say how very honoured we are that you, Mr. Prime Minister, have consented to be with us today, on such a busy day for you. We greatly appreciate your presence here as a mark of your government's interest in science. May I also thank you, Professor Rao for your welcome.

I would also like to convey to all those concerned our very real gratitude for the invitation to meet in this country and for the generous facilities which you have provided for our meeting. We are indeed happy to be here - happy to be with people who are so welcoming and to meet in a city which is so handsome and so historic.

Our Union has been bringing its members together in General Assemblies ever since 1922 ; in fact it is one of the oldest of the Scientific Unions. Its broad aim is to develop astronomy through international cooperation and these General Assemblies are intended to serve that aim in three main ways. Firstly, they have the straightforward scientific function of exchanging and reviewing the latest scientific results and of planning the international cooperation in research which is so essential to astronomy - no matter what our nationality may be, we all work in the same sky.

Secondly, these Assemblies help to make individuals feel that they are part of a real, live, world-wide community of astronomers. For a short while they make visible the invisible community to which all true scientists belong, the invisible college of science. To know that they are part of that great community is particularly valuable to young astronomers who may have little, if any, opportunity of attending international meetings. I am glad to say that in planning this meeting considerable efforts have been made to help young astronomers to attend.

Thirdly, it has been our experience that these Assemblies help to promote a public interest in astronomy in the country in which they are held ; I hope that it will prove to be true in India.

Many members of our Union, will, I feel sure already, know something about India. If they were lucky they could have learnt it from our late President Vainu Bappu whose death was such a grievous loss to astronomy, especially to Indian astronomy and to our Union. He was an excellent ambassador for Indian science - courteous, charming and, moreover, extremely good at the task which he had undertaken - the modernising of Indian optical astronomy. We all miss him greatly at this meeting ; I know how much he valued the prospect of our Union meeting in India.

Many members will, no doubt, have learnt something about India from those guidebooks which we all buy and promise ourselves that we will read, and often end up reading on the plane. From those books we can learn quite a lot about Indian history and culture. The word culture as it is commonly used, includes literature, architecture, painting, music, dancing, sculpture, religion and so on ; but it never includes science. Astronomy is an integral part of science and the pursuit of science should be an integral part of any worthwhile conception of modern culture and vision of progress. Maybe the more serious guidebooks have something to say about India's extensive and distinguished scientific past - perhaps they tell us something about India's contributions to algebra or to astronomy in the 5th century, or more likely they tell us about the magnificent medieval observatories such as the one at Jaipur. But what they do not tell us, unlike Professor Bappu, is anything much about what Indian science is like today. To take a very few examples from my own experience of this great country, I could tell you about the fine optical observatory at Kavalur, the impressive radioastronomical installation at Ootacamund or about the excellent work on radioastronomy at the Raman Research Institute in Bangalore. But I hope that some of you will see these things for yourselves.

One of the best ways of getting to know an unfamiliar country in a short time is to meet your opposite numbers in that country. I hope that you will meet some of the very many Indian astronomers and other Indian scientists at this General Assembly. If you do, you will discover something which cannot be discovered from a guidebook, that the tradition of scientific excellence which we find in Indian history is still very much alive today.

**Shri Ram Niwas Mirdha**, Minister of Posts and Telegraphs, was then asked to request the Prime Minister to release the one rupee commemorative stamp, depicting Comet Halley, which was issued at the occasion of the XIXth General Assembly of the IAU. The Minister then delivered the following speech :

सीरीफोट सभाभक्त में 19-11-85 को हुई हागोलीय संघ की 19वीं आम सभा में स्मारक डाक टिकट जारी करने के अवसर पर संचार मंत्री श्री राम निवास मिर्धा द्वारा दिया गया भाषण ।

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माननीय प्रधानमंत्री श्री राजीव गांधी, प्रो० हेनवरी ब्राउन, अध्यक्ष, अंतरराष्ट्रीय हागोलीय संघ, प्रो० सी० एन० राव, अध्यक्ष, भारतीय राष्ट्रीय विज्ञान अकादमी, प्रो० एम० जी० के० मेनन, अध्यक्ष, राष्ट्रीय संगठन समिति तथा विशिष्ट अतिथिगण ।



हमारे लिये यह वास्तव में गौरव का किणाय है कि अंतरराष्ट्रीय छागोलीय संघ की 19वीं आम सभा का आयोजन यहां हो रहा है। ऐसा पहली बार हुआ है कि IAU के वेनु बाप्पु के विशेष प्रयत्नों के फलस्वरूप भारत में संघ की आम सभा का आयोजन किया गया है। हमें इस बात की प्रसन्नता है कि सौर - निकाय ने लेकर ब्रह्मांड की उत्पत्ति तक के किणाय के अध्ययनों पर चर्चा करने के लिए संसार भर के अनेक वैज्ञानिक इस सभा में भाग ले रहे हैं। इसके द्वारा विश्व भर की सहकारिता पर चल रही परियोजनाओं की समीक्षा की जायेगी तथा नये कार्यक्रमों पर सहयोग द्वारा कार्य आरम्भ होगा। सन् 1946 से भारत अंतरराष्ट्रीय छागोलीय संघ का एक सदस्य है। पिछले कई वर्षों में छागोलविज्ञान तथा छागोलभौतिकी के प्रायोगिक पहलू पर भारत ने महत्वपूर्ण योगदान दिया है।

भारत में छागोलविज्ञान को सदैव सम्मान जन्क स्थान दिया गया है यद्यपि प्राचीन भारत में छागोलविज्ञान और ज्योतिष का परस्पर किणय हो गया था। उदाहरण के लिए वाराहमिष्र तथा ब्रह्मगुप्त दोनों को ही यह भलीभाँति ज्ञात था कि चन्द्रग्रहण पृथ्वी की छाया तथा सूर्यग्रहण चन्द्रमा के कारण होता है।

आधुनिक भारत में हमारे वैज्ञानिकों ने छागोल विज्ञान तथा छागोलभौतिकी के क्षेत्र में बहुत उपलब्धियाँ प्राप्त की हैं तथा विश्व-भार में उनके कार्य को सराहा गया है।

छागोलज्ञों की श्रेणी में मेघनाथ साहा का विशिष्ट स्थान है। डा० सुब्रह्मण्यम शोखार ने भी छागोल विज्ञान के क्षेत्र में बहुत योगदान दिया है।

छागोल भौतिकी के प्रयोगों में भारत ने असाधारण प्रगति की है, तमिलनाडु में केन्नूर, ऊँटी में उधागमन्दलम् तथा कोठाईकनाल में स्थित विशेष दूरबीनों से हमारे वैज्ञानिकों को कार्य करने की उपयुक्त सुविधाएँ तथा वैज्ञानिक वातावरण उपलब्ध हो गया है।