Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

NO. 1 : MONDAY, 22 JULY

Our logo

Several factors have been taken into account in designing the logo for the 21st IAU General Assembly. The lower half of the logo depicts part of an ancient circular pattern showing a nine-pointed star inscribed within a double circle of stones. Each star was set upon a platform which was 2 metres high and between 8 and 10 metres in diameter. Fourteen of these platforms were found at Vinchina Department in the Province of La Rioja. Undoubtedly they date back to the La Aguada civilisation which flourished in north-west Argentina between 650 and 800 A.D. The upper part includes the number (in Arabic numerals) assigned to the General Assembly, together with the abbreviation of the International Astronomical Union, thus completing a circular pattern enclosing a diagram showing the Southern Cross (Cruz del Sur in Spanish), the representative constellation of our hemisphere.

Acknowledgements

The Local Organising Committee wishes to express gratitude to official institutions and private companies for providing financial support and various facilities during the organisation of the 21st IAU General Assembly. A list of contributors is as follows:

- Secretaría de Ciencia y Tecnología (SECYT, Presidencia de la Nación) (National Secretary of Science and Technology).
- Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) (National Council of Scientific and Technical Research).
- The National Universities of Buenos Aires, Córdoba, La Plata and San Juan.
- Yale Southern Observatory.
- ANACITEC (Argentine-North American Association for the Advancement of Science, Technology and Culture).
- Service of Translation and Interpretation, Dept. of Modern Languages and Literature, Faculty of Education Sciences, University of La Plata.
- Audiovisión S.A. (They provided our logo).
- Oxer S.A. (Xerox Dealer).
- Papelera Jose Teddy Magariños S.A.I.C. (paper).
- Hidroplat S.A. (ball-pens).
- Transistemas S.A. (Communications equipment).
- Additional thanks are due to Sam Erdini and to Charles François.

Welcome to Argentina!

The Argentine Astronomical Association is delighted to welcome all the participants to the 21st General Assembly of the IAU. This is the first time that a General Assembly has been held in Argentina - or, indeed, in South America - so that it is a great honour for us, as well as being a great responsibility. Astronomy in our country has a tradition dating back for 120 years, and as the first Astronomical Association to organise a General Assembly in this part of the world, we are determined to make it a success. Unfortunately, the present situation in Argentina creates some problems, and our budget for the whole organisation has been very low, but we believe that we have used it in the best way possible. We hope you have a very comfortable stay and a pleasant time in Buenos Aires; take advantage of the General Assembly, and also enjoy our city life.

Esteban Bajaja
President, Argentine Astronomical Association

Breaking new ground

For the first time in the history of the IAU, a General Assembly is taking place in a Latin-American country. Previous Assemblies have been held in Europe (14 times), the United States (3 times) and once each in Australia, Canada and India.

Argentine astronomers feel very happy and proud with the decision - taken in Baltimore three years ago - to hold the 21st gathering of professional astronomers from all over the world in the city of Buenos Aires, particularly in view of the fact that 1991 is an eventful year in Argentine astronomy.

From time to time, opinions have been expressed by many members of the Union suggesting that General Assemblies last too long, that there is insufficient science in them and that it is more profitable to attend symposia and colloquia, which are much smaller. It has also been suggested that administrative matters are of no general interest. Up to now, however, each time a Committee has been formed to deal with this question, there has been no clear decision as to how to change the form of the General Assembly.

In my view, General Assemblies are very useful, and in many respects they are unique. They provide opportunities to meet not only people working in one's own field of research (as in symposia and colloquia) but also to meet people working in other fields, so that information can be gained about every branch of astronomy. It seems to me that there is another good reason for continuing with General Assemblies: they are of particular significance to young people. A General Assembly provides ample opportunities for young astronomers to meet senior scientists whom they have known only by name, and to have face-to-face discussions with them. This cannot easily be done elsewhere.

For us in Argentina, this particular General Assembly is extremely important in several ways.

First, we are rather isolated astronomically because we are so far away from other centres even in neighbouring countries. For the fortnight or so of the General Assembly we will be in very close touch with astronomy world-wide.

Secondly, notwithstanding our long tradition in astronomy, it is always useful to find ways of creating or re-creating an awareness of the existence and importance of our researches.

We have two Schools of Astronomy in this country. In addition, numbers of physics students are doing research and working for their Ph.Ds in subjects connected with astrophysics, so that all in all a fairly substantial number of young people in Argentina are engaged in astronomy. I feel certain that this General Assembly will be of great benefit to them, and will greatly influence their future scientific lives. The same will also be true for our more mature astronomers, who will have the opportunity to meet participants from other countries.

Last, but certainly not least, our colleagues coming to Buenos Aires will be bringing and discussing results from the space observatories which have been put into orbit since the Baltimore Assembly - the Hubble Space Telescope, ROSAT, HIPPARCOS, GRO and so on. This must surely make the 21st General Assembly of special interest to everyone.

This General Assembly will also have an influence on astronomy in other Latin-American countries which are members or potential members of the Union, because their astronomers can come here more easily than to most other General Assemblies and can use the opportunity to secure support for astronomical development locally.

Finally, let us hope that this General Assembly will make it even clearer that regional collaboration in astronomy in South America, as in Europe, is the only course in this highly competitive, challenging and inspiring epoch in which we are fortunate enough to live.

Jorge Sahade
Past President, IAU (1985-88)

The future of the IAU

It is a great pleasure for me to see so many guests and colleagues here to attend the 21st General Assembly of the International Astronomical Union. The General Assembly is, of course, the most important meeting of the IAU. It is held every three years, and this year the chosen venue is Buenos Aires in Argentina. This is the second time that a General Assembly has been held in the southern hemisphere, but it is the first time for South America.

The history of astronomy in Argentina goes back for many years. In fact, the Astronomical Observatory of Córdoba was founded in 1871, and the La Plata Observatory in 1882, while Argentina has been a member country of the IAU since 1927. There are now about ten observatories in operation; the largest optical telescope has an aperture of 215 cm, and there is a 30-metre radio telescope. This shows that Argentina is very active astronomically.

The IAU itself is one of the oldest scientific unions, and has played an important rôle in promoting astronomical research, not only in developed but also in developing countries. In the old days, IAU General Assemblies were meetings where almost all the members gathered; in fact these gatherings represented the only real chances for astronomers to meet each other and discuss their research projects.

During the past thirty years or so, the number of IAU members has risen very rapidly. As the number of participants increased, we found that the time allotted for each presentation was too short, which led to the idea of organising symposia on particular topics. The IAU has organised numerous symposia and colloquia attracting many astronomers. Yet even then it was found that since the range of subjects covered was rather wide, too many papers were included in the programmes. Next came the idea of holding workshop-type meetings devoted to more specific topics, and to give even more time for discussion. Nowadays there are several meetings every year, even without IAU sponsorship, some of which attract many participants.

Therefore, as time passes, I fear that the relative weight of the General Assembly has lessened in the IAU itself as well as in other astronomical societies. Methods of improving the system of the General Assembly, and of the IAU itself, have been discussed at recent meetings of the Executive Committee, but unfortunately we have not yet been able to reach any firm conclusions. However, we intend to introduce some new ideas at the present General Assembly, which will - we hope - attract new members, particularly those of the younger school.

It is expected that during the present Assembly there will be further discussions among the members of the Executive Committee, national representatives and Commission Presidents. I hope you will agree that the system of the General Assembly can be improved with the aim of attracting more members, as it is still an unique opportunity for astronomers of all disciplines to get together to discuss astronomical problems in a wide-ranging way. I believe that we must also try to improve the IAU system both administratively and financially.

With regard to science itself - which, after all, is the most important subject here - we expect that several important results will be presented during the present General Assembly, since in the past three years new astronomical satellites such as HIPPARCOS, the Hubble Space Telecope and COBE have been launched and brought into operation. In ground-based astronomy, new ideas for optical infra-red telescopes have been developed, and several large telescopes of this type are now under construction. For radio astronomy, interferometers of very high resolution are now in operation or are under construction. Exciting new aspects have also been opened in theoretical astronomy, particularly in the field of cosmology. Moreover, new fields of astronomy involving innovative techniques such as gamma-ray, neutrino and gravity-wave detectors have been inaugurated. This shows that astronomical research is still developing very rapidly.

Therefore, I anticipate that all the participants will gain a great deal by attending the many meetings organised here, by presenting their papers, and/or by participating in discussions both during the scientific sessions and elsewhere.

Yoshihide Kozai
President, International Astronomical Union

EDITORIAL

Welcome to all our readers of *Cruz del Sur* (Southern Cross). As with all IAU newspapers, ours will have a short life - a mere ten issues - but, we hope, a useful one. Because of circumstances entirely beyond our control, we will have fewer pages and a smaller format than previous IAU papers, but we aim to make up in quality what we lack in quantity!

Following the invitation to me to act as Editor, I was immensely relieved when Dr. John Mason agreed to join me as Associate Editor, one of the many reasons being that his expertise in computer-setting and design compensates for my deficiencies. Both of us will, of course, be available throughout the General Assembly. The newspaper office is on the second floor of the San Martin Centre; at other times we can be contacted at the Savoy Hotel, where we are staying.

We are most grateful for the help of our Editorial team: Dr. Estella Brandi, Dr. Mariano Méndez and Lic. Laura Palumbo of the Local Organising Committee, together with Lic. Sergio Federovisky, Professor Viviana Soler, Lic. Gerardo Milesi, Dr. Flavio Mammini, Lic. Susana Mammini and our designer, Arch. Carlos Mammini.

We will at all times welcome contributions, reports, suggestions and criticisms. Obviously we are limited in space, but we will do our best to give as complete an overall coverage of the General Assembly as is possible. Please help us to make *Cruz del Sur* fully worthy of the first General Assembly ever to be held in Argentina.

PATRICK MOORE
Editor, *Cruz del Sur.*

Why Buenos Aires?

After Patras (Greece, 1982) and Delhi (India, 1985) why go to yet another fairly remote place, and not stay closer to the centre of gravity of the distribution of IAU members? The 20th General Assembly took place in Baltimore (USA) in 1988, so why not choose Europe for 1991? This way of thinking definitely did not appeal to the Executive Committee during its 1986 meeting, held in the Colonster Castle on the campus of the University of Liège. The Executive Committee considered that it was time to go to Latin America, both in recognition of the excellent astronomy already being done in that area and also as a promotion of our science in South America. Europe could wait until 1994.

Before the final decision could be made, I was asked to assess the facilities in Buenos Aires, which I did with great pleasure in January 1987. I was shown the Centro-Cultural and the Teatro San Martín, some large cinemas (perhaps necessary for the opening ceremony), and the Teatro Colón, as well as a few hotels and restaurants. Everything looked fine and adequate and, of course, the Argentinian hospitality was a most pleasant bonus (not to mention the food and wine!).

I also took the opportunity to visit La Plata, Córdoba and San Juan, and was impressed by the existing facilities in view of the fact that some symposia or colloquia could well be organised in these cities before or after the General Assembly; this will, in fact, be the case in Córdoba.

Not far from Córdoba lies the well-known site of Bosque Alegre, with its interesting telescopes (worth the visit!). In the Andes, within easy reach of San Juan, lies El Leoncito, in a most beautiful landscape. The site, not easy to drive to when the roads are washed away by the heavy rains of January, can be approached by a small plane landing on a nearby dried lake: a very interesting experience indeed!

So, upon my return to Europe, I reported very positively about Argentina to the Executive Committee which, without any hesitation, re-endorsed its proposal to hold the 1991 General Assembly in Buenos Aires, and this was happily accepted at the 20th Assembly in Baltimore. The dates of the Assembly were chosen so as to leave plenty of time for those wanting to observe the super total solar eclipse in Mexico (July 11).

The organisation of the 21st General Assembly in Buenos Aires has led to the setting up of peripheral IAU meetings: four symposia and one colloquium in Brazil and in Argentina. We thus hope that many astronomers from all over the world will have numerous and fruitful contacts with their Latin-American colleagues at the General Assembly, at the peripheral meetings, and during trips to observatories in Brazil, Argentina and Chile, so that the wish expressed by the Executive Committee in 1986 will be fulfilled and that the promotion of Latin-American astronomy will be given new momentum.

JEAN-PIERRE SWINGS
Former General Secretary IAU (1985-88)

Observatories under the Southern Cross: La Plata

Astronomy in Argentina originated because of the drive and foresight of President Domingo Faustino Sarmiento, who governed the country during the second half of the 19th century. He realised that the development of science was of tremendous importance in any country which is anxious to overcome its basic problems and rise to the level of a modern nation. Therefore, despite the fact that Argentina was going through a difficult period in its history, he created the country's first observatory - that of Córdoba - in October 1871. Next, in 1883, came the observatory of La Plata. Both were based upon major observatories already in use in Europe and the United States.

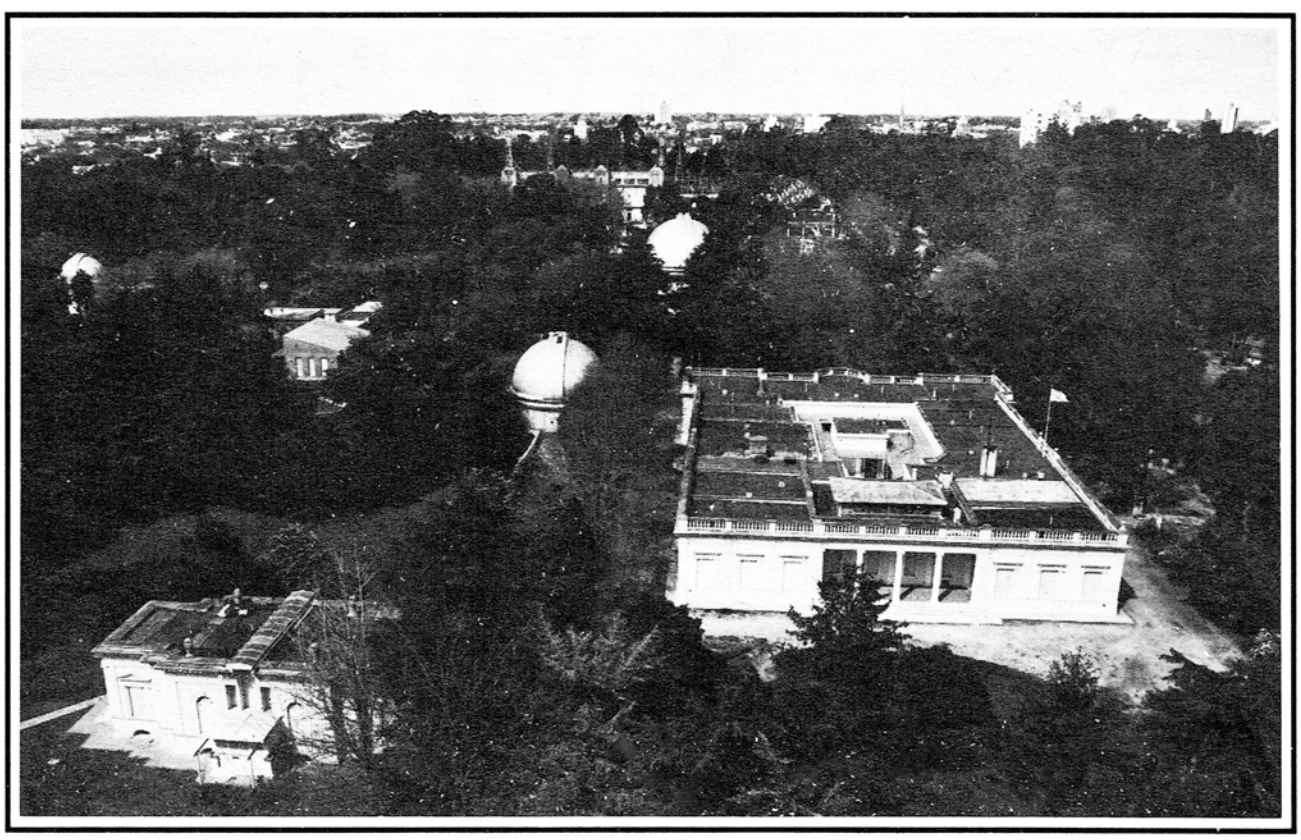
The establishment of the first two Argentine observatories took place under different circumstances, but the aims were the same: to provide centres of investigation, compilation and analysis of observational data. It must be remembered that at this time there were very few observatories in the southern hemisphere. Subsequently, scientific developments made it necessary to begin training astronomers. In 1934, therefore, the first Astronomy and Related Sciences High School of the University of La Plata was established, using the Observatory as its centre.

The story of the founding of La Plata Observatory is interesting. In order to observe the transit of Venus on 6 December 1882, the Government of the Province of Buenos Aires bought some astronomical equipment at Gautier, in France, and invited E. Perrin - an officer in the French Navy - to lead the team which was to carry out the observations from a site 200 km west of the city of Buenos Aires. In November 1883, François Beuf, a lieutenant in the French Navy and a colleague of Perrin's, was appointed Director of the Observatory to be established at the recently-founded city of La Plata.

Shortly afterwards, Dr. Joaquín V. González, founder of the National University of La Plata, realised that the Observatory would be a splendid centre for the University. González understood that the most important task of a modern University is to encourage scientific research, and he therefore appointed both researchers and teachers.

During the first thirty years of the Observatory's existence, Directors such as Dr. W. Hussey, from America, and Dr. J. Hartmann, from Germany, built up the most efficient working group concerned with astronomical and geophysical research in Argentina, and perhaps in all Latin-America. Yet it was not until 1934 that González' dream of a proper School of Astronomy and Related Sciences was finally realised. Between 1934 and 1985, some 200 professional scientists obtained their degrees from La Plata University, 130 in astronomy (including 50 Ph.Ds) and 70 in geophysics.

Today the Centre has various departments where research projects are carried out. These include astrometry, stellar spectroscopy, galactic structure, studies of extragalactic systems, photometry and celestial mechanics. There is also an Interdisciplinary Theoretical Group which covers subjects such as high-energy astrophysics. Electronic and Optical Departments support both the astronomical and geophysical researches, and instruments are designed and built in these Departments.



COMMENT

Peer review

An increasing number of research projects and publications are rejected because referees or editors judge them to be "incorrect". But if one thinks for a moment about how something is judged to be right or wrong, one realises that it is measured against what is currently known or believed correct. Of course if anything is ever to change - progress in the form of old understandings being replaced by new ones - then some previous knowledge will have to be discarded or modified. So even though many of these contradictory results indeed may be incorrect they necessarily also include the new correct results. Rejecting the "incorrect" inescapably discards the correct on which progress in the field depends.

Another way of putting it is that when a result disagrees with conventional wisdom, an editor or referee has no way of knowing if the result is correct or not. That is to be found out by further investigation of researchers in the field. It is not the job of the editor to decide for the reader of a professional journal whether a result is true or not and therefore whether the reader should be allowed to see it. The job of the editor is clearly to judge whether a submission:

1) is on an important matter
2) is clearly expressed
3) uses the scientific method

Censorship, however well or ill intended, is exactly the opposite of the job of an editor or a journal. In my opinion the primary responsibility of editorial boards and society directors is to clearly state and *enforce* this policy.

The matter is an extremely serious one - at the heart of science. This is because theories simply are connections between observed facts. The best ones are those with the least inconsistencies. The dominant theory always claims that it is scientifically true because it passes all possible current tests, but if there are contradictory observations that have been suppressed then the theory is based on false data. Falsification of data is the most serious ethical and practical crime in all of science. For this reason it is necessary for everyone involved in a scientific field to vigilantly insist on free, uncensored communication of scientific data.

HALTON ARP
Max Planck Institut für Physik und Astrophysik

Enjoy yourself in Buenos Aires!

Buenos Aires, capital of the Argentine Republic, is a large city with a population of 3 million. It forms part of the Area Metropolitana, which has a total of 11 million inhabitants.

The Cultural Centre General San Martín, where most of the functions of the General Assembly will be held, is down-town, one block from the most important street in Buenos Aires, Corrientes Avenue. This part of the city is shown in the map on page 6 of the Final Programme of the 21st General Assembly. Many historical and places of general interest in Buenos Aires are very close to the San Martín Centre. For example, 10 minutes' walk south down any of the side streets off Corrientes Avenue brings you to San Telmo, the oldest part of the city, where you will find museums and historical buildings. Ten blocks further takes you on to the most picturesque part of Buenos Aires - La Boca - near the river, with its brightly-painted houses.

The Recoleta district is 10 minutes' walk along Callao Avenue, north from the intersection with Corrientes Avenue. Here you will find the cemetery of La Recoleta, the Basílica de Nuestra Señora del Pilar and the Plaza Francia; also the Centro Cultural Ciudad de Buenos Aires, where the avant-garde artistic activities attract those who follow the culture of youth!

If you walk along Corrientes Avenue you will find many bookshops, theatres and typical Buenos Aires cafés. Five blocks from the San Martín Centre, along Corrientes Avenue, you will find the Obelisco, from which a diagonal street takes you to the Plaza de Mayo; here are the Catedral Metropolitana and the Government building, the Casa Rosada.

On this page you will find useful information about restaurants, museums and theatres. We sincerely hope that you will enjoy your stay in Buenos Aires.

Sergio Federovisky

Useful information

Long-distance telephone calls

707 Corrientes Avenue: 24-hour service
1 Florida Street (pedestrian precinct, five blocks from 9th July Avenue): Mon.-Fri. 8 am - 10 pm.
(Note that it is very much cheaper to make international telephone calls from these bureaux than from your hotel.)

Currency

Argentinian currency can be confusing to those who are not used to it. There are 10,000 australes to the US dollar! A simple rule is to delete the last four digits; what is left will be the equivalent in US dollars. Thus deleting four zeros from 200,000 leaves 20: therefore 200,000 australes = 20 US dollars.

Taxis

There are a great many taxis in Buenos Aires; they are yellow and black and can be flagged down in the street if the "Libre" sign is illuminated. The fare is approximately 1,200 australes (1.2 US dollars) for each unit shown on the taxi meter. Always ask for the card known as the "planilla"; in Spanish, "Por favor, me muestra la planilla". One taxi can hold up to three or four people.

Museums

• **Museo de Teatro Colon**, 1161 Tucumán Street: ballet and musical art.
• **Museum of Spanish Art**, "Enrique Larreta", 2291 Juramento Street: an ancient mansion formerly owned by the writer Enrique Larreta. It contains beautiful pieces of historic Spanish furniture as well as a valuable art collection.
• **Argentine Museum of Natural Sciences**, 470 Angel Gallardo Avenue. Permanent exhibition of geology and mineralogy; an aquarium, and the most important insect collection in the country.

Underground (Subte)

Line B follows the road, underneath Avenue Corrientes. The Callao station is at the corner or Callao and Corrientes. The Uruguay station is close to the San Martín Centre, at the corner of Corrientes and Uruguay.

Shops

Heading north, go to the commercial district of Once (station Pueyrredón), where you can buy clothes, shoes, jackets and many cheap goods. Heading south, cross 9th July Avenue, and go towards historical down-town Buenos Aires, where you will find many banks and currency exchanges.

Cafés and Bars

Buenos Aires is famous for its thriving cafés and bars; some are very traditional, others are more modern. Here are three for you to sample and enjoy:
• **La Opera**: at the junction of Avenue Corrientes and Avenue Callao.
• **La Giralda**: in Avenue Corrientes, between Paraná and Uruguay. Very traditional and lively.
• **El Ciervo**: at the junction of Corrientes and Callao, directly opposite La Opera. One of the more modern café/bars.

Restaurants

There is a wide range of restaurants, catering for all tastes, within easy walking distance of the San Martín Centre. Here is a selection:
• **Bachin and La Marca**:1660 Avenue Corrientes, near junction with Montevideo, in a small plaza off the street. These are just two of the six restaurants in the plaza, and serve mainly meat and pasta (medium price). Nearby, there are also two coffee shops and several theatres.
• **Chiquilín**: corner of Sarmiento and Montevideo. Meat and pasta (medium price).
• **German restaurant**: Corrientes, near corner with Callao, in front of the Pumpernic fast-food restaurant.
• **La Cantina China**: 967 Maipú (six blocks from San Martín Centre). For Chinese food (medium price).
• **La Robla**: Corner of Perón and Montevideo. Sea-food and cold meats, also typical Spanish food (medium price).
• **Los Teatros**: Talcahuano, between Corrientes and Sarmiento. International cuisine (expensive).
• **Pippo**: Montevideo, between Corrientes and Sarmiento. Good pasta restaurant (cheap).
• **Pumpernic:** near corner of Corrientes and Callao. Burgers and fast food (medium price).
• **Ratatouille**: Sarmiento, almost on the corner with Callao. Excellent vegetarian restaurant (cheap).

Useful phrases

Por favor	**Please**
Gracias	**Thank you**
Muchas gracias	**Thank you very much**
Buen día	**Good morning**
Buenas tardes	**Good afternoon**
Buenas noches	**Good night**
Hasta mañana	**See you tomorrow**
Cómo le va?	**How are you doing?**
Chau	**Good-bye**
Dónde queda el bar más cercano?	**Where is the nearest bar?**
Dónde puedo tomar un taxi?	**Where can I find a taxi?**
A qué hora es el desayuno?	**At what time is breakfast?**
Cuánto cuesta esto?	**How much does it cost?**
Me podría decir la hora?	**Could you tell me the time?**
Dónde queda el toilette?	**Where is the toilet?**
Dónde queda el Centro Cultural General San Martín?	**Where is the San Martín Cultural Centre?**

IAU Press Office

The IAU Press Office will be open throughout the General Assembly. In charge of the Press Office is Lic. Susana Mammini. The office is on the second floor of the San Martin Centre, next to the IAU newspaper office. The Press Office will be available to all delegates for contacts with the news media (journalists, radio, etc.). Delegates who need any assistance in this respect should contact the Press Office direct. The telephone number of the Press Office is 814-5014. Another telephone will be available for making overseas telephone calls, but this will NOT receive incoming calls. The fax number for both the Press Office and the General Assembly is (54-1) 11 1707.

A non-event!

Today there will be a penumbral eclipse of the Moon (mag. 0.28, time of mid-eclipse 18h 07m.8 UT). This eclipse is distinguished on two counts:
1) This is the first of a series which will become umbral with the eclipse of 10 October 2117.
2) It is not visible throughout the Americas!

E-Mail • Fax • Telex

The Local Organising Committee has arranged facilities for electronic mail, telex and telefax with a private company. This is operating from a booth on the lower floor of the San Martin Centre.

Any IAU member or registered guest can send and receive electronic mail to and from any Internet connected network, BITNET, NSI/DecNet and X.400 networks. You can also send and receive messages by telex and fax.

The cost of using these services varies according to the amount of material involved and the distance over which it is sent.

Announcements

The following changes have been made with regard to meeting rooms and times.

The Business Meeting (19.1) of Commission 19 will now be held in Room P at 1600-1730 on Wednesday, 24 July.

The Development of Space and Ground-Based Instrumentation (8.8) of Commission 8 will now be held in Room K at 0900-1030 on Friday, 26 July.

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NO. 2 : TUESDAY, 23 JULY

"Dead cows" in the desert

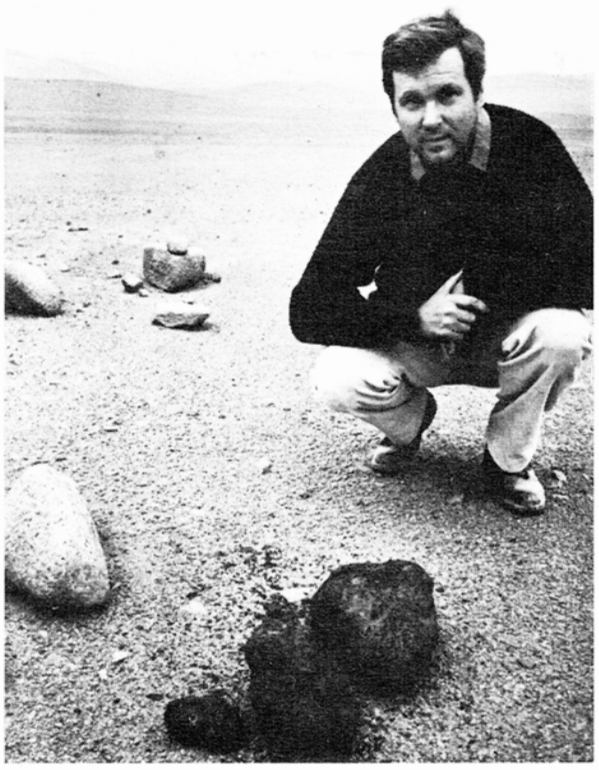
About 3500 years ago a large meteorite, at least one metre across and with a mass of several tonnes, fell in the Atacama Desert of northern Chile. During its descent it broke up into numerous smaller pieces, which impacted in the desert sand over an area of 20 square kilometres - where they remained, in an excellent state of preservation because of the very dry climate.

When prospectors travelled through the region in the 1860s, in search of valuable minerals, they found meteoritic fragments which they at first believed to be silver. They collected some of the fragments and brought them to the town of Copiapo - perhaps 1000 kg altogether - and many of them were lost, but about 45 kg found its way into mineral collections, and the meteoritic nature of the material was recognised. The meteorite fall was given the decidedly unattractive name of Vaca Muerta (Dead Cow) after a nearby dry riverbed (Quebrada Vaca Muerta), but subsequently the location was forgotten. It was rediscovered in 1985 by Edmundo Martinez, a geology student at the Universidad del Norte, Antofagasta (he now runs a travel agency in San Pedro de Atacama).

Martinez discovered one large meteoritic mass, and this became known to the Chilean geologist Canut de Bon, who decided to investigate. Together with two astronomers from the European Southern Observatory, Harri Lindgren and Holger Pedersen, he explored the site, and over a period of four years 77 specimens of the Vaca Muerta meteorite were collected, with a total mass of over 3400 kg. The meteorite is a mesosiderite (a rare stony-iron type), and the new finds have more than tripled the amount of this material available for study. The distribution of the recovered fragments (the fall area measures about 11 x 2 km) indicates that the meteorite entered from the east-south-east, so that it flew over the Andes Mountains before impact. One of the largest fragments landed with such force that it made a crater 10 metres in diameter and almost 2 metres deep.

Twenty of the specimens had been previously collected by miners, and made into objects such as tools, cooking utensils, cans, corks, horseshoe nails and in one case a coin. (The photograph shows ESO astronomer Harri Lindgren examining fragments of the Vaca Muerta meteorite at a miner´s depot.) However, 57 specimens, ranging in mass from a few grammes to one piece weighing 309 kg, were in their original condition. All the material is now in Chilean collections, mainly the Universidad de La Serena and the Museo Nacional de Historia Natural in Santiago. A full report by Pedersen, Lindgren and Canut de Bon will shortly appear in the journal *Meteoritics*.

An apt comment came from Holger Pedersen: "We are used to observing remote objects in space, but it was really great fun for once to do some down-to-earth astronomy!"



A brisk start!

Registration at an IAU General Assembly always begins briskly. This was certainly so on the present occasion, with delegates arriving from all parts of the world. But what was everyone expecting? There seemed to be a general feeling that this would be a very exceptional General Assembly, and that there would be dramatic items of news.

Jean-Claude Pecker (France)

For example, what will we hear about the Hubble Space Telescope, which still lay in the future at the time of the last General Assembly - held in Baltimore, home of the Space Telescope Science Institute? This was of interest to many delegates, as was pointed out by, among others, Pierre Bastien from Montreal and Frederick J. Urba from the US Naval Observatory at Flagstaff in Arizona. The results from the HST will be described during the Assembly, particularly during Joint Discussion VII on Wednesday, 31 July, and then, too, we will know more about the state of its health.

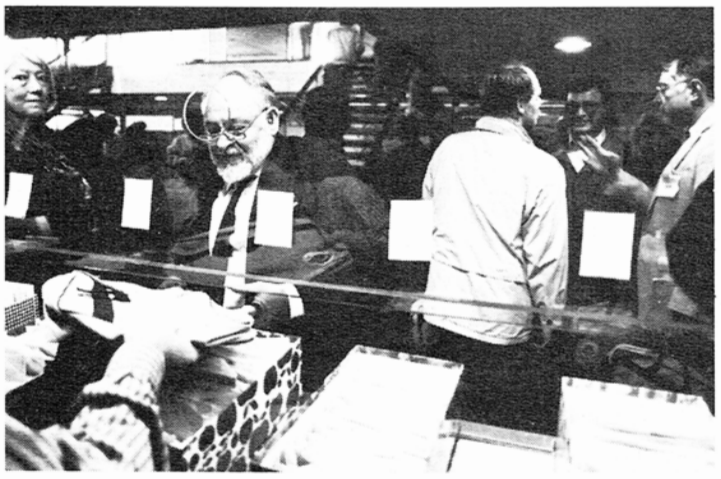
Richard Davis, from Jodrell Bank in England, was - understandably - looking forward to renewing his personal acquaintance with his colleagues in the field of radio astronomy; now that great networks are being set up, the scope seems to be almost unlimited. Another aspect of special interest to many of the arriving participants was that of the exploration of the furthest depths of the universe. Jean-Claude Pecker, former General Secretary of the IAU, commented that one of the Invited Discourses was to be given by Halton Arp (on Monday, 29 July), whose views on cosmological distances do not conform to those of many other researchers, and it was certain that this Discourse would lead to lively discussion.

Interests are, of course, diverse. Bruce McAdam, of the University of Sydney in Australia, had arrived by way of his native New Zealand, and said that he liked Buenos Aires - though his first impressions had been less favourable, because heavy rain had been falling, and Buenos Aires in the rain looks rather like any other large city in the rain! Bruce McAdam's main interest at the General Assembly concerned the plans for setting up an observatory in Antarctica. Conditions in that remote continent are exceptional, and the idea of establishing a really major institution there, with a large telescope, is very attractive, but it would need a tremendous amount of careful thought. McAdam felt that the discussions at the present Assembly (particularly during Joint Commission Meeting IV on Saturday, 27 July), might well have far-reaching consequences.

One or two new arrivals wondered whether General Assemblies, in their present form, might eventually be abandoned or at least drastically modified. There are certainly ways in which the organisational aspects of the IAU can be improved, and A.Akalin, from the Pulkovo Observatory in the USSR, said that there would be very important discussions about these matters during the present General Assembly.

Aynur Akalin (USSR)

From Britain, Astronomer Royal Arnold Wolfendale arrived together with his wife, and looked forward to an interesting and constructive ten days. Paul Murdin, from the Royal Observatory Edinburgh, was (like so many others) particularly concerned with the results from the Hubble Space Telescope, and also with the latest information about the supernova 1987A, in the Large Cloud of Magellan, which has set astronomers so many problems since its dramatic flare-up in February 1987. But, as always, nobody knew what was going to happen, and the situation was neatly summed up by Jean-Claude Pecker, who said: "Well, how can I possibly know what I'm expecting?".



Astronomy in the Media

A meeting of astronomers, Argentine journalists and other representatives of the news media was held in the National Senate in Buenos Aires on Friday, 19 July. It was convened and organised, to coincide with the General Assembly, by Dr. Laferriere, President of the Science and Technology Committee of the Argentine Senate: the theme was 'the popularisation of astronomy'. There were four speakers: Dr. Horacio Tignanelli (La Plata Observatory), Horacio de Dios and Diane Cazaux (Argentine journalists) and Patrick Moore (Britain).

There was an interesting exchange of views. All the speakers were in agreement that the spread of astronomical knowledge is extremely important, and that it is essential to present scientific facts in language which can be understood by those who have no previous knowledge. Dr. Tignanelli, who has written several popular books, emphasised the need for introducing young people to science, and he regretted that astronomy was not taught in Argentine schools. Mr. de Dios felt that there was still a 'generation gap' in language, and that it was important to concentrate upon teaching the teachers. Patrick Moore discussed the popularisation of astronomy in Britain, particularly with regard to television, and pointed out that the forthcoming General Assembly would present a great opportunity for the Argentine news media. He hoped that the Assembly would be fully covered in the Press and on television.

Dr. Laferriere, President of the Science and Technology Committee of the Argentine Senate

Following a question-and-answer session, Dr. Laferriere closed the meeting by thanking all those who had taken part. He agreed that the General Assembly should be fully reported, and was sure that it would be of great help in popularising astronomy in Argentina.

'First light' discovery with the ROSAT wide-field camera

The launch, switch-on and check-out of a satellite experiment is a careful, time-consuming process, causing considerable anxiety to the teams of engineers and scientists involved, even though everything that could reasonably have been done to make the mission a success has in fact been done, with testing and re-testing. New science, the reward for this anxious effort, usually emerges rather slowly, and only after extensive calibration and performance verification has shown that the results being produced are reliable and ready for the scrutiny of the scientific world. Occasionally, however, there are exciting results very early in a mission. The ROSAT wide-field camera (WFC) must be close to being unique in getting such a result during 'first light' into the instrument, and when pointing at a part of the sky chosen for another telescope!

The WFC took its first look at the sky in the extreme ultra-violet (EUV) region of the spectrum when the companion German X-ray telescope (XRT) was making a calibration observation of the galaxy cluster Abell 2256. Due to the substantial interstellar absorption of EUV radiation, it was considered very unlikely that the WFC could detect Abell 2256. This was the case, but the switch-on teams were delighted to find in their data an unusually bright EUV source toward the edge of the camera's field of view. This previously unknown source of EUV radiation, subsequently named RE1629+781, has turned out to have an intensity among the brightest of all the EUV sources seen to date by the WFC in its all-sky survey, and to be an unusual and very interesting example of a binary combination of a DA white dwarf and a cool dwarf star.

At the time of the discovery of RE1629+781, the pointing direction of the WFC was not known with sufficient precision to allow a truly reliable search for possible optical counterparts on sky survey plates. However, this kind of search is irresistible, and produced a few interesting bright objects (galaxies, etc.) which, temporarily, were possible candidates before they were discarded as the source position and size of error box were revised. Eventually, a reliably-positioned error box directed attention to a 13th-magnitude star which was unusually blue, and was very like the optical counterpart of the brightest EUV source in the sky (HZ43). Optical spectroscopy of the star revealed not only the characteristic absorption lines of a DA white dwarf, but also evidence for a cool star with emission lines caused by the energetic extreme ultraviolet radiation being reprocessed into optical radiation after hitting the cool star's atmosphere.

RE1629+781 has some simlarities to the EUV source Feige 24, but also some dramatic differences in the spectrum of the EUV radiation emitted. Continued study of both RE1629+781 and Feige 24 in the EUV, UV and optical wavebands will provide a valuable database with which to explore the astrophysics of hot white dwarf binary systems.

Without doubt the totally unexpected bright EUV source which was discovered in the very first hours of the life of the ROSAT WFC gave an exciting glimpse of the other discoveries which are to be made in this, until now, poorly explored part of the electromagnetic spectrum

K.A. POUNDS
Department of Physics and Astronomy,
University of Leicester, UK

The sky of the Tehuelches

Only three decades after Columbus discovered America, the equally renowned Magellan landed at San Julian Port, in the south of Patagonia, where he encountered a tribe of Indian hunters. He called them "Patagones", and eventually the whole region was named after them. Patagonia became widely known because of the writings of the famous chronicler Pigafatta, and it was he who referred to the myth of the "Patagonian giants".

The few modern descendants of Magellan's Patagonians are now known as the Tehuelches. They are tall, with massive features - characteristics shared by several of the races at the southern end of South America. From the cultural point of view the old Tehuelches were very primitive; they hunted with bows and arrows, and also used what was called the boleadora (a lassoo with balls). It has been said that they were Palæolithic people "frozen in time", though, strictly speaking, primitive and non-contaminated races, cultures and languages can no longer exist.

The art of the old Patagonians is significant. The most ancient examples are represented by paintings of human hands, dating back perhaps 10,000 years, together with rock frieses. The Patagonian art-styles changed over the years, no doubt because of the development of ideologies which came under the close scrutiny of the "wizards", who claimed to know the secrets of the cosmos and the "The Beyond".

Having traced the evolution of these art-styles through to historical times, when labyrinth paintings prevailed, I have come to the conclusion that one all-important idea was dominant throughout: that of The Beyond - the entrance to Paradise.

It is well known that the labyrinth is the symbol of the "Difficult Way" of the spirits of dead people through to The Beyond; that is to say, reward for the righteous and punishment for the sinner. The modern Tehuelches could therefore be the heirs to a secret which is so old that it may have its origins in Palæolithic times.

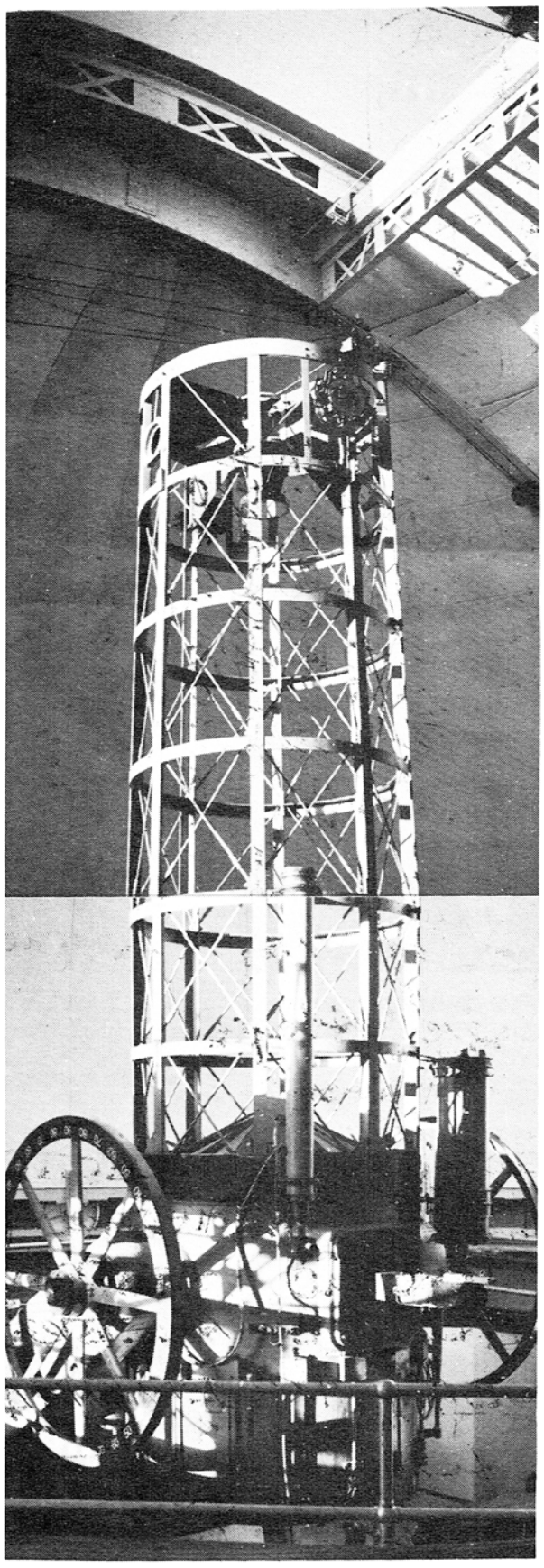
To them, the Lord of the Labyrinth - and hence of Paradise - was the most important of the gods; female, and the "Owner of Animals". This is marked in the sky by the little group of stars known as Corona Australis (the Southern Crown), in the southern part of the Milky Way, or Way of the Spirits of the Stars. The spirits of the hunters chase their prey - the running guanaco (a South American hoofed mammal, a member of the camel family closely related to the llama). There too, avoiding the boleadora aimed at it - indicated by the Pointers to the Southern Cross, Alpha and Beta Centauri - is the most valuable prey of all: the avestruz or American ostrich.

Familiar to all Indians and inhabitants of ancient Patagonia and a guide to all travellers by night, the Southern Cross is the true symbol of the southern sky.

RODOLFO M. CASAMIQUELA
Chief Researcher, CONICET,
Ameghino Foundation, Viedma

Observatories under the Southern Cross: Córdoba

In 1865 Domingo Faustino Sarmiento, the Argentine Ambassador in Washington, made the acquaintance of the American astronomer Benjamin Apthorp Gould, founder of the well-known *Astronomical Journal*. At that time the southern-hemisphere skies were much less well-known than those of the north, for which catalogues had been drawn up by Bessel, Argelander, Schönfeld and others. Gould was anxious to extend these surveys to the southern sky, and Sarmiento was in full agreement. Sarmiento accordingly put forward these ideas to the Argentine Government, but because our country was going through a difficult period little could be done for several years. In 1868 Sarmiento became the fourth constitutional President of the Argentine Republic, and on his recommendation Congress approved the creation of a National Astronomical Observatory, with Gould as Director. The Observatory was officially opened on 24 October 1871.



The 154-cm reflector of the Observatorio Astronómico de Bosque Alegre at Córdoba

At the inaugural ceremony, Gould addressed the President and other members of the distinguished audience as follows: "Tonight, all the stars you can see with the naked eye after the Moon has set have already had their positions and brightness recorded by astronomers at your Observatory." He was referring to the *Uranometria Argentina*, an atlas and catalogue of 7756 stars brighter than magnitude 7.0, within 100 degrees of the south celestial pole. Following this brisk start, astrometric work continued with the *Córdoba Zone Catalogue* (1884), the *Argentine General Catalogue* (1886), the *Córdoba A Catalogue* (1913) and the *Córdoba B Catalogue* (1914).

Gould returned to the United States in 1885, at the end of a successful period as Director. He was succeeded as Director by John M. Thome (1885-1909) and then by Charles D. Perrine (1909-1936). Thome began work on the now-famous *Córdoba Dürchmusterung*, completed by Perrine almost fifty years later; it includes 614,000 stars. The number of observations made to complete this monumental work was almost 2,500,000.

Córdoba Observatory took part in the international campaign to observe the minor planet Eros at its close approach of 1931, with the aim of improving our knowledge of the length of the astronomical unit (the distance between the Earth and the Sun). Measurement of the Córdoba plates yielded a value of 8".792 for the solar parallax, in close agreement with the value derived by Sir Harold Spencer Jones from results from observatories all over the world (8".790).

In 1909 Perrine asked the Argentine Government for funds for a 60-inch reflector for astrophysical research; at that time the only 60-inch (152-cm) reflector in the world was that at Mount Wilson, in California. Meanwhile, Perrine directed the construction and setting-up of a 30-inch (76-cm) reflector, with which he carried out important work in connection with southern galaxies, Cepheid variables, novæ, and the spectra of Wolf-Rayet stars.

The 60-inch reflector was finally set up by Perrine's successor, E. Gaviola, an Argentine physicist who specialised in optics (the Gaviola test, used in figuring large mirrors, is well-known). The mirror was completed in Argentina in January 1940, and the Bosque Alegre Astrophysical Station, with the 60-inch reflector operational, was officially dedicated on 5 July 1942. In the following year, Argentine scientists built the world's first spectrograph with all-reflecting optics.

Gaviola continued the programmes laid down by Perrine, and in 1956 founded an institute for the teaching of mathematics, astronomy and physics in the University of Córdoba.

Córdoba Observatory has made very important contributions to astrometry and celestial mechanics, but during the past forty years the main work has been in astrophysics. Activities have included studies of the light-curves and spectra of eclipsing binaries, novæ and supernovæ; variable stars in the Magellanic Clouds; the structure and chemical composition of open and globular clusters; carbon stars; the solar wind, and comets. A catalogue of variable stars in globular clusters has been produced. Great attention has been paid to extragalactic research, and many papers have been published in connection with the distances, structure and shapes of galaxies; an extensive atlas of southern galaxies has also been completed.

COMMENT

The future of Latin-American astronomy

For several years I have been a strong advocate of Latin-American integration in astronomy, and also for the establishment of a Latin-American Association. My reasons for this were the desirability of joining together our resources, both economic and intellectual, and also our experience, so that we can meet the challenge of today's astronomical progress. In this context, Europe is giving us a wonderful example of what can be achieved when integration is carried out in a rational way.

However, I do not believe that my views have received any support. In 1968 the Directors of the La Plata Observatory in Argentina (myself, at that time), the National Observatory in Rio de Janeiro, Brazil (then Dr. Luiz Muniz Barreto), and of the Cerro Calan National Observatory in Santiago, Chile (Dr. Claudio Anguita) jointly advocated a Latin-American facility equipped with a large telescope. Nothing happened then, for various reasons, and it now appears that the situation has changed. Moreover, I have come to realise that there are several factors working against a general Latin-American integration in astronomy.

First, there is the problem of the distances between the Latin-American countries. This makes travel between them very difficult, particularly in view of the present economic situation.

Secondly, I believe that although we often talk about general integration, we have a long way to go before we can really mean business.

Thirdly, a country such as Mexico is very close to the United States, and is within reach of US institutions, so that contacts between astronomers of the two countries are very strong. Chile is in a very good position astronomically, because of the training of young people and the advantages of the large, modern foreign obsevatories installed on Chilean territory. All this has a strong bearing on any possible integration plans.

It would appear, therefore, that I was wrong in hoping for the astronomical integration of Latin-America. It may well be better to aim for sub-regional integrations, linking Argentina with Brazil and Uruguay, and Mexico with perhaps Colombia, Cuba and Venezuela. When astronomy has developed sufficiently in Paraguay and Peru, countries which have very long-term associations with the IAU, they too could come into the picture.

At any rate, the ball is now in the court of the younger generation of Latin-American astronomers.

JORGE SAHADE
Past President, IAU (1985-88)

Meeting programmes

Joint Discussion IV on ´Cosmic Background´
Monday, July 29, Room A, 0900-1730
Commissions 44, with Commissions 40, 47 and 48. *R.B. Partridge (Chairman)*

SESSION 1

G. De Zotti, Theoretical Framework
J. Mather, Spectrum of the Cosmic Microwave Background (CMB)
G. Smoot, Large-Scale Isotropy of the CMB

SESSION 2

J. Ostriker, Sunyaev-Zel´dovich Perturbations
J. Narlikar, Alternative Explanations
M. Hauser, Infra-red Background

SESSION 3

M. Fukugita, Theory of Fluctuations
P. Lubin, Small-Scale Isotropy of the CMB

SESSION 4

A. Soltan, X-ray Background

The above programme replaces that on page 33 of the Final Programme.

Joint Commission Meeting VII on ´High-Redshift Galaxies & Large-Scale Structure´
Tuesday, July 30, Room B, 0900-1730
Commission 47 with Commissions 28, 44 and 48. *K. Sato (Chairman)*

SESSION 1

N. Bahcall, A Unified Picture of Large-Scale Structure
L. da Costa, Optical Redshift Survey
B. Tully, Possible Geometric Patterns in 0.1c-Scale Structure

SESSION 2

O. Lahav, Peculiar Velocities in the Local Universe
D. Mathewson, No Backside Infall into the Great Attractor
M. Hu, Structure and Morphology of Gas around High-Z QSOs
H. Yee, Clusters around QSOs

SESSION 3

A. Blanchard, X-ray Background Radiation
L. Cowie, K Band Number Counts, Dwarf Galaxies and Cosmology
G. Bruzual, New Models for Spectral Evolution of Galaxies
M. Fukugita, Galaxy Number Counts and Implications on Cosmological Parameters

SESSION 4

Y. Suto, N-body Simulations to Test the Reliability of Correlation Functions
A. Vilenkin, Cosmic String and Large-Scale Structure
J. Ostriker, Galaxy Formation at High Redshift in Various Scenarios

The above programme replaces that on page 43 of the Final Programme.

Other Announcements

Commission 8: Positional Astronomy
Session 8 (Developments in Space & Ground-based Instrumentation) of the Commission 8 meetings has been brought forward from Tuesday, July 30 to Friday, July 26. It will take place from 0900-1030 in Room K.

Film Preview

Please note that the preview of the set of ten videos on Astronomical Observatories and the History of Astronomy, directed by Robert Pansard-Besson, which was to have taken place in the Orange Room, has with very great regret had to be cancelled for technical reasons.

ESO exhibition opens

On Saturday, 20 July, a major astronomical exhibition was opened at the Galileo Galilei Planetarium in Palermo Park, Buenos Aires (near the intersection of Sarmiento Avenue and Belisario Roldán Street). It was organised by the European Southern Observatory (ESO), under the guidance of Claus Madsen. Among the many exhibits describing ESO facilities at the La Silla Observatory, in Chile (where there are 14 optical telescopes with apertures up to 3.6 metres, and a 15-metre sub-millimetre radio telescope) are some describing the 16-metre equivalent Very Large Telescope (VLT) and its site on Paranal mountain. It will be the world's largest telescope when completed.

The main speakers at the opening ceremony were Dr. Cornejo, Director of the Planetarium, and Dr. Richard West, Head of Information Services at ESO. A display was presented in the Planetarium using the excellent Zeiss projector - showing not only the southern night sky, but also unusual cloud effects, complete with a thunderstorm (though fortunately for the audience, no rain!). Following the display, Dr. West presented the Director with a copy of the famous ESO *Atlas of the Southern Sky*, compiled at La Silla.

The Exhibition will be open throughout the General Assembly, and is well worth a visit. The Planetarium, which also has some interesting meteorite exhibits, is not within easy walking distance of the San Martín Centre (it is about 40 blocks distant), but there are plenty of taxis.

Are you giving an oral presentation?

If you are speaking at a meeting during the General Assembly, please do not forget to give any material which you need to be made into acetate overlays for the overhead projector, and any other projection material (except 5 cm x 5 cm transparencies), to the Technical Support Office, in Room D, at least 12 hours before your talk. See sections 3.9 and 7.2 of the Final Programme for additional information.

Currency problems!

Some General Assembly participants may have currency problems in Argentina. These were noted in the pre-Assembly IAU Information Bulletins, but may not have been fully appreciated. Many hotels, restaurants and bars do not accept travellers´ cheques or even the most commonly-used credit cards, and if having a meal or a drink away from one´s own hotel it is advisable to carry a reasonable amount of Argentine currency. Moreover, do not be deceived - remember that a round of drinks could cost well over half a million australes! We are pleased to tell you that most of the restaurants listed on the back page of the first issue of *Cruz del Sur* do accept the most commonly used credit cards.

US dollars are the only preferred currency for foreign exchange. In some cases you may be able to use your credit card to obtain cash in US dollars (you will need your passport or other means of identification), and later change the dollars into australes, but it may not be easy.

Hotel charges

Several participants have complained to the Local Organising Committee about the large increase in hotel prices compared with the figures published in IAU Information Bulletin 64. Of course this unfortunate situation is deeply regretted, but there is nothing that we can do about it.

In our country all internal costs, in dollars, have increased by a large factor over the past year, since Information Bulletin 64 went to press. This increase is a by-product of the enormous changes introduced by the present Government. This unexpected situation has badly affected the budget of the present General Assembly. This means that we have been forced to increase the price of the ticket for the Closing Banquet (Wednesday, 31 July) from 10 to 20 dollars, and also to charge an entrance fee for the Colón Theatre Concert on Saturday, 27 July.

Unfortunately, Buenos Aires is not as cheap now as it used to be a year or two ago. We can only ask for your patience and understanding.

ROBERTO H. MENDEZ
Chairman, Local Organising Committee

Today's main events

08.00-19.00 Registration Desk open at the San Martín Cultural Centre, located on Sarmiento Street 1551. Following registration, badges must be worn at all times.

14..30 Inaugural Ceremony, to be held in Rooms A + B of the San Martín Centre. There is seating for up to 1000 people.

The **Opening General Assembly** follows on immediately after the Inaugural Ceremony. All participants are invited to attend.

19.00 Welcome Reception to be held at the San Miguel Palace, Suipacha Street 84, about 8 blocks from the San Martín Cultural Centre. Admission will be free. but badges must be worn. Walk down Sarmiento Street, cross 9th July Avenue, and turn right: Suipacha Street runs parallel to 9th July Avenue, one block on the far side of it, as you approach from the San Martín Centre.

Tour Programme

A friendly welcome to all our guests! We invite you to enjoy you visit to Buenos Aires by participating in the Registered Guest Tour Programme. It consists of half-day tours which reflect the history, culture and art of our people.

A Registered Guest interested in any of these tours must contact Ana Maria Orsatti or Gustavo Vázquez at the Registered Guest desk close to Room E (see map on page 8 of the Final Programme for location) of the San Martín Centre to receive a ticket for the tour. In the case of a morning tour, pre-registration must be made before 5.00 p.m. (17.00) of the previous day. For an afternoon tour, before 10.00 a.m. (10.00) of the day of the tour.

Note that Registered Guests are given priority for space on all tours, but IAU Members and Invited Participants may enquire at the desk to check on the availability of a place on the tour, between 5.00 p.m. (17.00) and 6.00 p.m. (18.00) of the previous day (in the case of a morning tour), or from 10.00 a.m. (10.00) to 11.00 a.m. (11.00) on the day of the tour, in the case of an afternoon tour. Everyone except Registered Guests (with yellow IAU badges) must pay 10 US dollars for a place on any tour.

Seats for each tour are limited, so that we strongly recommend early booking. we hope that you find the Tour Programme highly interesting. Come with us!

See section 5 (pages 12 to 15 inclusive) of the Final Programme for more details.

Local tours for Wednesday, July 24

1.40 p.m. (13.40)
• Tour 5.5: Visit to the Colón Theatre and Museum, Libertad 600
2.20 p.m. (14.20)
• Tour 5.1: National Historical Museum, Defensa 1600
Tours depart from the San Martín Cultural Centre, at the indicated times; badges are required.

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • Associate Editor: *JOHN MASON*

NO. 3 : WEDNESDAY, 24 JULY

President Menem at the IAU

The first ceremonies of an IAU General Assembly are always memorable - and this one was particularly so, because the main speaker was the President of the Argentine Republic.

The first speaker was Roberto Méndez, Chairman of the Local Organising Committee, who was followed by Fernando R. Colomb, his counterpart in the National Organising Committee; both expressed great pleasure at being able to welcome the delegates, and this was echoed by Esteban Bajaja (President of the Argentina Astronomical Association) and Osvaldo E. Devries (Secretary of Education and Culture of the Municipality of Buenos Aires). Next came a musical interlude, given by the excellent La Plata University Brass Quartet, and then, to great applause, President Menem entered the hall, together with Raúl F. Matera (Secretary of Science and Technology), and Yoshihide Kozai (President of the IAU).

Dr. Matera welcomed the astronomers on behalf of the City of Buenos Aires; it was a great opportunity for people of different countries to get to know each other. Following him, Y. Kozai reminded the audience of Argentina's long history of astronomical research, and recalled that his predecessor, Jorge Sahade, had made many important decisions during his period of office.

President Menem, greeted most enthusiastically by the audience, began by saying that when in Argentina he spoke Spanish; when abroad, he still spoke Spanish - though he appreciated the fact that English was now becoming the accepted language of science! It was, he said, a great pleasure to greet so many astronomers from all over the world. He had just returned from a meeting in México, involving the Heads of State of all Latin-American countries, and although astronomy, as such, had not been on the agenda there had been considerable discussion about communications in space, inasmuch as Argentina would shortly be launching its first artificial satellite.

Astronomy, said the President, was not only the oldest of all the sciences, but also the youngest, because new discoveries were always being made; whether regarded from a purely theological or a purely scientific point of view, it was equally important. It would be even more so in the future. Men had been to the Moon, and could no doubt shortly travel to the planets. Astronomy showed the way toward a greater understanding of the wonderful world in which we live, and since there were now 1200 astronomers visiting Argentina he felt that when he looked into the streets of Buenos Aires, he was seeing 1200 stars.

The President's speech was greeted with loud and prolonged applause. He then left the platform, and the first meeting of the General Assembly was held, in which Yoshihide Kozai made some opening remarks and Derek McNally (General Secretary) read some announcements. The meeting then adjourned, and everyone made ready for the official Welcome Reception due to begin later in the evening.

Cosmic bullets!

NASA is currently studying the hazard to the Earth posed by cosmic impacts. An international scientific workshop, with 20 participants (held at San Juan Capistrano, California on 3 July 1991), is preparing a report that will be completed late this year. This statement constitutes an interim report from the on-going work of this Near-Earth Asteroid Detection Workshop.

A number of studies have shown that the Earth is subject to occasional large impacts from comets and asteroids, with sometimes catastrophic results. Examples of such catastrophes include the impact of a 10-km diameter comet or asteroid 65 million years ago that produced a global climatic change, and resulted in the extinction of the dinosaurs, as well as such smaller impact events as the 10-megaton Tunguska explosion which took place in Siberia 83 years ago. The greatest risk to Earth´s population is found to be associated with impacts of asteroids in the approximate diameter range from 5 km down to 0.5 km . The associated energies of these impacts range from almost ten million to more than one thousand megatons. Such impacts produce devastating effects on a regional scale, and the larger impacts are probably capable of global damage to the ecological balance of the Earth, leading to the deaths of hundreds of millions and perhaps even billions of people. Although these impacts are rare, it would be prudent to assess the dangers they pose and to try to identify any asteroids in this size range that might impact the Earth.

Astronomers estimate that there are approximately 10,000 Earth-approaching asteroids in the size range from 5 km to 0.5 km. Of this number, only about 100 (one per cent) have actually been observed and their orbits tracked. None of these known objects is on a collision course with the Earth in the short term. However, it is entirely possible that one or more of the 99 per cent that have not been discovered may pose such a threat to our planet.

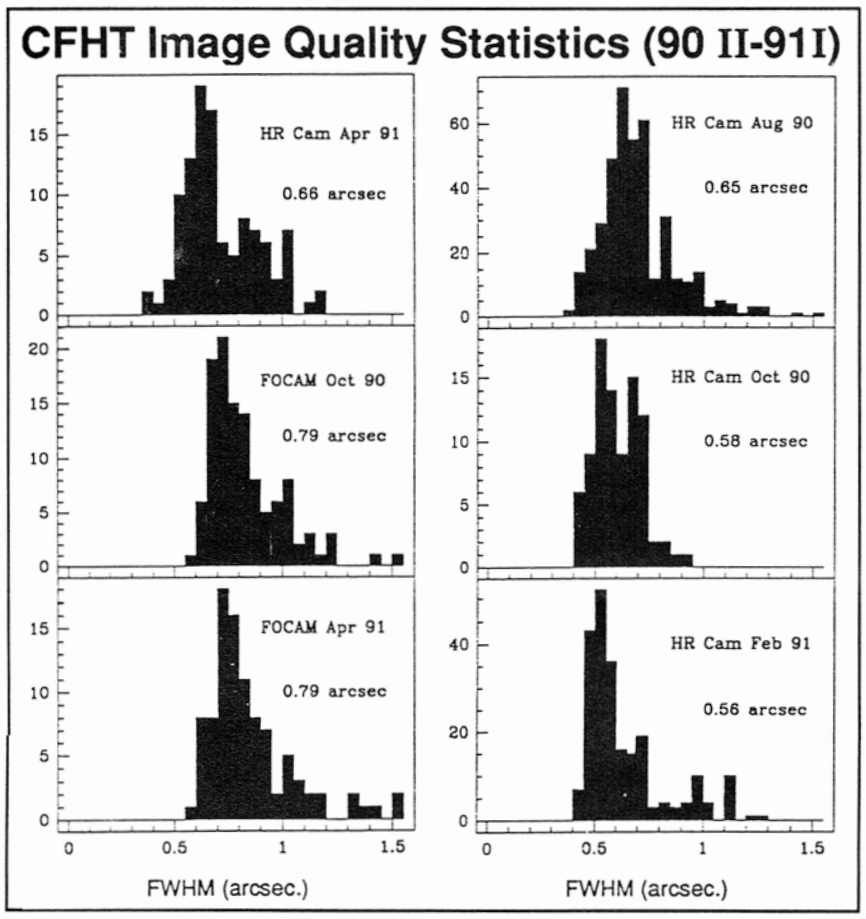
..The NASA workshop is investigating ways to detect and determine the orbits for the entire population of Earth-approaching asteroids larger than 0.5 km diameter. Our objective is to identify approximately 50 per cent of these objects within the first decade of the search programme, and to achieve a nearly complete inventory within the next 25 years. Such an effort can be started by enhancements of present searches, with the near-term goal of identifying as many as possible of the larger Earth-approaching asteroids (diameters greater than 2 km). However, to meet our goals we will require construction of several large new wide-field telescopes equipped with the most advanced CCD detectors and sophisticated software to distinguish faint asteroids from the background of stars. The proposed asteroid detection programme will also yield the discovery of many thousands of smaller asteroids, and will permit us to assess the hazard posed by impacts in the energy range near 1000 megatons, which is still some 50,000 times greater than the explosive power of the atomic bombs used in 1945

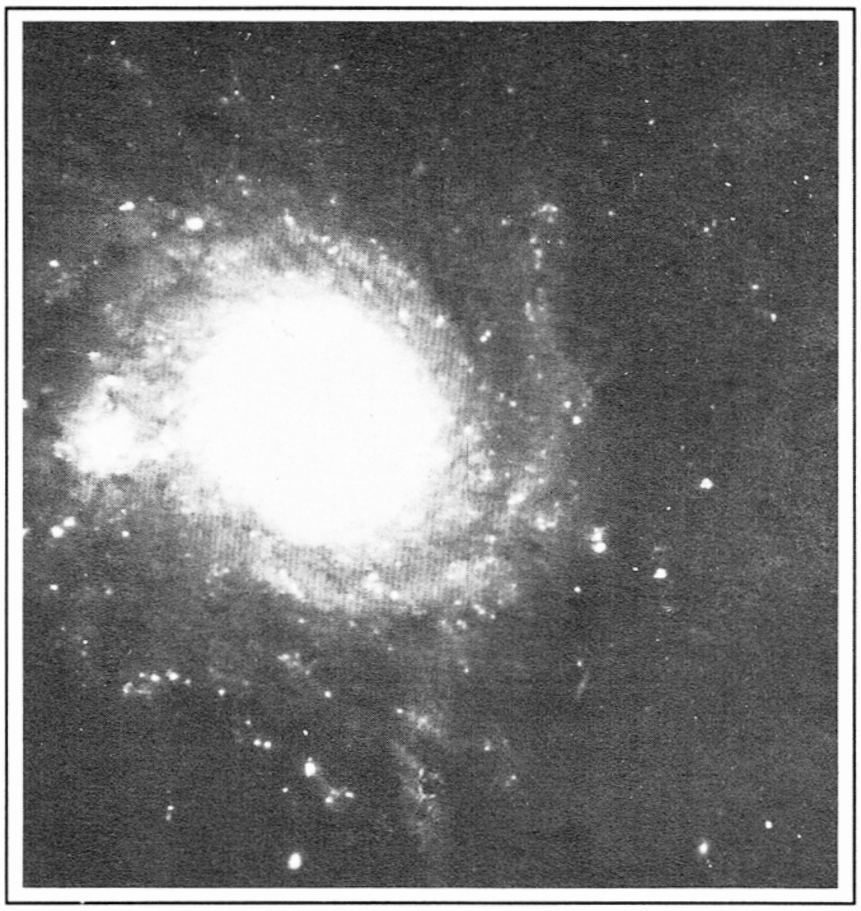
The programme to discover and track Earth-approaching asteroids is international in scope. The threat posed by these asteroids is felt by all nations and can best be met by an international campaign of discovery and follow-up observations. The search for near-Earth asteroids requires telescopes located in both hemispheres and at a variety of longitudes around the Earth. We envisage this effort as an excellent opportunity for a collaborative, multi-national programme that will benefit the entire population of the planet.

The DAO/CFHT high resolution camera

The Canada-France-Hawaii Telescope is one that provides the best image quality obtainable from the ground. In recent years, an image stabilizing camera (HRCam) using a fast tip/tilt mirror has been operating routinely on the telescope, improving the already good seeing significantly for direct imaging. HRCam was developed by the Dominion Astrophysical Observatory (DAO) instrument group, National Research Council of Canada, with collaboration of CFHT staff, and Réne Racine of the University of Montreal. Figure 1 shows the image quality statistics collected by an automatic process, without any data selection, from all frames taken during the last year with HRCam and with the normal prime-focus camera (FOCAM). These statistics were compiled by CFHT staff from more than 1000 frames taken on approximately 50 nights. It is apparent from these data that the image quality with HRCam often reaches 0.4 arcsec (FWHM), that the median seeing is near 0.6 arcsec, and that this is about 0.2 arcsec better than the un-stabilised median seeing at the prime-focus of CFHT.

Some of the scientific programmes carried out with HRCam in the last year include photometry to below the horizontal branches of globular clusters in M31, measurement of brightness fluctuations of elliptical galaxies in Virgo for determination of H_o, and resolution of a Virgo spiral into individual stars. Figure 2 shows a 60-minute red exposure of NGC 4571, an ScIII galaxy in the Virgo Cluster (frames kindly obtained by G. Luppino and J. Tonry). Photometry of stars has been done from these frames to near the 26th magnitude. From a comparison of the brightest red stars with estimates of the magnitudes of the brightest red supergiants in comparable nearby galaxies, the distance modulus to Virgo is estimated by M. Pierce, R. McClure, and R. Racine to be approximately 15 Mpc, leading to a Hubble parameter near 85. It is apparent from this photometry that long-period variables, and even Cepheid variables, should be within reach of HRCam.





ROBERT D. McCLURE
Dominion Astrophysical Observatory,
National Research Council of Canada

Invited Discourse I: *Gravitational lensing*

Wednesday, 24 July, Rooms A + B, at 6.00 p.m. (18.00)

Atmospheric lensing effects distort our view of distant objects. Similarly, without doubt, gravitational lensing distorts our view of the distant universe, and affects our understanding of various classes of extragalactic objects from a physical point of view. During this Invited Discourse we will summarise the theoretical and observational evidence supporting these claims.

After briefly reviewing the history of gravitational lenses, we will discuss the basic principles underlying the formation of gravitationally-lensed images of distant cosmic sources. Numerical simulations, and an optical lens experiment, will be of help to us in presenting these concepts in a simple manner.

Among the astrophysical and cosmological interests of observing and studying gravitational lenses, we will point out the possibility of deriving the value of the Hubble parameter H_o from the measurement of the time-delay, and how to estimate the sizes and structures of distant quasars through observational studies of micro-lensing effects.

Current observations of known gravitational lens systems, obtained with highly sensitive ground-based telescopes, will then be presented. These will include several examples of multipy-lensed QSO images, giant luminous arcs, arclets and radio rings. From models of these enigmatic objetcs, we will show how it has been possible to find out the masses of distant lensing galaxies, to study the distribution of luminous and dark matter in the universe, and to estimate the sizes of absorbing clouds located along the lines of sight to remote quasars. The various optical and radio searches for new gravitational lens systems, now being carried out at major observatories, will also be reviewed.

At the end of our presentation, we will discuss major astrophysical and cosmological aims for the immediate future by setting up, on a site with good atmospheric seeing, a medium-sized (1-2 metre) telescope to be devoted to the photometric monitoring or the multiple images of known and suspected gravitational lens systems.

SJUR REFSDAL, Hamburg Observatory
& JEAN SURDEJ, University of Liège

The ESO exhibition at IAU

In addition to the big ESO exhibition in the Buenos Aires Planetarium, ESO is also represented with a stand at the exhibition in the Orange Room of the San Martin Cultural Centre.

The main subject of the exhibition is ESO's Very Large Telescope (VLT), now under construction in Europe. Following more than six years of site testing, the ESO Council at its meeting of December 1990 chose the mountain Cerro Paranal as the site for the new telescope. The ESO exhibition presents this extraordinary site, mainly by means of photography, and also by a new video describing the extensive site tests conducted at Paranal.

Furthermore, recent images obtained with the New Technology Telescope (NTT) at ESO's La Silla Observatory are shown, including a photograph reaching mv= 29.

Dr. R. Warmels of ESO/Garching will demonstrate the MIDAS image processing programme at the stand, and finally some of the latest ESO publications can be studied there.

Observatories under the Southern Cross: Complejo Astronómico El Leoncito

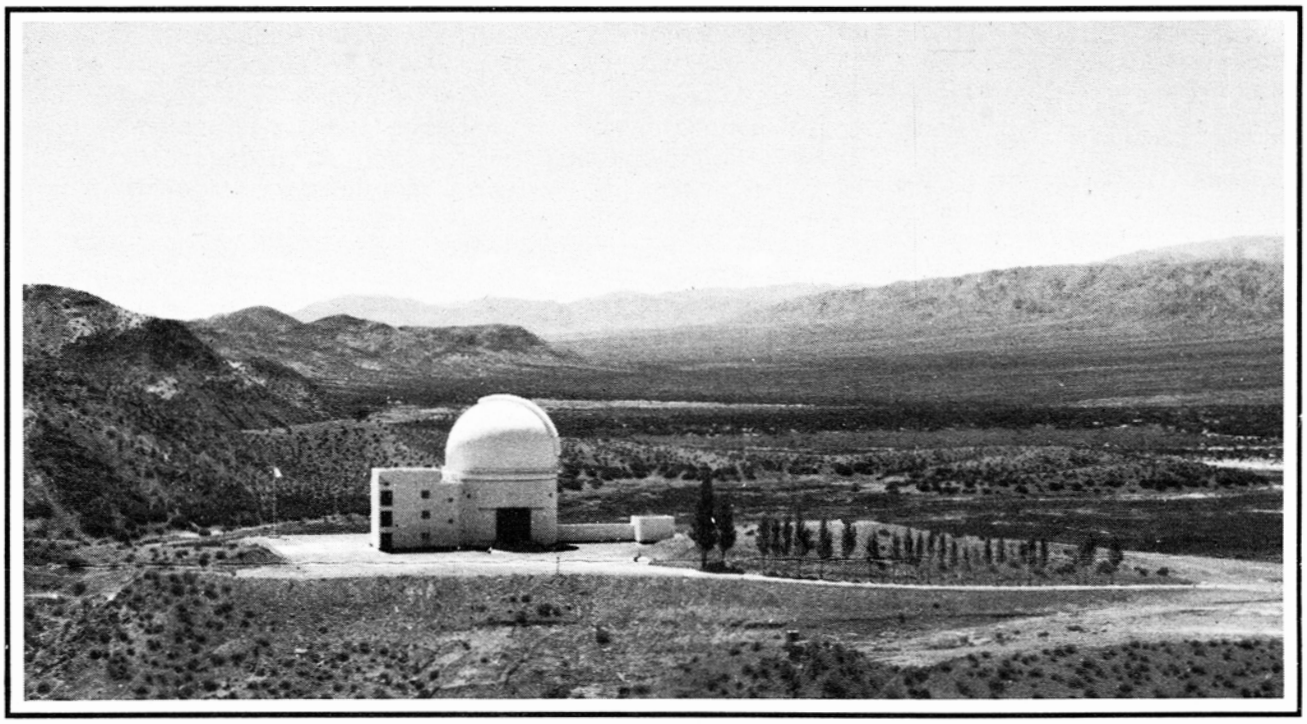
A national facility for ground-based astronomical observations has been operating in Argentina ever since the end of 1986. The Complejo Astronómico El Leoncito is the result of an agreement between the Universities of La Plata, Córdoba, and San Juan, the National Research Council and the Secretary of Science and Technology.

The Observatory operates a 2.1-metre Boller & Chivens telescope, situated in the San Juan province of western Argentina at latitude -31° 47'. The site is remote (220 km away from the administrative offices in the city of San Juan) and is therefore not affected by light pollution or industrial activities. A state law has been passed by Congress to safeguard the site as an astronomical reservation. There are around 300 clear nights per year.

There are mechanical and electrical workshops at the top of the mountain, together with living quarters for the technical staff and visiting astronomers. A commercial line provides electrical power, but in addition the Observatory has its own power plant. Other services available include water supply, communicatons and computing facilities, and a library.

At present the auxiliary instrumentation consists of a Boller & Chivens Cassegrain spectrograph, with five gratings which provide a range of dispersion between 30 and 300 A/mm. The spectrograph can be used either with a two-stage magnetic image tube or with a CCD. A precision offset guider module, together with a plate-holder, is available for direct photography; it provides a 45 arc-minute field. A CCD is also available for direct imaging at the Cassegrain focus. A photopolarimeter is on loan from the Vatican Group at Arizona, and an echelle on loan from the Institute of Astrophysics at Liège is also available. Astronomers can also use a photon-counting system, particularly suitable for radial velocity measurements of galaxies, which has been installed with the collaboration of the National Observatory of Río de Janeiro in Brazil. Finally, there is a high-speed photometer for the detection of very rapid light-variations in astronomical objects; it can detect fluctuations with periods of between 100 sec and 10 nanoseconds. This instrument has been made available from collaboration with the Special Astrophysical Observatory of the Soviet Union.

New projects include the installation of telescopes for gamma-ray research, and the acquisition of CO antennæ. There are plans for collaborating with other institutions with the aim of increasing the observing programmes, and installing new telescopes on the site.



COMMENT

On resistance to new ideas in astronomy

Controversies are not new to astronomy. As in other sciences, they form part of the development of the subject, after heralding new ideas that would enrich the field. The heliocentric theory, the notion that diffuse nebulæ are extragalactic, the view that the Solar System is not at the centre of the Galaxy, etc, came to be accepted only after a good deal of opposition from the established viewpoints. Of course, in the final analysis, facts rather than the majority consensus decides the issue. Indeed, in each of the examples cited above the majority view turned out to be wrong.

Of course, this is not always the case. More common is the situation of mainstream science, well established and checked against several facts, pitted against a stream of 'half-baked' ideas not properly worked out as scientific theories. The 'crank-mail' received by many leading scientists is of this kind. Who has the time to persuade such people that their ideas are not valid?

Does it mean that the mainstream ideas are inmune to criticism? According to Karl Popper, a good scientific theory should be falsifiable, i.e. one should be able to say what experimental or observational tests can in principle disprove the theory. If the tests, when carried out, are consistent with the theory, then the theory is on a stronger footing. If the tests go against the predictions of the theory, then the theory has to be modified or abandoned.

In practice, things do not work out that way, as can be seen from various instances from astronomy and cosmology.

Take the 'very early universe', for example. It brings together untested very high-energy particle physics and an unobservable era of the big bang universe in a highly speculative exercise. Unlike any other scientific scenario, the events which this exercise describes were transient (of some 10-36 second duration) and unrepeatable. It is argued that they can be tested by the relics they have leaved behind. Yet the major relic observed today, viz. a combination of inhomogeneous discrete structure with a smooth microwave background, remains unexplained.

Consider also the vicious circle surrounding Hubble's Law. How universal is it, in its applicability to extragalactic objects? We cannot test its validity unless we know the distances of these objects independently. On the contrary, the law is falsifiable by demonstrating that two extragalactic objects in the neighbourhood of each other have significantlly different red-shifts. There is now growing evidence of such discrepant cases. A good deal of it was reviewed by Chip Arp in his 1987 book entitled *Quasars, Redshifts and Controversies.*

..The typical establishment response to a criticism of the big bang cosmological model and Hubble's Law is that they work well in most cases, and hence must be correct. This is missing the whole point of Popperian doctrine. The scenarios of the very early universe, inflation and dark matter are presented in a form that is essentially unfalsifiable, as it makes no testable prediction, while in the case of Hubble's Law the discrepant cases of evidence are either ignored or dismissed as 'accidental'.

..Last year, five of us (Arp, Geoffrey, Fred Hoyle, Chandra Wickramsinghe and I) reviewed this situation in an article in Nature (346, 807, 1990). We also discussed a possible alternative to the big bang scenario, which also includes explanation of the discrepant red-shift cases. When dealing with such a fundamental subject as the origin and large-scale structure of the universe, it is premature to assume that in the big bang scenario we have found the answer. The subject could do with rival alternatives, especially when the favcurite one is losing some of its glow.

It is, however, more difficult now to influence the establishment than it was in the early part of this century, for money for research is at stake. Research grants are hard to come by for 'risk' projects which challenge the establishment. Bright young minds (graduate students and post-doctorates) opt for 'safe' topics for their research, where their future is secure.

In this climate, how can we expect new ideas to flourish?

JAYANT NARLIKAR
Inter University Centre
for Astronomy and Astrophysics
Pune 411 007, India

Meeting programme

IAU Commission 46:
Teaching of Astronomy
Wednesday, July 24,
Room H, 1400-1730

Aa Sandqvist (Chairman)

"Introducing modern astronomy and astrophysics into classroom exercises - at high school, university undergraduate and graduate levels."

SESSION 3

L. Bottinelli, Undergraduate Exercises in Modern Astrophysics
M. Gerbaldi, Undergraduate Projects Using Astrophysics and Astronomical Data Bases
M.K. Hemenway, Undergraduate Astronomy Laboratory Exercises
S. Isobe, Distribution of Astronomical Data Through a Personal Computer Network

SESSION 4

J.A. Mattei, Variable Star Activities and Projects for School and University
J. Pasachoff, Including Contemporary Astronomy in Astronomy Curricula and in American School Courses
J. Percy, Activities for an Astronomy Unit in a Senior High School Physics Course
N. Raghavan, Modern Astronomy Projects at the High School Level - a Delhi experience
D. Wentzel, Laboratory Exercise on Solar Photos

Tour Programme

Local tours for Thursday, July 25

8:20 a.m. (08:20)
Tour 5.9: Visit to the Ecological Reserve
10:20 a.m. (10:20)
Tour 5.3: Museum of Spanish and American Art
2:30 p.m. (14:30)
Tour 5.3: Museum of Argentine Popular Motifs
5:30 p.m. (17:30)
Tour 5.13: Art Galleries

Tours depart from the San Martin Cultural Centre at the indicated times; badges are required.
See section 5 (pages 12 to 15 inclusive) of the Final Programme for more details.
For more information on how to apply for a place on any tour, see also page 4 of yesterday´s issue of *Cruz del Sur.*

Interviews with news media

No doubt some participants will receive requests for interviews from the news media (journalists, TV, radio, etc). In order to make quite sure that there can be no cases of distortion or faulty reporting, we strongly recommend that all interviews be arranged through the Press Office rather than by direct contact with the journalists concerned.

This procedure may seem rather laborious, but it will certainly be to your advantage. The Press Office is located in the same room as the IAU´s daily newspaper, on the second floor of the San Martin Centre. Please ask for Lic. Susana Mammini, who is in charge of the Press Office. Her telephone number is 814-5014.

Amateurs and professionals meet

As a preliminary to the opening of the General Assembly of the IAU, a joint meeting of professional and amateur astronomers was organised on Sunday, 21 July at the Fundación Campomar in Parque Centenario, Buenos Aires. The main guest speakers were Dr. David Crawford ("Past, present and future of amateur-professional relations"), Dr. Patrick Moore ("The work of the amateur in modern astronomy"), and Dr. William Liller ("Hunting for novæ for pleasure and for little money").

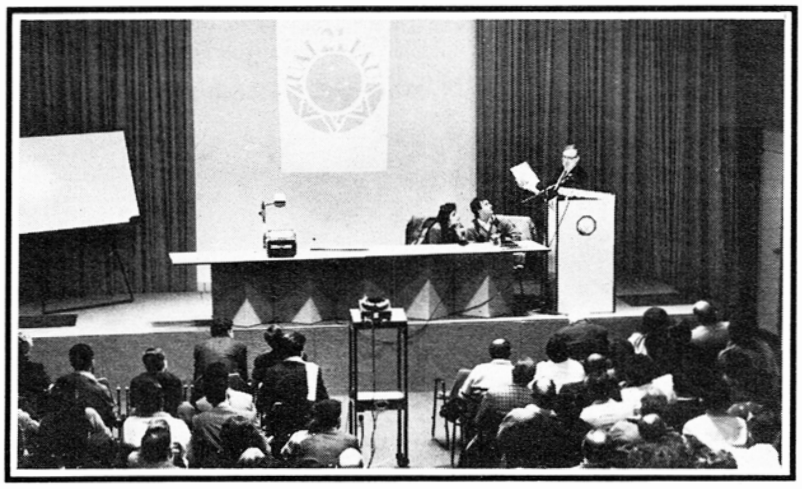
David Crawford stressed that amateur astronomers carried out their work for enjoyment, and were not paid for doing so; amateurs came from every walk of life - historians, lawyers, even politicians. Very valuable work could be done, and in addition there were some people who could be regarded as semi-professionals, such as planetarium staff and science writers, who were directly connected with astronomy and yet were not professional astronomers. There were many excellent organisations to coordinate amateur work. Dr. Crawford then turned to the question of light pollution, which was, he said, a very serious problem; we were in danger of losing our view of the night sky, and unless action were taken it might be that future generations would be restricted entirely to theoretical astronomy. He referred to the International Dark-Sky Association (IDA), whose membership was steadily increasing, and appealed for extra support.

Patrick Moore, the next speaker, outlined the work of the amateur, which was, he said, of tremendous importance; amateurs could undertake observations which professionals did not want to do, had no time to do, or genuinely could not do. He described observations of the Moon (his own special subject) and then the planets, but stressed that the modern amateur, unlike his predecessor, has to be really specialised, and will probably, make use of highly sophisticated electronic equipment - though there are some "dinosaurs" (such as himself) who continue to concentrate upon visual observations of bodies in the Solar System. He commented that the important white spot on Saturn had been discovered in 1990 independently by two American amateurs.

William Liller (speaking in Spanish) described the ways in which novæ and supernovæ are discovered by amateurs, who now have an enviable record in this field. Early detection of novæ and supernovæ is important, because professionals can then take photographs of their spectra during the early stages.

Following a short interval, there were papers from Latin-American amateurs of the Amigos de la Astronomía. These dealt with the photometry of asteroids (R.G. Hutton), the observation of supernovæ (M.L. Alvarez), variations in the atmospheric activity of Jupiter (R. Mackintosh and G. Rodríguez), variable star work (E.R. Minniti), and radio astronomy at 612 MHz (G. López). Finally, David Crawford discussed the concept of a global network of astronomers, including those equipped with small telescopes.

At the end of the meeting, a reception was held at the oldest observatory in Argentina, now the headquarters of the local Society, which is equipped with a 23-cm refractor originally brought to Argentina to observe the transit of Venus of 1882 (though, unfortunately, the skies on the day of the transit were cloudy). In conclusion, the Chairman said that the meeting had been a great success, and he looked forward to continued close cooperation between amateurs and professionals in Argentina and elsewhere.



Room changes

There have been some changes in room numbering. Rooms K and L were originally combined. They have now been separated, so that the old 'Rooms K + L' have become simply Room L.

If you were scheduled to have a meeting in Rooms K + L, this is now Room L. However, if you were to have a meeting in Room K, it is still Room K - and if the meeting was to be in Room L, it is still Room L.

For example, on Thursday, 25 July, the meetings of Commission 15 (15.1 and 15.2), listed as being in Rooms K + L, are now in Room L. On Saturday, 27 July, the meeting of Commission 7 (7.2) was in Room K, and is still in Room K. At the same time, the meeting of Commission 5 (5.4), in Room L, is still in Room L.

Today´s main events

Scientific meetings of Commissions in four sessions throughout the day:
- **Session 1**, 09.00-10.30
- **Session 2**, 11.00-12.30
- **Session 3**, 14.00-15.30
- **Session 4**, 16.00-17.30

See pages 19-30 inclusive of the Final Programme for listings in numerical order of Commission No. See also pages 52-55 inclusive for schedule of room assignments.

- **09.00-17.30 Joint Discussion I** on ´An overview of the interstellar medium´, in Room A. Commission 34 with Commissions 28, 40, 44 & 48. Chairman, B.G. Elmegreen.

- **09.00-17.30 Joint Commission Meeting I** on ´Rotation of the Solar System bodies´, in Room B. Commission 19 with Commissions 10, 12, 15, 16 & 20. Chairman, M. Feissel.

- **18.00 Invited Discourse I**, by Sjur Refsdal and Jean Surdej, on ´Gravitational lensing´, in Rooms A + B.

Meeting changes

Commissions 5 and 6 have amalgamated their meetings 5.8 and 6.2.

6.2 will be on Rapid Communication and E-mail, and will be in Room M. This meeting will be on 30 July, Session 2.

The Working Group on Planetary Surface Nomenclature has postponed its meeting from 24 July to 30 July - Sessions 1 and 3 in Room L.

Commissions 5 and 40, Informal Meeting on "Steps Towards a Radio Source Data Base", on Thursday 25 July, Session 4, Room K. For contributions, please contact Heinz Andernach.

Session 51.4 on 27 July, Room H, Session 1, has been cancelled.

FREE COFFEE!

During the morning (10.30-11.00) and afternoon (15.30-16.00) coffee breaks, free coffee will be available from three trolleys in the San Martin Centre. Between Room F and the Poster Room, coffee, cola, mineral water and biscuits will all be available.

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

NO. 4 : THURSDAY, 25 JULY

Discovery of a new planet

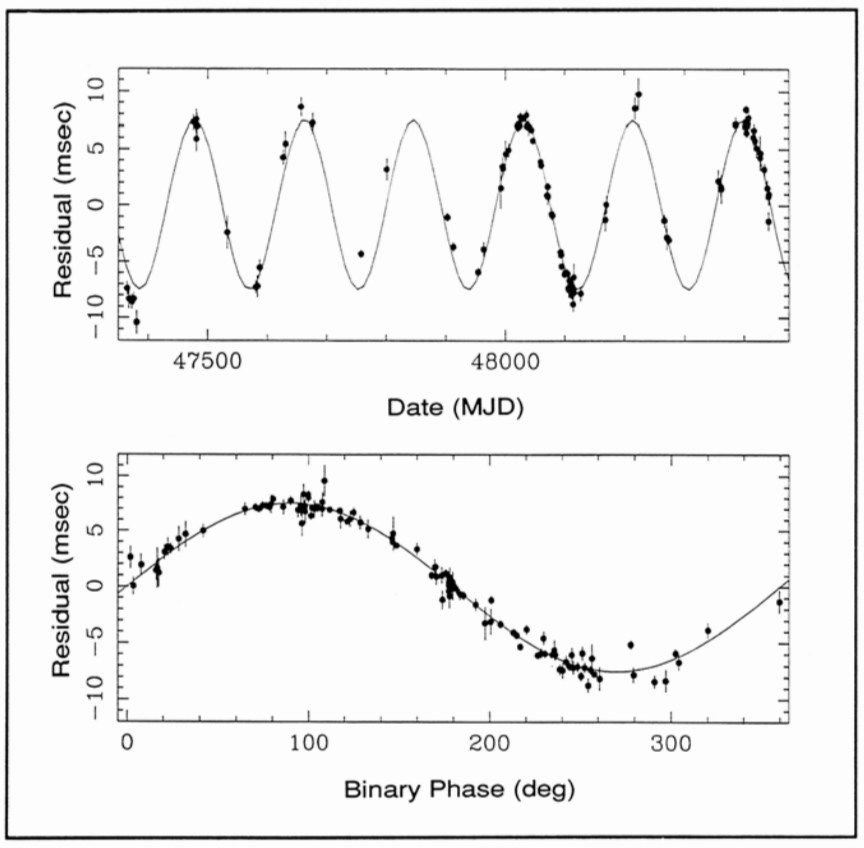
The first new planet to be discovered outside the Solar System has been found by radio astronomers at Jodrell Bank, University of Manchester, UK. The new planet was discovered by Professor Andrew Lyne and two colleagues, Matthew Bailes and Setnam Shemar, during accurate timing measurements of a pulsar near the centre of the Galaxy.

Using the 76-metre Lovell radio telescope, a survey in 1985 of an area close to the galactic plane revealed 40 new pulsars. Of these, 39 fitted previous models of solitary and binary systems. The last was PSR 1829-10, whose period of 330 milliseconds appeared at first to be erratic. More concentrated timing observations, extending over three years, now show that the variations are periodic, so that the pulse arrival times vary by 8 milliseconds sinusoidally with a period of 184 days. This corresponds to the motion of a neutron star with a mass of 1.4 solar masses under the gravitational pull of a 10 Earth-mass planet at a distance of 0.7 AU.

The measured period derivative of the pulsar gives the characteristic age of 1.25 million years. The pulsar is losing rotational energy, probably in the form of high-energy particles and gamma-rays as well as a 3 Hz electromagnetic wave, at about the same rate as the total flux of energy from the Sun. Although at first sight it is unlikely that the planet could sustain life, it is interesting to speculate how this energy flux might be converted into a more useful form.

The second differential of the pulsar periodicity is surprisingly large. This may indicate the presence of another planet with a longer orbital period. It is interesting to note that if the Sun were a pulsar, it would be difficult to detect the presence of any of the outer planets in observations over a six-year period.

The origin of the planet will be the subject of much speculation. The standard scenario of red giant followed by Type II supernova is unlikely, as the supernova would disrupt any planetary system that survived the giant phase. The orbit is very circular, with eccentricity less than 0.05, suggesting that it may have been circularised by interaction with a disk. Possibly the neutron star may have collapsed from an accreting white dwarf, the collapse being slowed down by the same rapid rotation that formed a disk in which the planet was embedded.



Residual deviations of pulse arrival time, after allowing for rotational slow-down. The superposition of observations using an 184.4-day orbital period shows an accurate sinusoid, with amplitude 7.6 milliseconds.

The pulsar timing observations at Jodrell Bank currently cover 200 pulsars; no other comparable planets have so far been found. Longer-period planets may nevertheless exist around some, and it will be worthwhile to continue the timing observations for the next decade or two.

This spectacular discovery is reported in a paper by M.Bailes, A.G. Lyne and S. Shemar in *Nature*, 1991 July 25. A brief account of it will be given in the Commission 51 meeting at 11.00 today (25 July), in Room M. Further discussion may be expected in Joint Discussion V on Monday, 29 July.

F. GRAHAM-SMITH
Jodrell Bank, University
of Manchester, UK

The 76-metre Lovell radio telescope at Jodrell Bank, UK, used for the survey of pulsar periodicities described here.

What's new in infra-red astronomy?

That's what we will find out today (25 July), in the afternoon session of Joint Commission Meeting I. The second part of this joint session between Commissions 9 and 25 is entitled "Performance and Results with Infra-Red Arrays" (Chairman, Professor Ian S.McLean). As the title suggests, the goal is to give IAU members a glimpse of the astonishing revolution which has been occurring in infra-red astronomy in the last few years.

The exciting changes in this subject are a direct consequence of technological developments in infra-red detectors. Now, with the advent of infra-red "arrays" - solid-state imaging devices with two-dimensional arrays of infra-red sensitive picture elements - measurements deemed quite impossible using single-element detectors and scanned apertures are not only viable, but are competitive with optical imaging in depth and photometric precision .

This is also a fast-changing subject. Just five years ago the first high-quality infra-red arrays burst on to the scene. These devices had 62 x 58 pixels and were sensitive for wavelengths from I to 5 microns; the detector material was the semi-conductor indium antimonide (InSb) cooled to a temperature of about 35K. Shortly afterwards, detectors with I28 x 128 pixels made from mercury-cadmium-telluride (HgCdTe) and sensitive over the range from I to 2.5 microns appeared. Already both of these technologies have reached 256 x 256 pixels, and they are not expected to stop there... Meantime, infra-red astronomers have wasted no time in learning the ideosyncrasies of these distant cousins of silicon CCDs and, of course, pushing them to their limits.

The new infra-red arrays have found immediate application in cameras for a wide range of morphological studies. Incredibly sharp infra-red images of "optical" quality are now available for many interesting cosmic sources, from planets to star-forming regions, from the galactic centre to the most distant galaxies in the universe. Infra-red cameras are proving vital in large-field searches for elusive, weakly-luminous, low-temperature objects such as low-mass stars and brown dwarfs. But that is not all. Infra-red arrays are proving to be amazingly powerful quantitative photometers. New colour-magnitude diagrams of globular clusters, open clusters and star-forming regions have been obtained; luminosity functions; galaxy light profiles; photometry and polarimetry of galactic regions; and extremely deep infra-red photometry of galaxies at high red-shifts. The latter achievement is a consequence of the good quantum efficiency, stability and extremely good flat-field performance of these arrays so far - better than one part in I0,000. Moreover, the wavelength range benefitting from these "array" detectors has now extended to the 7 - 20 micron region, using doped silicon devices.

And as if that were not impressive enough, new spectroscopic instruments with infra-red arrays are just beginning to produce first results. These huge, cryogenically-cooled infra-red array spectrometers are almost as large as optical spectrometers, and for high red-shift galaxies they appear to offer a most efficient way to study the early universe.

Of course, the performance of these infra-red arrays on ground-based telescopes has not escaped the attention of planners of space missions. Special developments are under way for space-qualified infra-red array detectors which can be flown on missions such as ISO (ESA), HST (NASA) and SIRTF (NASA).

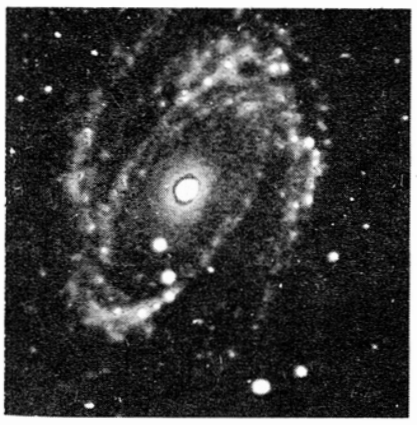
All this, and more, will be discussed at the Joint Commission Meeting here in Buenos Aires, and members can expect to be hearing more and more about infra-red astronomy in the years ahead.

The view from Astro-1

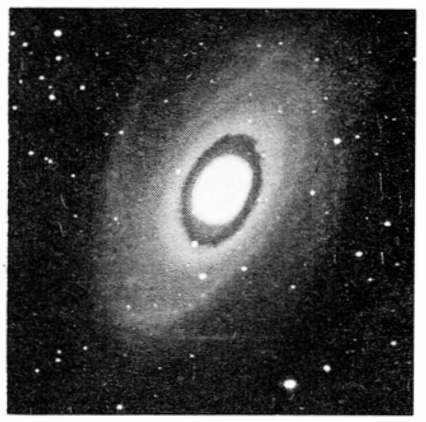
The Astro-1 Observatory flew on the Space Shuttle *Columbia* from 2 to 11 December, 1990. Three ultra-violet instruments and one X-ray instrument collected a wealth of data. Many results from this exciting mission will be presented in Sessions 44.2 and 44.3 of the Commission 44 meeting this afternoon (July 25), in Room P. (See page 4 for the full meeting programme.)

The Hopkins Ultra-violet Telescope (HUT) observed hot objects over wavelengths shorter than about 130 nm, while the Wisconsin Ultra-violet Photo-Polarimetry Experiment (WUPPE) obtained polarisation measures between 150 and 350 nm. The Ultra-violet Imaging Telescope (UIT) is a 0.38-metre telescope which was designed and built at NASA's Goddard Space Flight Centre in Greenbelt, Maryland. It obtained UV images of some 80 targets, three of which are reproduced here. The Broad-Band X-Ray Telescope (BBXRT) collected high-resolution imaging spectroscopy.

The UIT image of the Crab Nebula reveals the eerie glow produced by extremely energetic electrons rushing out from the centre of the nebula at almost the speed of light. These observations give a clue as to how this huge population of sub-atomic particles is transformed by interaction with its environment. Another supernova remnant, the Cygnus Loop, was photographed by UIT on 5 December 1990; the expanding clouds shine with great intensity in the light of triply-ionised carbon atoms - an indication that the temperature of the shining gas is about 100,000 °C. To quote Theodore P. Strecher, the Principal Investigator for the UIT: "Study of the Cygnus Loop photographs should tell us more about the shock waves and other forces at work in interstellar space."

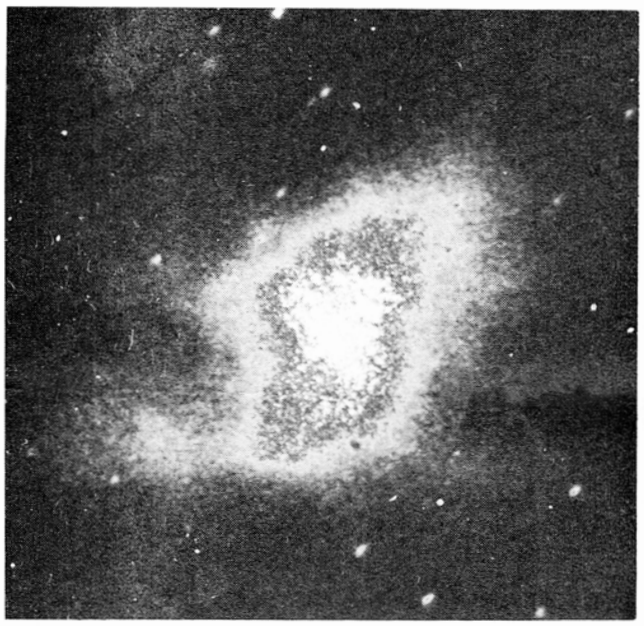


The spiral galaxy M81 (UIT)

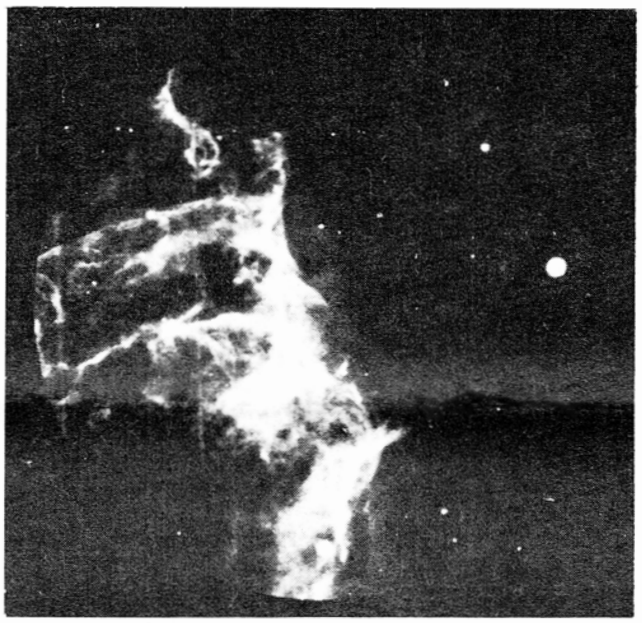


The spiral galaxy M81 (Kitt Peak)

Galaxies were also studied with the UIT; the ultra-violet picture of the spiral galaxy M81, 12 million light years away, reveals regions where stars are forming at an unusually rapid rate. The bright spots in the spiral arms of the galaxy are concentrations of very young, hot stars. A picture of the same galaxy in red light, photographed with the 0.9-metre telescope at the Kitt Peak National Observatory, is shown alongside (at right) for comparison



The Crab Nebula (UIT)



The Cygnus Loop (UIT)

HUT captures outburst of Z Cam in the far UV

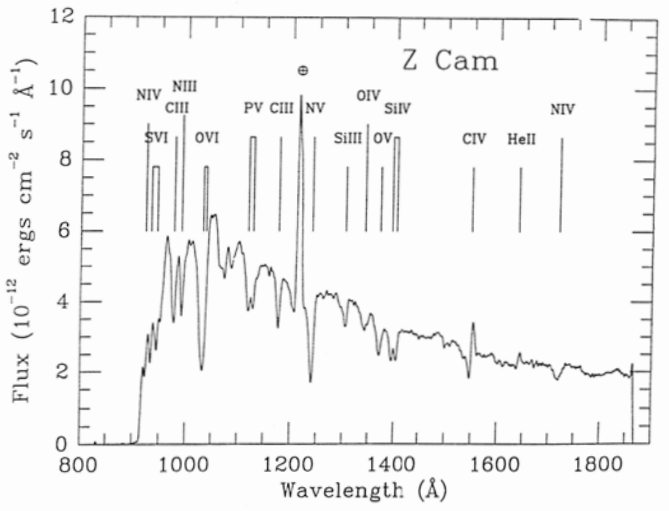
During the Astro-1 space shuttle mission last December, astronomers who built the Hopkins Ultraviolet Telescope were hoping to observe an outburst from one or more of the bright, well-studied cataclysmic variables. HUT obtains spectra from 185 to 83 nm, overlapping previous IUE studies longward of Lyman alpha, and extending all the way to the Lyman limit and beyond. It was expected that HUT's new data would contribute significantly to studies of the accretion disks around white dwarfs in these mass transfer binaries.

Of course, no-one knew which cataclysmic variable would be in outburst when the mission plan for Astro-1 was drawn up, but the possibility of inserting new objects into the timeline during the mission had been practised extensively in numerous simulations. On the ground, the forces of the American Association of Variable Star Observers (AAVSO) were arrayed, with orders to report the onset of an outburst immediately to Janet Mattei at their headquarters.

On 6 December, the HUT team at NASA's Payload Operations Control Centre was alerted by the AAVSO that Z Camelopardalis had begun an outburst. A flurry of activity began, stretching an already busy mission planning team, who were responding to several problems encountered early in the shuttle mission. A slot on the mission timeline for Z Cam was found, and the observation was made on 9 December, just when Z Cam was at a maximum light.

The spectrum obtained is shown in the accompanying figure, which is from a paper by Knox S. Long and colleagues, recently submitted to the *Astrophysical Journal*. This and other new results from the Hopkins Ultraviolet Telescope will be described during the meetings of Commission 44 (Astronomy from space) on Thursday afternoon, 25 July, in Room P.

ARTHUR DAVIDSEN
HUT Principal Investigator



COMMENT *More funds for astronomy?*

When King Charles the Second of England founded the Royal Observatory at Greenwich in 1675, he appointed John Flamsteed as his Astronomer Royal - Christopher Wren was asked to design the Observatory buildings, and Flamsteed was given a small annual salary. The King omitted to provide funds for instruments, however, with the result that Flamsteed had to buy his own! Now, three centuries later, we seem to be heading the same way again: at least, funding for astronomy in the UK is becoming very tight indeed.

In the knowledge that colleagues in some other countries are having similar difficulties, or can see similar clouds on the horizon, it might be of interest to have some comments on the UK scene.

Our predicament stems from a number of causes. Firstly, there is inflation: negligible by South American standards, no doubt, but at 6-10% per annum - and never adequately indexed - it is serious for projects with long lead times. Secondly, there is a stop-go attitude to basic science - the Government cannot make up its mind whether it really is high on their priority list, in competition with Health Care and so on, or not. Thirdly, and here is the rub - there is the oft quoted criticism by senior scientists of spending on 'big science', such as astronomy and nuclear physics. There is no doubt that we are way ahead of the solid-state physicists, biologists, academic engineers, etc., in terms of pounds sterling per head. And there is no doubt, too, that their needs are real and are growing.

We try the old arguments: of tradition (of Newton, Halley, Herschel, Eddington, and many others); of civilised man's curiosity of the heavens; of astronomy's undoubted influence on the young in the way of leading them into careers in science; of the subject's interest to all ages, indeed, and of its stimulus to high techonology. But, somewhere along the line, the arguments are becoming diluted by the incessant clamour from the vast numbers of 'small science' practitioners.

Thus, on behalf of all those nations under astronomical stress, I say to those who are still hitting the big time - and securing ever bigger fractions of your GDP: "How do you do it?" We would all like to know.

Mind you, we are not completely broke, and there is life in the old dog yet. And remember that even after Flamsteed's widow had sold all the telescopes at our Royal Observatory in Greenwich and Edmond Halley -Flamsteed's successor - had to start from scratch and surmount his own financial difficulties, he made quite a success of his endeavours!

ARNOLD WOLFENDALE
Astronomer Royal, UK

Observatories under the Southern Cross: Félix Aguilar, San Juan

In 1947, the National University of Cuyo founded the School of Exact Physical and Natural Sciences. Studies included a Geographical Engineering Programme, which offered courses in practical astronomy, spherical astronomy and celestial mechanics. Faced with the need to have a highly-qualified teaching staff, they were able to call upon three astronomers from the University of La Plata: Dr. Juan José Nissen, Dr. Carlos Ulrico Cesco and Dr. Bernard H. Dawson. The arrival of these well-known astronomers at San Juan was undoubtedly the cause of the development of astronomical activity in the Province.

To carry out a course in practical astronomy, Dr. Cesco installed a somewhat improvised 90-mm telescope in a house on the School premises. The course was taught alternately by Dr. Cesco and Dr. Dawson between 1947 and 1953. Meanwhile, they started to consider establishing an observatory whose function would not only be to help teachers, but also to undertake proper scientific research. After many difficulties had been overcome, the Observatory was officially opened on 28 September 1953. It was named the Observatorio Astronómico Félix Aguilar (OAFA) in honour of the famous astronomer and geodesist Engineer Félix Aguilar, who had died ten years earlier; he had been Dr. Cesco's teacher.

In 1959 there was an important development which had a great effect on OAFA. This was a Scientific Cooperation Agreement between the National Observatory of Cuyo and the University of Columbia and Yale in the United States. OAFA was put in charge of a programme of systematic observation, and was invited to choose a suitable site for the setting-up of an astronomical observatory in the southern hemisphere.

This project was conceived and directed by two astronomers, Jan Schilt and Dirk Brouwer. It took them over two years to choose El Leoncito in the Calingasta Department of the Province of San Juan, 2500 metres above sea-level. The first observatory there, known as the Yale-Columbia Southern Hemisphere Observatory - a joint project with the National Observatory of Cuyo- was opened in March 1965; it was closed at the end of 1973, after the programme of observation carried out together with the meridian circle of the Naval Observatory at Washington (D.C.) for the Survey of the Southern Sky Astrometric Programme', and with the double astrographic telescope, for the first stage of the Southern Proper Motion (SPM) programme, an extension of the Northern Proper Motion (NPM) programme, started at the Lick Observatory in 1947, had been completed. At the beginning of 1974, when the American astronomers returned to their own country, the newly-created National University of San Juan entered into an agreement with the Yale-Columbia Southern Observatory Inc., according to which the University was authorised to continue using the equipment at El Leoncito; this enabled Argentine astronomers to continue with their educational and research work. This agreement is still in force - it covers the period from 1984 to 1993 - and therefore the Yale-Columbia Southern Observatory has become part of the National University of San Juan. It is known as the Dr. Carlos U. Cesco Height Station.

Research projects developed at OAFA include the determination of stellar positions and movements; time and latitude measurements; determinations of the individual and systematic errors in stellar catalogues; movements of asteroids and comets; observations of major planets; variable star research, and observations of nebulæ and galaxies.

For many years after OAFA was established, in 1953, it was concerned almost entirely with traditional astrometry, but since 1975 two new branches of research have been added; celestial and Solar System dynamics, and chaos dynamics in the Solar System, in collaboration with the Astronomical and Geophysical Institute of the University of San Pablo in Brazil. Astrophysical research is carried out together with specialists from the Complejo Astronomico El Leoncito (CASLEO) in San Juan. The electronic laboratory and the workshop give strong support to all these actitivities, as well as carrying out routline mainenance and undertaking studies with regard to the design and modernisation of the instruments.

New results on high-velocity HI in normal galaxies

High-velocity hydrogen clouds in our Galaxy are features whose velocities do not fit the standard model of galactic rotation. Although recognised for close to 30 years, the distance(s) to these clouds is still unknown. Are they nearby and hence of moderate mass, or extragalactic and much higher in mass? It is likely that these clouds originate through more than a single mechanism. A favoured explanation is a 'galactic foundation', disk gas which rises through supernova heating and from which clouds form due to thermal instabilities in the hot gas. The Magellanic Stream is an additional likely source for some of the clouds. The detection of high-velocity clouds in other galaxies would be of inmense help in understanding these ubiquitous clouds, which cover some ten percent of our sky. So far only one example of high velocity HI in another galaxy is known - found by van der Hulst and Sancisi in M101. However, this feature is so different from Galactic examples that van der Hulst and Sancisi feel they are seeing the result of a collision of a gas-rich dwarf galaxy with M101.

Recent high-sensitivity observations with the Arecibo 1000-ft antenna have shown that many spiral galaxies have HI features which have the identifying mark of high velocity gas, that is to say features which do not fit the model of galactic rotation. Their detection requires high signal-to-noise and a stable baseline. The concept involves the recognition that the standard 'two-horned' 21 cm velocity profile has its almost rectangular edges defined by the maximum rotational velocity. Hence any HI with velocity greater than this maximum velocity will appear as a wing beyond the edge(s) of the profile. In recent tests of this concept, Joel Bregman and Morton Roberts found, in six out of eight cases, galaxies with at least one such wing.

One of these galaxies has been observed with the VLA. Analysis of the data is still going on, but clearly the more prominent wing seen in the Arecibo data is confirmed, and it arises, as it should, from near the major axis. That such features are so common in other galaxies implies that high-velocity gas is a normal component of spiral systems. The galactic fountain model is thus a likely explanation for much of the high-velocity neutral hydrogen in our Galaxy.

MORTON S. ROBERTS
National Radio Astronomy Observatory, USA

Meeting programmes

IAU Commission 21:
Light of the night sky
Thursday, July 25,
Room F, 1400-1730

SESSION 3

"Extragalactic and galactic components of the light of the night sky"

M.G. Hauser (Chairman)

S. Bowyer, Recent advances in understanding the diffuse far and extreme UV background

R.F. Silvenberg, The infra-red brightness of the sky determined by DIRBE/COBE

SESSION 4

"Atmospheric (nightglow) component of the light of the night sky"

A.C. Levasseur-Regourd (Chairperson)

S.M. Kwon, Zenith distance dependence of the atmospheric diffuse light

H. Teitelbaum, Airglow emissions as a contamination for astronomical observations

H. Tanabe, Airglow observations of the Tokyo Astronomical Observatory

M.J. Lopez-Gonzalez, O, O_3 and H concentration profiles inferred from airglow observations

D. Crawford, Adverse environmental impacts on astronomy

IAU Commission 44:
First results from the
Astro-1 mission
Thursday, July 25,
Room P, 1400-1730

T. Gull (Chairman)

SESSION 3

T. Gull, Overview of the Astro-1 mission

P. Serlemitsos, The Broad-Band X-ray Telescope: first spectral reductions

R. Petre, BBXRT spectra of supernova remnants

K. Nordsieck, The Wisconsin Ultra-violet Spectropolarimetry Experiment

SESSION 4

A. Davidsen, First results from the Hopkins Ultra-violet Telescope

T. Stecher, The Ultra-violet Imaging Telescope

M. Roberts, Normal galaxies imaged by UIT

S. Neff, UIT imagery of peculiar galaxies

IAU Commission 51:
Bioastronomy
Thursday, July 25,
Room H, 0900-1230
"Astronomy, life, extinction"

Jean Heidman (Chairman)

SESSION 1

G. Marx, Astronomy, life, extinction

D. Schwartzmann, The relative stability of the biosphere - Geophysiology

C.O. Olano, Encounter with interstellar clouds and mass extinction

SESSION 2

F.G. Smith, First observation of a planet outside the Solar System

I. Almar, Supernovæ, co-rotation, life

M. Papagiannis, How nature and life help biological evolution

SIMBAD demonstration

If you would like to find out any information about your favourite astronomical object, you can ask the database 'SIMBAD'. Continuous demonstrations are being given at the SIMBAD booth in the Orange Room, from 0900-1800, daily.

Tour Programme

Local tours for Friday, July 26

9 a.m. (09:00)
Tour 5.7: Visit to the National Congress

9:20 a.m. (09:20)
Tour 5.4: Museum of Natural Sciences

10:40 a.m. (10:40)
Tour 5.6: National Museum of Fine Arts

2 p.m. (14:00)
Tour 5.10: Buenos Aires Cultural Centre

3:50 p.m. (15:50)
Tour 5.14: Leather Goods Exhibition

5:30 p.m. (17:30)
Tour 5.12: Antiqueries

Tours depart from the San Martín Cultural Centre at the indicated times; badges are required.

See section 5 (pages 12 to 15 inclusive) of the Final Programme for more details. For more information on how to apply for a place on any tour, see also page 4 of issue No. 2 of *Cruz del Sur*.

Official photographer

If somebody offers to take a photograph of you in the San Martín Centre, remember that there is an official, registered photographer for the IAU General Assembly. His name is Fabián Yahbes, and he should carry a red badge with his name. The price for one picture is 3 dollars. General Assembly participants should beware of unofficial photographers who are offering to take pictures at prices of up to 10 dollars! You will find Fabián Yahbes, throughout the day, in the hall of Room D. He also sells and develops films: if you give it in early in the morning, you will have it back the same day; if not, the next day.

IAU logo badges

Circular, colour pin-on badges, showing the logo of the 21st IAU General Assembly, may be obtained from Fabián Yahbes, the official photographer, at a cost of $4 each.

Programme update

IAU Commission 25
Ian S. McLean (President)
Please see Commission 25 noticeboard, situated near the mail boxes, for full and final programme.

Thursday, 25 July:
Joint Commission Meeting II, Room B
(Sessions 1, 2, 3 & 4)
Commission 25 with Commission 9

Part 1: Automated telescopes for photometry and imaging
Part 2: Performance and results with infrared arrays

Friday, 26 July:
Business meeting, Room G (Session 2)
Elections and report

Saturday, 27 July:
Photometry meeting, Room H (Session 2)
(Not multi-site co-ordinated observations)

Monday, 29 July:
Contributions of polarimetry to stellar astrophysicis, Room C (Sessions 1, 2, 3 & 4)

Cheap lunches for IAU participants!

Three local restaurants, close to the San Martín Centre, are offering reduced prices for IAU participants (badges must be worn) on selected items from the lunch menu. The restaurants are: Cafetín Miró, Bachin and La Marca.

If you are interested in the menus below, you must choose one item from those listed, and obtain a lunch ticket from Room E, before 6.00 p.m. (18:00), at least one day in advance.

Cafetín Miró (La Plaza Centre)

- Roast chicken with potatoes, or
- Canneloni à la Rossini, or
- Escalopes in bread crumbs, mixed salad, and
- Soft drinks (with all options) **4,50 US$**

Bachín (La Plaza Centre)

- A quarter of a grilled chicken, or
- Grilled chops, or
- Steak, or Escalope à la Marsala

All the options can be served with potatoes or salads, and

- Flan, or fruit salad, or ice-cream, and
- Soft drinks (with all options) **5,50 US$**

La Marca (La Plaza Centre)

- Escalopes in breadcrumbs with French fries and flan, or
- Grilled chicken with mixed salad and fruit salad with ice-cream, or
- Pasta and fruit salad, and
- Soft drinks (with all options) **8,50 US$**

Women in astronomy

On Thursday, 30 July at 6.00 p.m. (18:00), in Room E, there will be a panel discussion on the topic: "Status of women in Astronomy"

Silvia Torres-Peimbert (Chairperson)

- Peter Boyce (USA)
- Sushma Mallik (India)
- Miriam Pastoriza (Brazil)
- Elena Terlevich (UK)

All IAU participants are invited

After the Welcome Reception?

"We are with you, Galileo... the Earth moves, it turns around..."

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

NO. 5 : FRIDAY, 26 JULY

Eclipses

The total solar eclipse of July 11 was described to a session of Commissions 10 and 12 and to the Working Group on Eclipses on 24 July. Observations of the solar chromosphere and prominences were obtained from various points along the path of totality, though the weather proved to be far inferior to the predictions along much of the path.

Scientists on Mauna Kea in Hawaii had to settle for observations through cirrus clouds and through a veil of dust from the volcanic eruption of Mount Pinatubo; the fog that nipped at the base of the telescopes receded in time for totality. The volcanic dust in the Earth's stratosphere, in particular, compromised the observations of dust in interplanetary space to an unknown degree. Six separate groups in Hawaii and Mexico were observing such interplanetary dust with infra-red arrays. A group led by Serge Koutchmy of l'Institut d'Astrophysique, Paris, used the Canada-France-Hawaii Telescope to obtain high-resolution coronal observations. US astronomers Harold Zirin and Charles Lindsay obtained submillimetre and millimetre observations of the solar limb to refine atmospheric models, and Drake Deming obtained observations of 12-micron spectral lines above the limb. Clouds obscured the corona for the group led by Jay M. Pasachoff, which was observing from the west coast of Hawaii, to study the coronal temperature and mechanisms of coronal heating.

Observational conditions were better in Baja California, where scientific teams from several countries obtained images and spectra of the solar chromosphere and corona. Cloud coverage was patchy further along the eclipse path in Central and South America. Observations showed an active corona, with exceptionally large and bright prominences.

Jay M. Pasachoff has become Chairman of the Working Group on Eclipses, taking over from E.Hiei of Japan. He will be working with the IAU Secretariat to appoint national co-ordinators for the 30 June 1992 eclipse, which starts in Uruguay, and for the 3 November 1994 total solar eclipse which crosses parts of Peru, Chile, Bolivia, Paraguay and Brazil. Scientists from these countries wishing to work with him on eclipse planning are invited to contact him at Box 448, or write to him at Williams College - Hopkins Observatory, Williamstown, Massachusetts 01267, USA, e-mail JPasachoff @ Williams.edu.

JAY M. PASACHOFF
Williams College - Hopkins Observatory
Williamston, Massachusetts 01267, USA

High-energy breakthrough

There has been excitement and drama in the last year in the high-energy end of the electromagnetic spectrum, from X-rays to high-energy gamma-rays. ROSAT was launched and was almost lost, and GRO was at last successfully deployed by the Shuttle. On the ground, more gamma-rays have been detected at TeV energies, and a PeV radiation station is active at the South Pole. Many of the latest and most exciting results will be presented during the four sessions of Joint Discussion III - Results from ROSAT & GRO & other recent high-energy astrophysics missions - which takes place today (26 July), in Room A, from 09:00-17:30.

In June 1990 the ROSAT satellite was launched as a German/USA/UK collaboration. The inmediate results from the Position Sensitive Proportional Counter were impressive: an X-ray survey of the Large Magellanic Cloud, and a beautiful X-ray image of the Moon. After the failure of one of the two star trackers in November, the whole ROSAT craft tumbled out of control on 25 January this year, for no apparent cause. The satellite was almost lost, but just managed to be brought under control before the batteries were flattened beyond recovery. The surviving PSPC (one was destroyed when the Sun entered its field of view) will be used to study a wide range of objects, including distant quasars. The observations on clusters of galaxies have been new and exciting, and the first results may be of great cosmological significance. Also of significance is the programme of co-ordinated ROSAT/GINGA observations, which provides a broad-band spectral coverage and cross-calibration of the instruments.

On future missions, the X-ray Timing Explorer (XTE) is under development, and is planned for launch in August 1995. The ASTRO-D X-ray satellite, a Japanese/US successor to GINGA, is on target for a February 1993 launch.

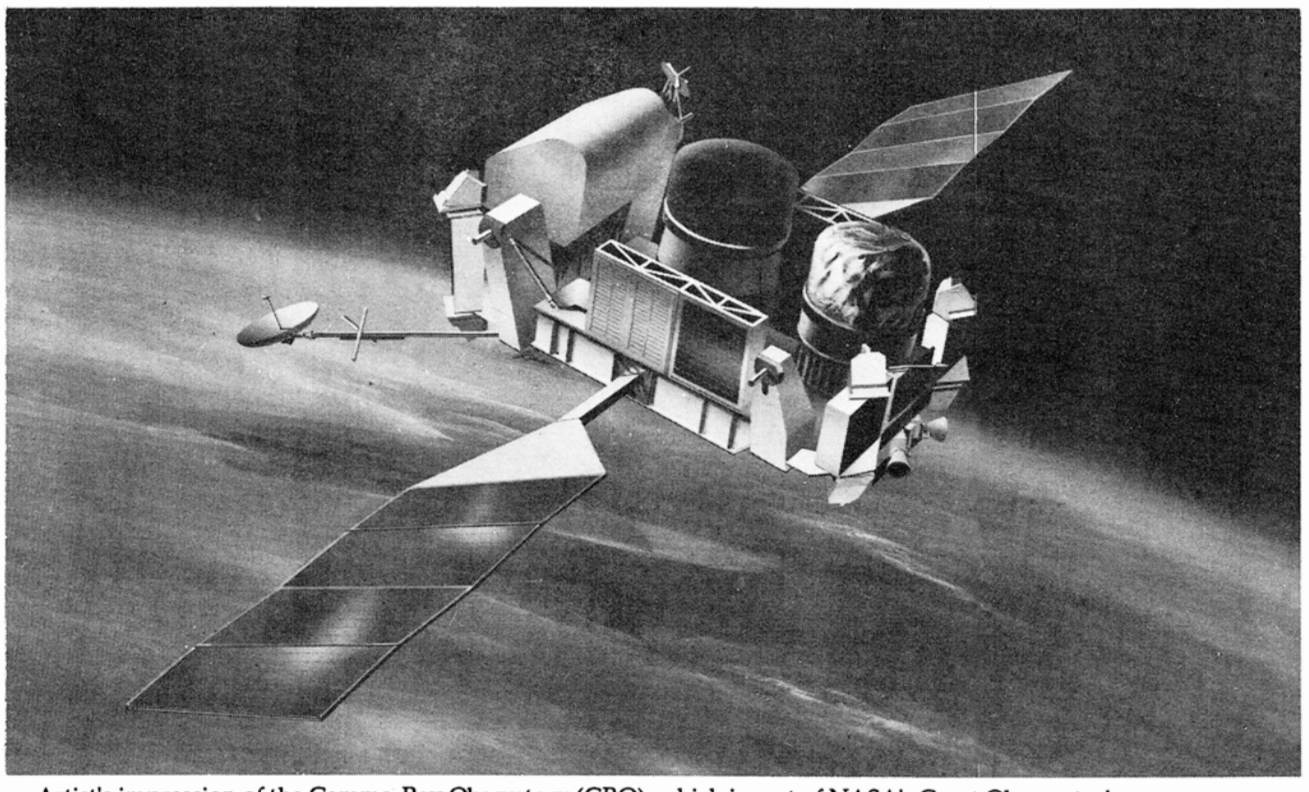
The Gamma-Ray Observatory, following its successful launch in April, has continued to perform well. All of the sub-systems are exceeding their target performances by a wide margin. All of the experiments on board are now activated, and are performing well. The first high-energy gamma-ray satellite for over a decade contains two telescopes of complementary designs - EGRET and COMPTEL, the first of which has already detected the enigmatic gamma-ray source Geminga, during its verification phase. At lower energies, the Oriented Scintillation Spectroscopy Experiment (OSSE) verification runs have detected, for example, 0.511 positron annhilation radiation. The Burst and Transient Source detector (BATSE) has seen many solar flares, and is seeing bursts at the rate of almost one per day. BATSE's positional accuracy of about one degree will help in the search for the origin of gamma- ray bursts, which has recently been suggested (in *Nature*) to be galactic, on statistical grounds. On 16 May the first of 33 two-week targets was acquired. When the list of targets is complete, the two large-field instruments will have accomplished a full sky survey - the first in gamma-ray astronomy. As GRO entered the observing phase, it was renamed the Arthur Holly Compton Gamma-Ray Observatory, or Compton Gamma-Ray Observatory for short.

At higher energies, in the TeV range, the second Durham University ground-based telescope has been relocated from the Canary Islands, where it continued to observe 12.6 ms pulsations from Cygnus X-3, to join its larger brother in New South Wales. The University of Adelaide telescope in South Australia, which confirmed the first pulsar detected in VHE gamma-rays is being upgraded, and new telescopes are being constructed in the USA and UK.

The telescope constructed at the South Pole by the Bartol Institute and the University of Leeds is fully operational, and is involved in continuously monitoring southern objects such as Centaurus X-3 and SN1987A at PeV energies.

For high-energy astronomy, the highlight of the year must be the successful start of the GRO programme, the first to be able systematically to explore the whole sky in the entire gamma-ray range of energies from 100KeV to 10 GeV. The much less sensitive COS-B mission made startling discoveries, so GRO's results are awaited eagerly.

KEITH ORFORD
University of Durham, UK



Artist's impression of the Gamma-Ray Obsrvatory (GRO), which is part of NASA's Great Observatories programme.

The women of Venus

Until the results from space-craft became available, nothing was known about the surface features of Venus; as recently as 1960 it was still believed that the planet might be oceanic. Now that we have detailed radar maps, it has become necessary to allot names to the various features. Following the lamented death of Dr. Hal Masursky, Dr. Kaare Aksnes of Norway has become Acting Chairman of the Nomenclature Committe.

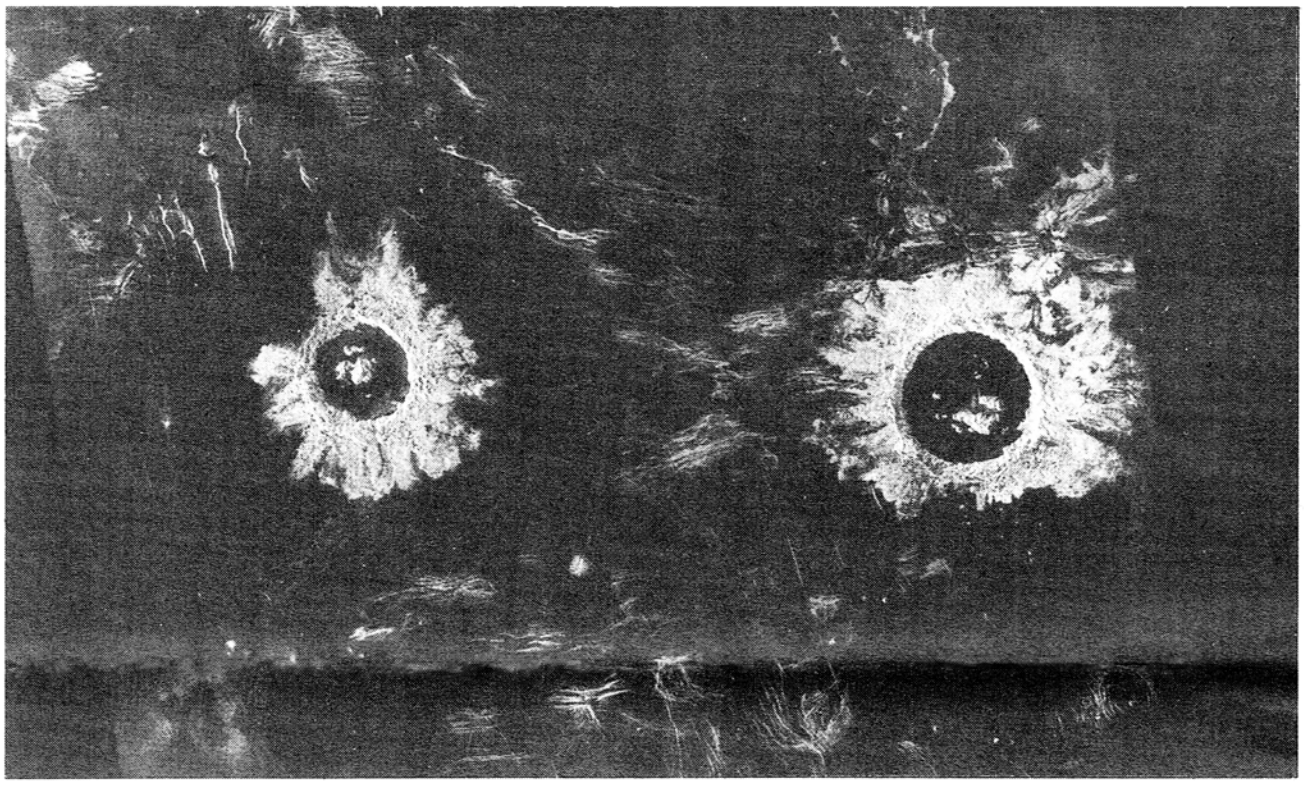
There are various rules, laid down by the IAU some time ago. For example, duplication of names is to be avoided as far as possible, though asteroids are exempted - there are so many of them. Solar System nomenclature should be international; no names having political, military or religious significance can be included; nobody can be honoured unless he (or she) has been dead for at least three years.

Venus is named after the goddess of beauty, and is essentially feminine in tradition - perhaps the intensely hostile character of the planet is rather ironical! More than a hundred new names have now been put forward by the IAU Working Group. Until ratified, they cannot be given full official status, but it is very likely that all the Group recommendations will be accepted unchanged.

Some of the new names are notable. For example, María Celeste is on the list; she was Galileo's daughter, and is certainly worthy of inclusion even though the great Italian astronomer's marital affairs were somewhat irregular. Nobody will question the inclusion of Joliot-Curie; here too is Woolf (Virginia Woolf, the eccentric British writer), together with Piaf (the famous French singer), and Marsh (Ngaio Marsh, the New Zealand authoress of detective stories).

The arts are represented by Flagstad (Kirsten Flagstad, the great Norwegian soprano), Danilova and Nijinskaya (Russian ballet dancers), Halle (Austrian violinist) and Henie (Sonja Henie, Norwegian skater) - and it would be unthinkable to leave out Callas (María Callas, the formidable and never-to-be-forgotten Greek singer). Another addition is 'Monna Lisa', though her enigmatical smile is hardly reflected in her crater, and from most people's point of view her name has acquired an extra N!

History is not neglected. Stuart commemorates Mary Queen of Scots, who came to an untimely end after a career which cannot be said to have been wholly creditable. There is probably more to be said for the Roman empress Anna Faustina, and for Julius Cæsar's mother, Aurelia. There are several deities and geographical names, and astronomers now allocated craters include de Lalande (France), Scarpellini (Italy) and Simonenko (Russia). But there may also be some names which do not strike a chord with many people. See if you can identify the following: (a) Quetzalpetlatl, (b) Xiao Hong, (c) Al-Taymuriyya, (d) Hwangcini, (e) Erxleben, and (f) Titibu. Answers in Column 1 of page 4!



This Magellan picture shows craters in the Lavinia region of Venus, centred on latitude 27°S, longitude 339°E. The large craters range between 37 and 50 km in diameter. Situated in a region of fractured plains, the craters show rough (bright) material around their rims, with terraced inner walls and central peaks. Numerous domes, probably volcanic, are seen in the SE corner of the mosaic. The domes range in diameter from 1 to 12 km; some have central pits, typical of some types of volcanoes. North is at the top of the image.

Invited Discourse II: *Retrospect on Voyager*

Friday, 26 July, Rooms A+B, at 6.00 p.m. (18:00)

There can be little doubt that the Voyagers have been among the most successful of all interplanetary missions. Voyager 1 surveyed Jupiter and Saturn, sending back information which was vastly better than that supplied by the earlier Pioneers; Voyager 2 not only surveyed the two inner giants, but went on to Uranus and Neptune as well. It is fair to say that a very large percentage of our knowledge about the outer planets is due to these two probes.

Before the Voyagers, we had a considerable amount of information about Jupiter and Saturn, but there was a great deal that was uncertain. For example, we had no knowledge of the existence of a Jovian ring, and the complex nature of Saturn's ring system was totally unexpected. Then, of course, there were the satellites; who would have expected the violently active volcanoes of Io, the smoothness of Europa, the huge crater on Mimas or the nitrogen-rich atmosphere of Titan? With Voyager 2, we at last learned some definite facts about Uranus and Neptune. New satellites and new rings were found, and new data obtained; much of the information was surprising.

Perhaps the Neptune pass was the climax of the whole programme. The lovely blue planet, with its Great Dark Spot, was so unlike its bland, non-identical twin Uranus, and Triton was a fitting conclusion. Where we had half-expected to find chemical oceans, we found an icy surface with indications of geyser activity.

The Voyagers are still in contact; if all goes well, they may remain so until they reach the heliopause. But their main work is done, and they have accomplished all and more than their makers could have expected. Every giant planet provided its quota of surprises. Sadly, it may be a long time before we find out much more about Uranus and Neptune, at least, so that the data sent back by the Voyagers will be our main sources of reference for decades to come - and surely, therefore, this is a suitable topic for this evening's Invited Discourse by one of the leading astronomers of the Voyager programme.

WORKING GROUP ON THE WORLDWIDE DEVELOPMENT OF ASTRONOMY

In one sense, the IAU has always been concerned about the worldwide development of astronomy, so why do we now need a working group devoted to that topic? The answer can be seen by looking at the growth of the Union - not in terms of individual members, but in terms of adhering countries. In recent years many of the countries joining the Union are newly-independent, small, and supporting only a few astronomers, who have few facilities for research and often feel isolated from colleagues. Even well-established astronomical communities, in some of the larger countries that have long been self-governing, sometimes experience difficulties because of political and economic circumstances, particularly the non-convertibility of currencies. Those of us fortunate enough to be free of these difficulties often forget the problems that so many of our colleagues have to overcome. The new Working Group, established at the last GA in Baltimore, aims to help colleagues less favourably placed, to support the beginnings of astronomy in countries not yet adhering to the Union, and to increase the awareness of the rest of us of the worldwide situation of astronomy.

The meeting on Friday afternoon (2 pm - 5.30 pm in Room M) will introduce the Group to the whole Union. We want to tell you what the Union is already doing, for example by Visiting Lecturers Programmes and Schools for Young Astronomers. We also want you to hear what astronomers in various parts of the world are doing to help themselves - there will be particular reference to India and to Latin-America. Above all, we want the meeting to act as a sounding-board for the concerns of the people whom we most want to help. The world has enough people in it who know what is good for everyone else, and we do not want to be like the Boy Scout who helped the old lady to cross a road that she did not want to cross. We hope, therefore, that the programme will stimulate discussion both during the meeting and after, that some of you will join the new Working Group, and that all of you will help us to define our task more clearly.

A.H. Batten,
Herzberg Institute for Astrophysics, Canada

COMMENT

Environmental impact!

Astronomy is also caught in the world's adverse environmental impacts. Almost everyone worries about air pollution, water pollution, toxic waste and, here in Buenos Aires at least, noise pollution. So far, however, very few people, even astronomers, are adequately aware of the extent of light pollution, radio frequency interference, or space débris. There is no doubt that many of our observatories are suffering, and that the problems are getting worse. Education about these issues is important, and increased action is called for.

The IAU is involved in the issue through Commission 50 (and a few others), and the President, General Secretary and Executive Committee have expressed their concern during this General Assembly and at earlier meetings. Previous General Assemblies have adopted numerous resolutions, as they will do again on this occasion. Those of us who are actively campaigning on a daily basis will appreciate your interest and support. We wish that all astronomers were so supportive!

Let me say a few words about light pollution. A later number of *Cruz del Sur* will probably include a note about the radio frequency interference problem.

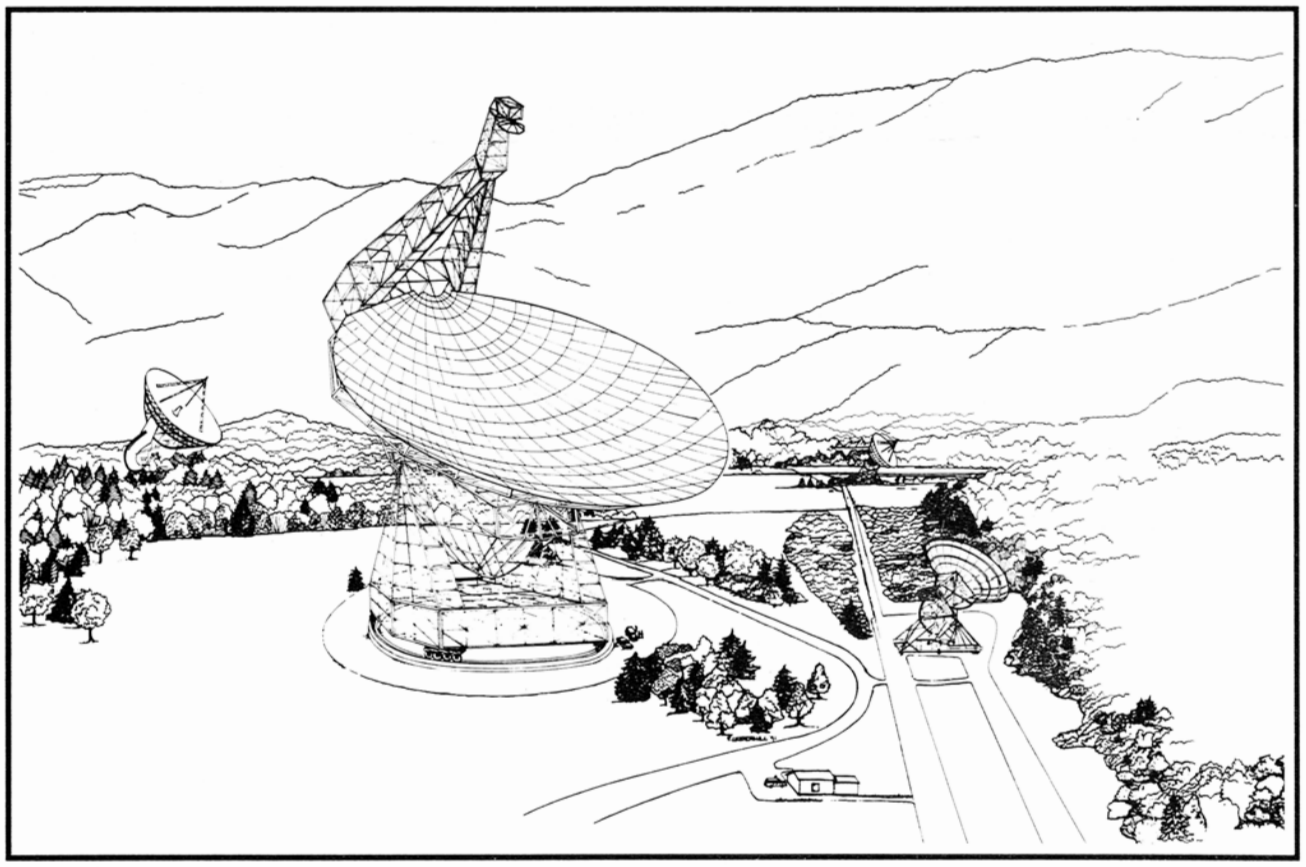
Few observatories are still free of any adverse effects due to light pollution. Much of the problem arises from urban growth and its associated, uncontrolled, rather poor outdoor lighting. There are solutions to this problem, however. Many of these include working with the lighting industry and with Governmental staff to provide quality night and outdoor lighting. Such lighting minimises wasted light, thus saving a great deal of energy and money. It is easy to show that one billion dollars a year is wasted in the USA alone, simply to illuminate the sky. We know that the proposed solutions do work, and that they can be implemented - as indeed they already have been in small locations where we have been able to spend the time to educate lighting engineers, Governmental officials, and the public.

Much more remains to be done, and a viable future for observational astronomy is dependent upon the problems being overcome. It will be difficult to make progress if, in only a few generations, most or all observational research will have to be done in a planetarium.

Any questions, suggestions or offers of help are welcome. In addition, a new international (non-profit) organisation has been formed to help in these educational efforts: the International Dark-sky Association (IDA). It is a membership organisation, with over 800 members already from 32 countries. Astronomers are most welcome (and needed) as members, because at present there are more lighting engineers as members than there are professional astronomers. IDA would welcome your involvement.

Contact address:
DAVID CRAWFORD,
KPNO-NOAO, PO BOX 26732,
Tucson, Arizona 85726, USA
E-mail, dcrawford @ NOAO EDU (Internet).

The Green Bank Telescope



Construction has recently begun on the Green Bank Telescope (GBT), a fully-steerable 100-metre diameter radio telescope. It is the replacement for the NRAO 300-foot telescope, which collapsed suddenly in November 1988 after 26 years of service. The GBT is being built about 1 km east of the site of the 300-foot telescope, at the NRAO's observatory in Green Bank, West Virginia. At present, the excavation is almost complete, and initial work on the foundation is under way. Erection of the main steel members should begin early in 1992, and the telescope is expected to be in routine use for astronomical observations at the beginning of 1995.

The GBT will be an offset paraboloid, and will thus have a completely unblocked aperture. It will operate at the prime focus for frequencies below about 1 GHz. The reflecting surface will consist of more than 2000 surface panels, which are adjusted by actuators to compensate for gravitational deformations. A laser-ranging system will continually measure the precise shape of the surface by determining the distance to retro-reflectors mounted on each panel, and will pass this information back to the active surface control system. The laser-ranging system will also be used to aid telescope pointing, by determining the location of the telescope with respect to a set of known locations on the ground. The surface panels will have an rms error of no more than 75 microns, so the GBT might work at very high frequencies if the active surface can be used to remove the effects of thermal gradients on the surface shape.

JAY LOCKMAN
National Radio Astronomy Observatory, USA

STRANGE JOURNEY

Some delegates have come to Buenos Aires from the other side of the world, but surely the most curious journey on this occasion has been that of three Peruvian physicists from the San Marcos University in Lima: Rafael Torres, Rafael E. Carlos and José Hisacaya. They set out on July 15th, and finally arrived on the 26th!

They started by taking a Peruvian bus from Lima to Tacna. From there they went to Arica, in Chile, by car, and then took a Chilean bus. Their route lay down the Santiago-Mendoza road, but they found, to their dismay, that heavy snow had blocked the frontier with Argentina. They had no choice but to take the bus back to Pullehue, and - despite snow, which was still falling - they managed to cross to Bariloche in Argentina. They then went to Mendoza by bus, and finally caught a train from Mendoza to Buenos Aires. They had spent several nights on a bus, and admitted that it was far from comfortable, but at least they said, when they arrived at the General Assembly, tired but still cheerful: "It was worth while - we are really here!"

Clearly, our Peruvian friends deserve to be congratulated!

Meeting programmes

IAU Commission 21:
Light of the night sky
Friday, July 26,
Room C, 1600-1730

SESSION 4

"Interplanetary (zodiacal light) component of the night sky"
M.S. Manner (Chairperson)
J.M. Vrtilek and M.G. Hauser, Interplanetary dust emission as determined from IRAS data
S. Dermott, B. Gustafson, D. Durda, S. Jayaraman, Y.L. Xu and R.S. Gomes, Origin and evolution of the zodiacal dust cloud
B.A.S. Gustafson, R.H. Zerull, E. Corbach and K. Schulz, Light scattering by comet dust models
R.K. Soberman and M. Dubin, Jetting cosmoids and the zodiacal light

Meeting change

Commission 22:
Meteors and interplanetary dust
Colin Keay (President)
Amended programme for sessions

Friday, July 26, 1400-1530, Room K
Business meeting

President's welcome
Roll call
Nomination and election of Secretary, New President & Vice-President.
Notice of review of Commission membership, terms of reference of Commission 22 and links with other Commissions
President's report
Other reports (Colloquium, Meteor Data Centre)
Resolutions: (i) Professional-Amateur Co-operation;
(ii) Interplanetary pollution prevention;
(iii) Near-Earth asteroid search
Other business

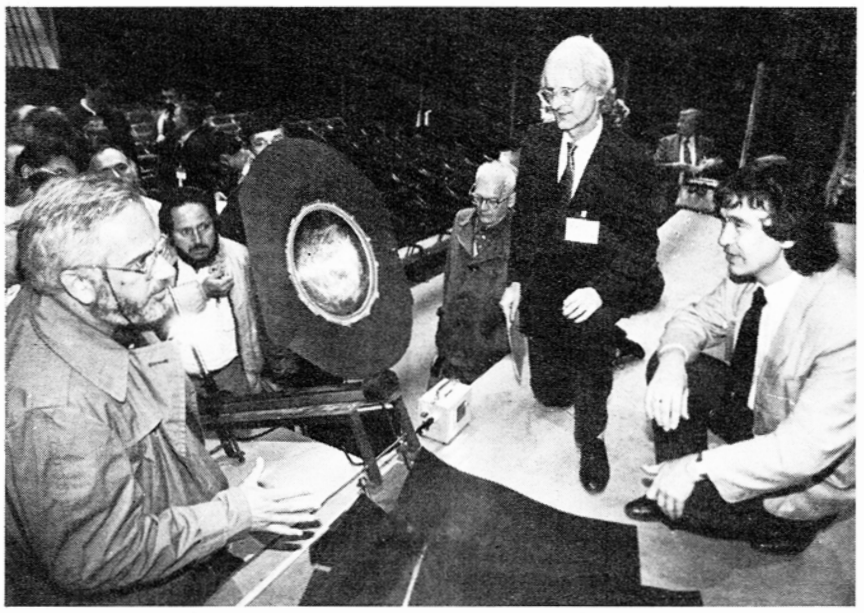
Friday, July 26 1600-1730, Room K
Scientific meeting
The Taurid Complex and related science

D.Steel, D. Asher and S.V. Clube, The Taurid Complex
J.Stohl and V. Porubcan, The Taurid Complex
J. Mason, Ten-year analysis of the Taurid Stream
D. Steel and S.V. Clube, Radar meteors and the small comet hypothesis
R. Soberman and M. Dubin, Cosmoid meteor signature
C. Keay, Electrophonic meteor fireballs

Answers to "Women of Venus" questions:

(a) Quetzalpetlatl: Aztec fertility goddess
(b) Xiao Hong: Chinese novelist
(c) Al-Taymuriyya: Egyptian author
(d) Hwangcini: 16th-century Korean poetess
(e) Erxleben: German scholar
(f) Titibu: Japanese Haiku poetess
If you have scored 6 out of 6, you have done very well indeed!

Gravitational lenses explained



Sjur Refsdal and Jean Surdej explain, to an interested audience, how gravitational lenses distort our view of distant objects in the Universe, during their Invited Discourse on Wednesday evening.

SERC-EJ (Equatorial J) Atlas on film Announcement for potential customers

The Royal Observatory Edinburgh announces that reproduction of the SERC-EJ Equatorial Sky Atlas on film has commenced and that copies can now be ordered.

The complete atlas will consist of 288 fields (numbers 607-894) on centres spaced 5° apart with $-15° \leq Dec \leq 0°$. The SERC-EJ Atlas is the northerly extension to the equator of the blue (BJ) component of the ESO/SERC Southern Sky Atlas. The film copies are being made in the Photographic Laboratories of the Royal Observatory Edinburgh and the Atlas will be issued in six instalments which will probably span a period of three years.

The cost of the Atlas will be fixed at £4,000 (provided that sufficient orders are received) to be paid pro-rata with each instalment. The number of copies made will be restricted and will be allocated on a first-come-first-served basis. We will hold sets on reservation until 31 January 1992 for purchasers who indicate their intention to purchase by 31 October 1991.

Orders should be sent to:
The UK Schmidt Telescope Unit
Royal Observatory
Blackford Hill
Edinburgh EH9 3HJ UK
Local contact at the IAU: Quentin Parker, Mailbox 547, San Martín Centre

Astronomy on Argentine television

The only regular television programme on astronomy in Argentina is broadcast weekly by TV Cable Channel 2, Cablevideo, in the province of Entre Ríos (not available in Buenos Aires). It is named *Ecos de un mundo estrellado* (Echoes of a world full of stars). The programme is produced by the Asociación Entrerriana de Astronomía, an amateur organisation, and is presented by Luis Pablo Trumper, a journalist and amateur astronomer. The director is Juan Carlos Borre. The aim of the programme is to popularise astronomy in Argentina, by making use of all possible visual aids.

The programme has a large audience, and it is hoped that in the future its example will be followed by other Argentinian television stations. Needless to say *Ecos de un mundo estrellado* is providing full coverage of the 21st IAU General Assembly.

Telescope for hire!

The Argentine Association of Friends of Astronomy offers its telescope - the only one in Buenos Aires- for any astronomer who wants to observe the southern sky during the General Assembly. The observatory will be open after 7 p.m. (19:00) every day. It is located at 555 Patricias Argentinas Avenue, Parque Centenario. For any information you must contact Horacio Tignanelli at the Press Office.

The newsletter of IAU Commission 46

The newsletter of IAU Commission 46 (The teaching of Astronomy) contains information on astronomy education at all levels, in all parts of the world.

We welcome short contributed articles, notes and news items which would be useful and interesting to astronomy teachers. Please send them to the editor: John R. Percy, Mailbox 371, San Martín Centre, or at: Erindale Campus, University of Toronto, Mississauga, Ontario, Canada, L5L 1C6

Tour Programme

Local tours for Saturday, July 27

11 a.m. (11:00)
Tour 5.15: Handicraft fair

Tours depart from the San Martín Cultural Centre at the indicated times; badges are required.

See section 5 (pages 12 to 15 inclusive) of the Final Programme for more details. For more information on how to apply for a place on any tour, see also page 4 of issue No. 2 of *Cruz del Sur*.

• Visit to La Plata Observatory

A visit to the La Plata Observatory, founded in 1883, has been arranged only for Saturday, 27 July in the afternoon; for details please contact the Marsans office.

Commissions 5 and 6 discuss electronic communications

Commission 6 (Astronomical Telegrams) will join forces with the Working Group on Computer Software and Communications of Commission 5 on Tuesday, 30 July, to explore how electronic communications can be extended to astronomers in parts of the world where access to e-mail is difficult. Information about the rapid communication services of the Central Bureau for Astronomical Telegrams will be presented, but participation of astronomers who experience difficulties is needed for a better understanding of the factors that limit their access to electronic networks. Any interested astronomers are invited to attend, whether members of the sponsoring commissions nor not. The meeting will be held in Room M during the second morning session, from 11.00-12.30. Further information: Elizabeth Roemer, Mailbox 130, San Martín Centre, or at the Savoy Hotel.

Today's planetarium shows

The following shows will take place at the Galileo Galilei Planetarium in Palermo Park:

Friday, 26 July

- **09.30 and 10.30** (pre-school and 1st grade) "Travelling with Patatin"
- **11.30** (2nd and 5th grades) "The southern sky"
- **13.30, 14.30 and 15.30** (6th and 7th grades) "The Universe"

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

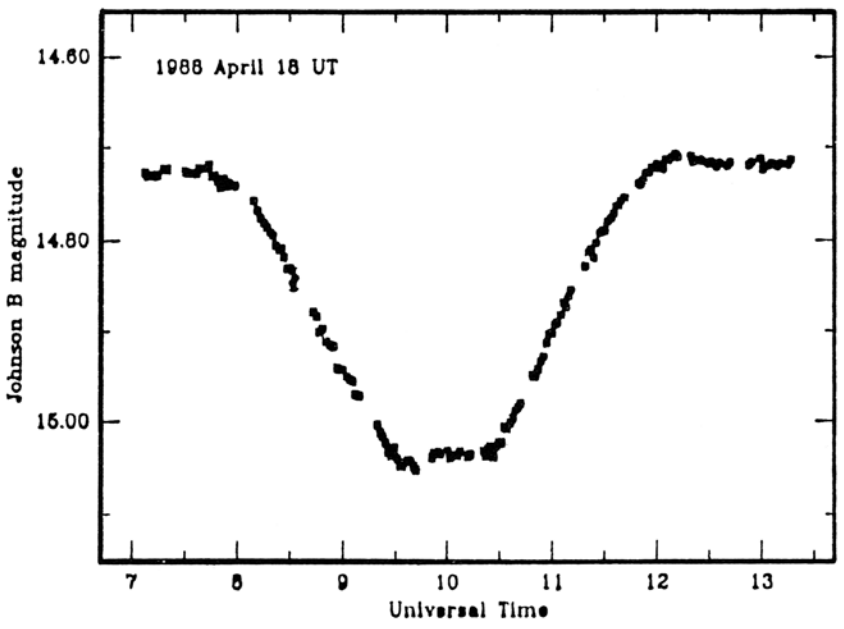
NO. 6 : SATURDAY, 27 JULY

Charon reveals Pluto's secrets

Planetary scientists regret that the Voyager space-craft, which have so gloriously revealed the beauty and secrets of the majestic planets from Jupiter to Neptune, were not also allowed to visit Pluto, as in the original plan of the so-called "Grand Tour". However, the ingenuity and skill of ground-based observers has to a considerable extent made up for what Voyager might have seen at Pluto. This was described during Joint Commission Meeting I, "Rotation of Solar System bodies", on 24 July.

In a remarkable investigation, L.E. Andersson and J.D. Fix (1973) found an increasing amplitude of Pluto's light variations, but with decreasing mean brightness. They interpreted this as being due to bright polar regions being gradually turned away from the Earth, and they gave a position for Pluto's north pole which is very close to the position now accepted (see accompanying diagrams). Five years later, J.W. Christy discovered an unresolved satellite - Charon - moving only 0".8 away from Pluto. We can say that Charon has become a "natural Pluto probe", taking place of the man-made Voyagers!

Christy and his colleague, R.S. Harrington of the US Naval Observatory, quickly determined a surprisingly accurate orbit for Charon, which is the only known natural satellite in a synchronous orbit - always hovering over the same equatorial spot on Pluto. Through application of Kepler's Third Law, Pluto's mass was found to be much smaller than formerly believed. Andersson (1978) immediately saw another opportunity to obtain new information: from the Pluto/Charon occultations and transits which he predicted would take place over a 6-year interval around the time of the edgewise presentation of Charon's orbit, in 1980 ± 4 years. Mother Nature has been very kind to us, since the next series of these mutual events will not occur for 120 years! Sadly, Leif Andersson did not live to see the fruits of his prediction.



Light-curve of transit of Charon across Pluto

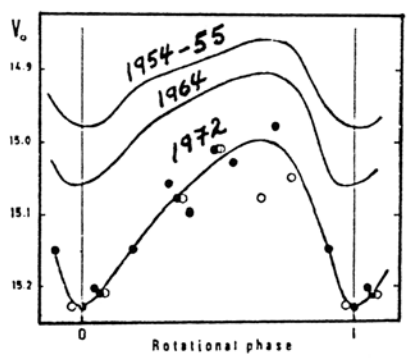
Speckle-interferometric observations pioneered by the French astronomers D. Bonneau and R. Foy (1980) led to a greatly improved orbit for Charon, and better mutual events predictions were made by D.J. Tholen and his co-workers at the University of Hawaii.

Also shown here is a remarkably precise light-curve, from observations by Tholen, of a transit of Charon across Pluto. The telescope used was the 2.24 m reflector at Mauna Kea. Tholen and M.W. Buie of the Space Telescope Science Institute have just completed an exhaustive analysis of mutual event observations, made between January 1985 and July 1990. They have determined that the radii of Pluto and Charon are 1151 and 593 km respectively. Pluto's mean density is 2.03 g/cm^3, almost exactly the same as that of Neptune's satellite Triton.

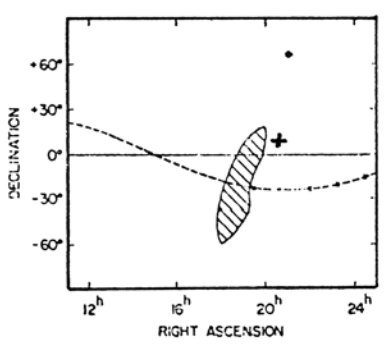
On the reasonable assumption that Charon moves in the equatorial plane of Pluto, the planet's north pole is found to be located at right ascension 313°.02 and declination 9°.09 in the J2000 system.

M.W. Buie, K. Horne and D.J. Tholen (1990) have been successful in drawing albedo maps for Pluto and Charon. This is surely a remarkable success story.

KAARE AKSNES
University of Oslo, Norway



Magnitudes of Pluto

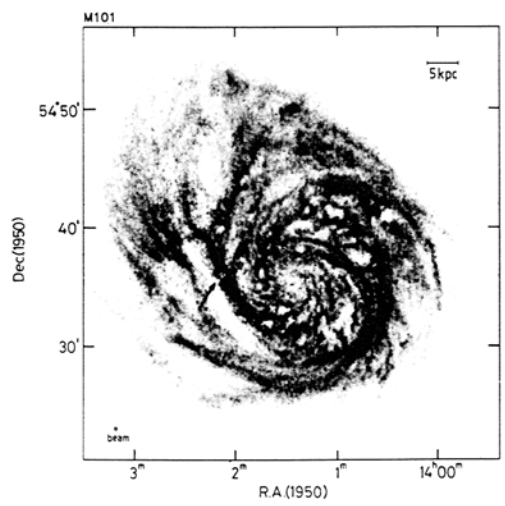


Position of Pluto´s north pole

The interstellar medium in nearby galaxies

Radio synthesis images of the distribution of HI in nearby galaxies, with linear resolutions ranging from 20 to 400 parsecs, now allow us to study the small-scale structure of the cool interstellar medium (ISM) in nearby galaxies. HI images of M31 and M33 show that the HI has a very filamentary structure, reminiscent of the frothy structure found in H-alpha in nearby irregular and spiral galaxies. Part of this structure is the presence of many shells, holes and semi-shells. Expanding motions of the gas associated with these shells has been found in many cases, and the general properties are consistent with the idea that OB stars and supernovæ blow cavities into the ISM. The detection of gas with radial motions of several tens of km/s up to 100 km/s, especially in the larger galaxies M.101 and NGC 6946 (which also have many shell and hole structures up to 3 kpc in size) suggests strongly that gas is blown out into the halo. H-alpha observations of the edge-on galaxy NGC 891 show the presence of filaments prependicular to the plane reaching up to 1 kpc, thus supporting this blow-out, chimney picture. Though some correlation between the location of recent star-formation regions and ISM structure and kinematics exists, a more detailed and quantitative study is required to establish the precise interaction between the star-formation regions and the ISM in nearby galaxies.

J.M. VAN DER HULST
Kapteyn Astronomical Institute, The Netherlands



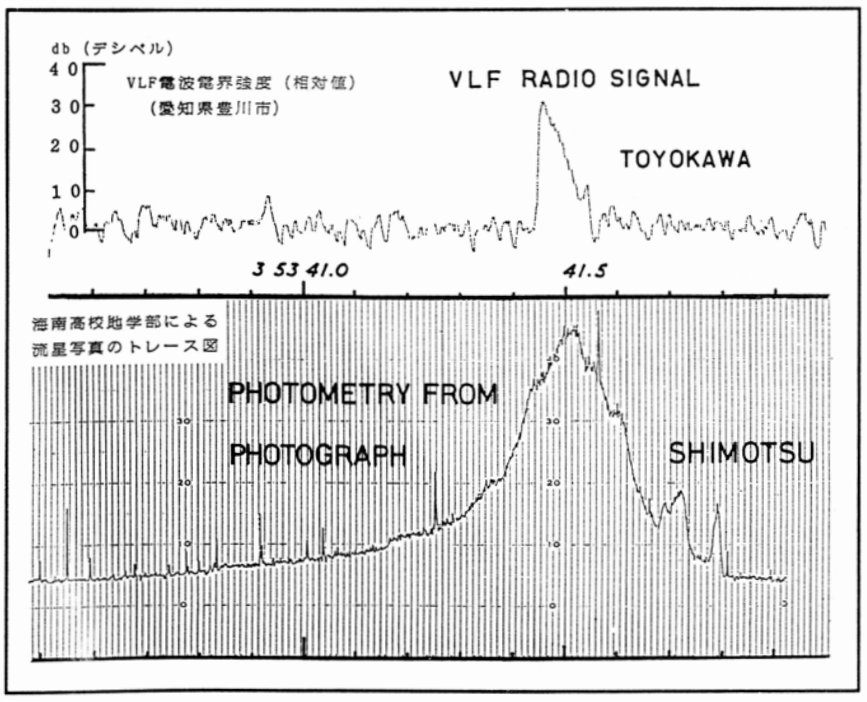
Strange sounds from the sky explained

An excruciatingly elusive physical phenomenon, first described by Chinese observers in 817 AD, dismissed by Edmond Halley in 1719 as "the effect of pure fantasy" and debunked by meteor scientist C.C. Wylie in 1932 as "without doubt psychological", has finally been established as a real physical effect. Yesterday, to Commission 22, Colin Keay, of Newcastle University in Australia, described his decades-long search for a viable physical explanation and the evidence to support it.

His interest was aroused by a magnitude -16 fireball which passed over Sydney and Newcastle in the early morning of 7 April 1978 One third of the witnesses reported hearing the "swish" of the fireball as it passed by. Two of them had their attention drawn to the fireball by the sounds before they actually saw it. Their testimony convinced him to seek an explanation within existing physical science. Reporting this conviction, along with the observational anecdotes, to a meeting of Commission 22 during the Montreal General Assembly in 1979 drew a response from the meteor science establishment in the *Montréal Météore* (our sister news-sheet of the 17th General Assembly) stating, "Or is this a more fruitful field for psychologists rather than physicists?"

Electromagnetic radiation from large meteors had been searched for without success, and the rarity and highly capricious incidence of concurrent sounds from bright fireballs argued strongly against a physical mechanism, but Colin Keay decided the matter was worth pursuit. A careful examination of the radio spectrum revealed that radio emission at frequencies in the audible range was not ruled out. Tests in an anechoic chamber with human subjects exposed to an electric field varying at audio frequencies revealed that some had a far lower auditory threshold than others for perceiving such sounds - floppy or frizzy hair was a great help. The key to the problem lay in the realisation that mundane material objects, like hair, may sometimes act as transducers, converting the radio energy directly into perceptible sound. He also developed a theory for the generation of radio energy by large fireballs, and published his work in the journal *Science* in October 1980.

After the physical explanation was published, electrophonic sounds from meteor fireballs gained respectability, and the number of reported events shot up from one every two years to an average of nine per year. Electrophonic sounds were reported from Space-Shuttle re-entries over Texas and Oklahoma, but attempts to record them were frustrated by the *Challenger* disaster. Colin Keay continued to gather supporting evidence, through further laboratory work and studies of fireball light-curves, to determine the necessary conditions for the production of the required radio energy. The first direct evidence was unearthed last year during a visit to Japan, when Colin Keay was shown an article which "blew his mind". Two Japanese groups had recorded radio signals simultaneous with the appearance of a bright Perseid fireball, while a third group, one of whose members heard a "phut" sound when the fireball exploded, obtained a splendid photograph of the event. The quest was over. Immediate sounds from lightning strokes are similarly explainable, and it appears likely that age-old reports of auroral sounds may be due to radio energy produced by very intense auroral displays.



The Very Low Frequency radio signal recorded at Toyokawa, Japan, over 100 kilometres from a large meteor fireball photographed simultaneously from Shimotsu (courtesy of T. Watanabe, T. Okada and K. Suzuki).

Call for Radio Source Archive

On Thursday, 25 July, Heinz Andernach called for the establishment of a radio-source database for scientific studies by "armchair astronomers". Speaking to a meeting of Commission 40 (Radio Astronomy), Andernach noted that there were 350 000 radio sources listed in the 28 largest radio catalogues, only two of which were archived for common use. The remainder could not be effectively accessed by the wider astronomical community. "The source lists should be correlated with optical source lists from plate-measuring machines such as APM in Cambridge and COSMOS in Edinburgh, and infra-red source lists from the IRAS satellite, to facilitate multi-waveband studies", said Andernach. Although the earlier era of source surveys in radio astronomy gave way temporarily, in the 1980s, to a decade of radio imaging, there has been a recent resurgance of interest in deep radio surveys; and looking to future measurements, Andernach quoted Becker, White and Evans: "The challenge in the future will be as much in assimilating as in collecting radio-source data."

Andernach plans informal discussions during the next few days on the form of the radio database. These discussions should be lively, judging from the interest expressed by Commission 40 meeting participants. Andernach will present the outcome of the discussions to Joint Commission Meeting III, on Archiving, on Wednesday,31 July from 9.00 to 12.00 a.m, in Room I.

Astronomy in Venezuela

After many delays (J. Stock 1981, Rev. Mex. Astron. Astrophys. 6, 13), astronomy in Venezuela finally began as a modern science in 1975. During the last 16 years several major research groups have been developed, and have achieved international recognition: astrometry (J. Stock et al., Centro de Investigaciones de Astronomía - CIDA), radiative processes in young stars (N. Calvet et al., CIDA), astrophysical gas dynamics (M. Ibanez et al., Universidad de Los Andes - ULA), chemical processes in the interstellar medium (A. Parravano et al., ULA), physical processes in comets (I. Ferrin et al., ULA), atomic parameters of astrophysical interest (C. Mendoza et al., IBM Computer Centre of Venezuela) and population synthesis and galaxy evolution (G. Bruzual et al., CIDA). From the observational point of view, high priority is being given to installing a locally-built CCD camera to use with our one-metre reflector and one-metre Schmidt telescope (G. Sánchez et al., CIDA). This has taken some time, but there has been considerable progress during the past year.

The relatively quick growth of astronomical research in Venezuela during this period has been due in part, at least, to the fact that considerable numbers of undergraduate students from different universities in the country have been attracted to astronomy. Masters and Doctoral degrees are now offered. There has also been increased contact between Venezuela and astronomical institutions in Europe and North America, and it is hoped that these contacts will continue to increase in the future.

GUSTAVO BRUZUAL
Director, CIDA

Mexican astronomy

The Adhering Organisation to the IAU is the Universidad Nacional Autónoma de Mexico (UNAM), via its Instituto de Astronomía (IA). Most professional astronomy in Mexico is carried out at UNAM. Another institution concerned with astronomy is the Instituto Nacional del Astrofísica Optica y Electrónica, which runs two telescopes - a Schmidt camera in Tonantzintla, Puebla, and a 2.1-metre reflector at the Guillermo Haro Observatory in Cananea, Sonora.

The IA includes 43 astronomers and 52 technicians. Of the astronomers, 18 obtained their highest degrees in the USA, 8 in Mexico, 7 in Britain, 4 in France, 2 in Italy, 2 in Germany, 1 in Canada and 1 in Australia. The IA offers a Ph.D in astronomy, and there have been graduates from Puerto Rico, Venezuela and Spain as well as from Mexico.

The IA has two locations, one in Mexico City, with about two-thirds of the personnel, and another in Ensenada, Baja California, with the remaining one-third. In addition, the IA runs two observatories: one in San Pedro Martir, Baja California, with three reflecting telescopes (having apertures of 0.84 metre, I.5 metres and 2.1 metres respectively), and the other at Tonantzintla, Puebla, with a one-metre telescope. The San Pedro Martir Observatory is 2850 metres above sea-level, so that the seeing is often better than one second of arc, the amount of water vapour in the atmosphere is very small, the number of clear nights per year is very high, and it has the least amount of artificial light pollution of any observatory on the North American continent.

The IA astronomers publish about 70 research papers per year: about one-third of these appear in the *Revista Mexicana de Astronomía y Astrofísica* (RMAA), and the rest in various international journals. The RMAA was founded in 1974, and has now issued 21 volumes, including the *Proceedings* of the last five Latin-American Regional Meetings of the IAU. The remaining volumes contain contributions from astronomers of many countries, mainly Brazil, Argentina, Chile, Venezuela, the USA and Spain.

The IA maintains excellent relations with many foreign institutions. Countries from which Mexican astronomers have observed include the USA, Japan, Chile, India, France, Australia, the USSR, Spain and Germany. Visitors to Mexican observatories have come from the USA, Japan, the USSR, France, Spain, Italy, India, Poland, Argentina and Denmark. Moreover, the IA has research and technical agreements with observatories in the USA, Denmark, Italy and France.

MANUEL PEIMBERT
Institute of Astronomy, UNAM

Coronal mass ejections: results from a dead telescope!

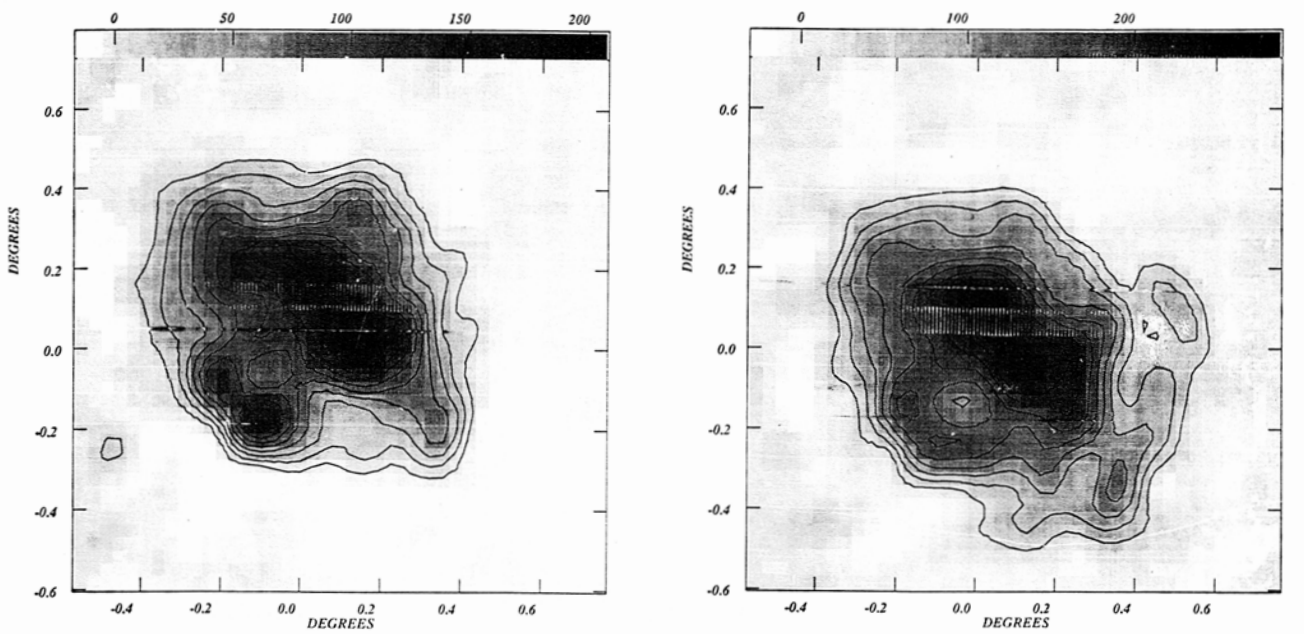
The Clark Lake Multi-frequency Radioheliograph, an imaging telescope at metre-decametre wavelengths, owned and operated by the University of Maryland, USA, was an unique instrument. It was used to observe the radio effects of shock-waves and charged particle beams moving through the solar corona. Tragically, the telescope was closed in 1987 because of the lack of funding - and has since been bulldozed. However, the data accumulated between 1983 and 1987 have been invaluable.

These data have helped to increase our understanding of various problems related to the solar corona. Large-scale magnetic fields often erupt from the Sun - the approximate rate is one per day- and they carry with them billions of tonnes of coronal material into the interplanetary medium. These Coronal Mass Ejections (CMEs) have been primarily observed by space-borne coronagraphs, such as those in Skylab, P78-1 (SOLWIND) and the Solar Maximum Mission Coronagraph Polarimeter experiments. The coronagraphs record the photospheric light, Thompson-scattered by the electrons in the plane of the sky. These ejections are often accompanied by flares and prominence eruptions from near the solar surface, producing charged particles and shock-waves. The latter produce intense bursts of radio radiation, which mask the quiet-Sun emission in the radio images.

The event of 16 February 1986, shown in the two accompanying figures, is one of the rare events where CME is seen at radio wavelengths (73.8 MHz). Two radioheliograms are shown, taken approximately one hour apart. The first one is the quiet Sun, which is the "normal" Sun observed at metre-decametre wavelengths. In the second one, a huge additional structure can be seen in the lower left corner of the image. The additional structure is the coronal mass ejection whose bremsstrahlung emission is detected by the radio telescope. In the white-light coronagraph, the CME was observed moving with a velocity of 450 km/s. This is the first time that such a fast CME has been associated with thermal emission at radio wavelengths.

Since the bremsstrahlung formulæ are well known, it is easy to calculate the mass of the CME, which is normally done using white light observations. It turns out to be about 10 000 million tonnes. The event stresses the importance of low-frequency radio imaging of the Sun in general. In particular, the event demonstrates that not all eruptions produce energetic charged particles - and this has profound implications in the understanding of solar transient events.

N. GOPALSWAMY & M.R. KUNDU
Astronomy Programme, University of Maryland



Two radioheliograms showing the coronal mass ejection of 16 February 1986.

COMMENT

Coming soon to a city near you?

Previous columns in *Cruz del Sur* have put forward controversial or unpopular views on the ways in which the writers see what is happening around them. This column will express a belief which is bound to be unpopular and which I also hope will prove to be incorrect: that our great-great-grandchildren will be subject to bombardment from space which will lead to widespread devastation, and will at least bankrupt the planet.

Issue number 3 carried a story about 'Cosmic Bullets', and the well-founded plans to carry out an international search for asteroids and comets which would cause a global catastrophe if one were to strike us soon. The chance of such an event is small, although uncomfortable, the time-scale between impacts being many thousands of years. Impacts by smaller objects which could obliterate a city - say a 50-metre asteroid - occur once every few centuries, the last having flattened the forests of Siberia in June 1908, near the Tunguska river.

However, an underlying assumption is that these events occur randomly in time. Recent work done by myself in collaboration with Victor Clube and David Asher (Oxford), and also involving Bill Napier (Royal Observatory, Edinburgh) and Mark Bailey (Manchester), has shown that rather than being random in time, in fact such impacts may occur cyclically, and on quite a short time-scale.

As our starting point we have taken the so-called Taurid Complex of interplanetary objects, which includes Comet Encke, several Apollo asteroids, four well-studied meteor showers, and also the Tunguska object. Numerically integrating the various orbits backwards, we have been able to explain the observed phenomena in terms of the break-up of a single giant comet 10 000-20 000 years ago. Having arrived at that time-scale theoretically, we were stunned to find that the youngest-known meteorite (in terms of its space-exposive age), which fell in Kentucky in the late nineteenth century and is also a member of this complex, has been dated as having been released from its parent 7000-25 000 years ago.

However, our analysis points not only to the origin of the complex but also to its evolution. It has a precession cycle of about 3000 years, during which there are four intersections with the Earth (and hence four meteor showers). The activities of these will be cyclic, and for a century or so in each 3000 years a shower will correspond to the core of the complex, where the large fragments reside. At such times the Earth is subject to a century of cosmic fireworks, the inhabitants suffering a blasting. Since the fragments are not sufficiently strong to survive high-velocity entry into the atmosphere, craters are not formed: rather the effect is like having many large nuclear explosions in the atmosphere.

Apparently we've been on the edge of one of these phases for some time, with Tunguska being one well-known event. But there are many others, for instance the seismically-detected lunar impacts in June 1975. Since these phases come in pairs, we can predict that the next one will start in about 100 years: hence my comment about your great-great-grandchildren.

All of the above has resulted from astronomical modelling and observation. Is there any other evidence to support the idea? The answer is a resounding yes, if only one takes the historical and mythological record at face value. Clube and Napier have recently published an excellent book (*The Cosmic Winter*, Blackwells, Oxford 1990) in which they show that many ancient civilizations suffered catastrophes contemporaneously, with the written reports and graphical descriptions showing the cause to be what we would now recognise as the detonation of large bolides meeting the atmosphere at 100 000 kilometres per hour. No-one was exempt from this harsh treatment at the hands of the gods: the Romans, Greeks, Mayans, Incas, Chinese, Babylonians and so on all suffered hammer blows. I recently presented a brief paper in which I suggested that the myths of the New Zealand Maoris indicate such an event 800 years ago (the last active phase of the Taurids) and have since been told that the Australian aborigines have a myth of the same antiquity. The idea - and hence the experience - seems to have been global, with conservative astronomers providing the strongest resistance.

As I wrote to begin with, I hope that we are wrong with this particular hypothesis: but if we are right, prepare your descendents for some spectacular fireworks at the end of the next century.

DUNCAN STEEL
Anglo-Australian Observatory, Australia

CD-ROM of astronomical catalogues available

Through a co-operative effort between astronomical data centres in France, USSR, Japan, China, Argentina, Germany, India, and USA, along with co-sponsorship by the IAU (to facilitate distribution to developing countries) and NASA, a Compact Disk-Read Only Memory (CD-ROM) containing the 120 most frequently requested catalogues of stars and galaxies will be available in August 1991 from the Astronomical Data Center, Goddard Space Flight Center, Code 930, Greenbelt, MD 20771. For more information on obtaining this pair of disks (one FITS, one ASCII), contact Wayne Warren or Jayle Mead (Box 375).

Working Group in "Data Centres and Services"

The IAU Executive Committe is considering a proposal made by a group of data centres, to create a new Working Group on "Data Centres and services" (provisional title).

Proposals for the constitution of the Working Group and its affiliation within the IAU Commission structure will be discussed on: 30 July, session 1, Room K.

A second informal session on 30 July, session 3, Room K will consider the application of IAU designation rules and connected matters. All interested colleagues are cordially invited to both meetings.

C. JASCHEK
Box 5050, San Martin Centre

Young author wins astronomy price

Rowan Morton-Gledhill, who only recently completed her studies in architecture and history, has carried off the prestigious Arthur Beer Memorial Prize for the best article published in the international review Vistas in Astronomy in the last two years.

The prize, which is announced at every IAU General Assembly, was created in memory of Dr. Arthur Beer (1900-1980), long-time member of the Union, who founded this journal in 1956. Miss Morton-Gledhill won the unanimous approval of the udges for her paper on *The Architecture of Observatories in Great Britain.* The judges also highly commended Professor R.K.Kochhar's article on the development of modern astronomy in India.

Meeting programmes

IAU Commission 22:
Meteor streams and surveys
Saturday, July 27
Room G, 1100-1230

Scientific meeting

SESSION 2

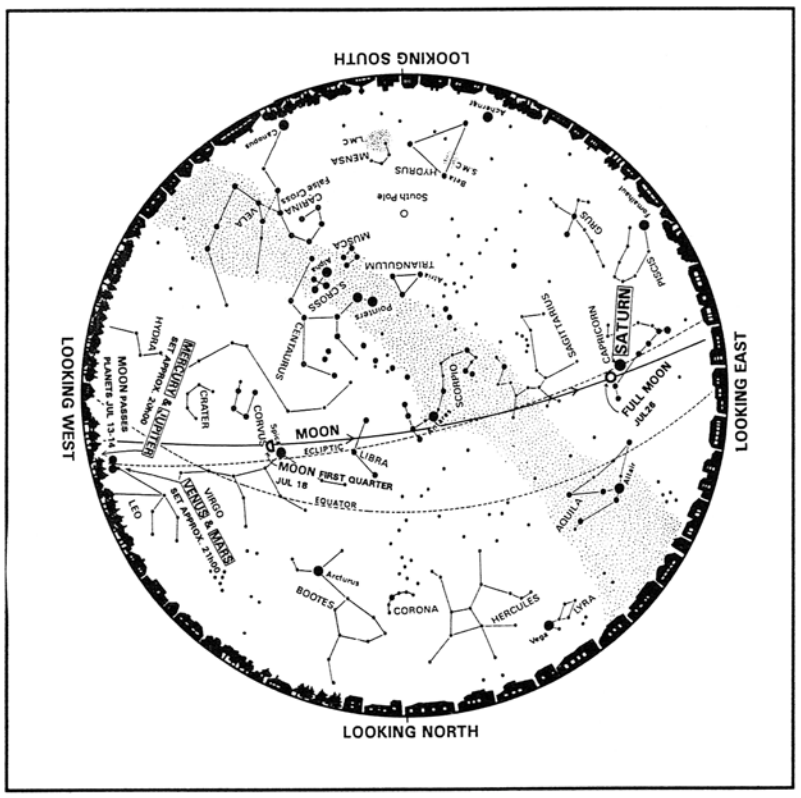
C. Keay and F. Rogers, Newcastle Meteor Radar - first and last results
D.Steel, K.Taylor and W.J.Baggaley, New Zealand Meteor Orbit Radar
J.Mason, Geminid results for 1990
I.Williams, Leonids and Bielids
V.Porubcan and J.Stohl, Burst of Lyrids in 1982
I. Hasegawa, Meteors associated with Comet Levy (1991q)

Can you find the Southern Cross?

To anyone living in Argentina, the Southern Cross - Crux Australis, now generally shortened simply to Crux - is almost ever-present in the night sky. Yet because it lies so far south of the celestial equator, it is not visible from anywhere in Europe, Japan or most of North America, and there must be many delegates to the General Assembly who have never seen it.

The map shown here should help. The Cross is very high up after sunset, slightly to the west of the zenith, and you cannot mistake it, together with the two Pointers, Alpha and Beta Centauri. But do not look for an X! The Southern Cross is shaped more like a kite; it is in fact a rather distorted quadrilateral, with one of the four stars much fainter than the other three. It is actually the smallest constellation in the entire sky; until 1678 it was not even regarded as a separate group, but was included within Centaurus. On the other hand, it is exceptionally rich. One of the four main stars (Gamma Crucis) is a red giant of type M; the brightest star (Alpha Crucis) is a fine, wide double, with a third star in the binocular field; here too we find the 'Jewel Box' cluster, Kappa Crucis, and the dark mass of the Coal Sack - the most famous of all dark nebulæ.

Antares, in Scorpius, is near the zenith; low in the south you will find the two Magellanic Clouds. Look north, and you will see stars such as Arcturus, Vega and Altair, but Europeans will look in vain for their Great Bear. Of the planets, Venus is glorious in the west, close to the now faded Mars; in the east, Saturn is gaining altitude among the stars of Capricornus. Yes, there is a great deal to see in the evening sky, once you can get away from the glare of Buenos Aires - but even from the city, you should be able to make out the unique Southern Cross. The Argentinian sky would indeed seem barren without it.



Adapted from: *A Beginner's Guide to the Southern Stars* by 35 Bondietti, illustrated by C. Hunter. Full booklet available in the Museum bookshop. •

ESO's data analysis system:ESO-MIDAS

The Munich Image Data Analysis System, ESO-MIDAS, has been developed at the European Southern Observatory (ESO) and provides a data analysis system as well as a programme environment.

The data analysis system is a command driven system, i.e. in order to execute a particular task, the user has to issue a command. The basis system contains roughly 250 commands. These commands can be grouped into five main categories: monitor commands, to control the various parameters and processes during a session; general image processing commands; display commands, to visualise the one- and two-dimensional data frames; graphic commands, to produce graphic information about the data; and table commands, to manipulate data stored in MIDAS table files.

Apart from these general image processing commands, ESO-MIDAS also includes commands for reducing data acquired at the ESO telescopes at La Silla (Chile), and commands for detailed analysis. The MIDAS system also contains a highly developed control language that enables the user to create his/her own reduction and analysis procedures, composed from commands already present in MIDAS and own software.

In order to make it possible to contribute software to ESO-MIDAS, a set of sub-routines has been written to interface application programmes with data as well as with devices. This set of routines is called the Standard Interfaces, and is described in detail in a separate MIDAS document: MIDAS Environment. They are provided both in Fortran and C. Several foreign packages (e.g. DAOPHOT and ROMAFOT) could be implemented with the minimum of effort, using these interfaces.

ESO-MIDAS can run on computer systems with VAX/VMS or the various flavours of UNIX as operating systems. The display and graphic software requires a dedicated image display system, or a workstation using the X11 windowing software. Several kinds of graphics terminal can also be used.

ESO-MIDAS is available free of charge to all non-profit research institutions with no reproduction charge. An ESO-MIDAS User Agreement has to be signed, in order to use the released software. An ESO-MIDAS request form is needed to obtain the software.

Information about ESO-MIDAS can be obtained from the ESO stand in the Orange Room. A portable lap-top computer, running UNIX, is present for demonstrations, which will be held at regular intervals during the General Assembly.

REIN H. WARMELS European Southern Observatory

Marsans Tours

IMPORTANT NOTICE

Marsans Tours would like to inform General Assembly participants that from today, departure for all tours will be from your hotels, not from the San Martin Cultural Centre.

Today's planetarium shows

The following shows will take place at the Galileo Galilei Planetarium in Palermo Park:
Saturday, July 27
and Sunday, July 28:
• **16.30, 18.00** and **19.30** (show for the general public) "In deep space"

Tour Programme

Local tours for Monday, July 29

8:30 a.m. (8:30)
Tour 5.7 Visit to the Congress
8:50 a.m. (8:50)
Tour 5.9 Ecological Reserve
9:30 a.m. (9:30)
Tour 5.2 José Hernández Folk Museum
1.20 p.m. (13:20)
Tour 5.8 Agricultural and Cattle Annual Exhibition
2.40 p.m (14:40)
Tour 5.11 Promenade along Avenida de Mayo
Tours depart from the San Martín Centre at the indicated times; badges are required.

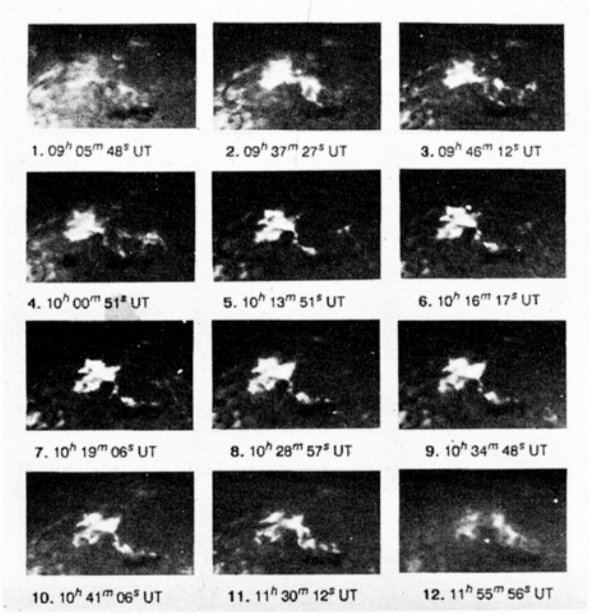
Cruz del Sur

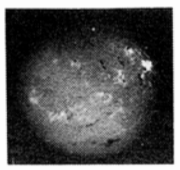
XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

NO. 7 : MONDAY, 29 JULY

Solar flare of 11 July





A series of photographs taken at tne H_α line (6563 Å) with the 10.2 cm, f/15 refractor of the Astronomy Laboratory at the University of Thessaloniki during a strong (importance 3B) solar flare on 11 July, 1991. The frame at lower centre shows the full disk of the Sun at $10^h\ 16^m\ 17^s$ UT as photographed through thin cloud.

Contact?

No evidence of extraterrestrial intelligence has so far been forthcoming. Nevertheless, the subject is of great importance, and at a business meeting of Commission 51 (Bioastronomy: Search for Extraterrestrial Life) on Friday, 26 July (Chairman, G. Marx) a "Declaration of Principles Concerning Activities Following the Detection of Extra-Terrestrial Intelligence", accepted by the International Academy of Astronautics, was discussed.

The Declaration begins with the recognition that the search for extraterrestrial intelligence is "an integral part of space exploration and is being undertaken for peaceful purposes and for the common interest of all mankind". Since any initial detection may be incomplete or ambiguous, "it is essential to maintain the highest standards of scientific responsibility and credibility", and various principles of behaviour are laid down:

1. Any individual or institute believing that any sign of extraterrestrial intelligence has been detected, should seek verification and confirmation before taking further action.
2. Before making any such announcement, the discoverer should promptly notify all other observers or organisations which are parties to this Declaration. No public announcement should be made until the credibility of the report has been established. The discoverer should then inform his national authorities.
3. After concluding that the discovery is credible, the discoverer should inform the Central Bureau for Astronomical Telegrams of the International Astronomical Union, and also the Secretary-General of the United Nations. Other organisations to be notified should include the Institute of Space Law, the International Telecommunication Union (ITU), and Commission 51 of the International Astronomical Union.
4. A confirmed detection of extraterrestrial intelligence should be disseminated promptly, openly and widely through the mass media.
5. All data necessary for confirmation of detection should be made available to the international scientific community.
6. All data relating to the discovery should be recorded, and stored permanently in a form which will make it available for further analysis.
7. If the evidence of detection is in the form of electromagnetic signals, the parties to this Declaration should seek international agreement to protect the appropriate frequencies. Immediate notice should be sent to the Secretary-General of the ITU in Geneva.
8. No response to a signal or other evidence of extraterrestrial intelligence should be sent until appropriate international consultations have taken place.
9. The SETI Committee of the International Academy of Astronautics, in co-ordination with Commission 51 of the IAU, will conduct a continuing review of all procedures relating to the detection of extraterrestrial intelligence and the subsequent handling of the data.

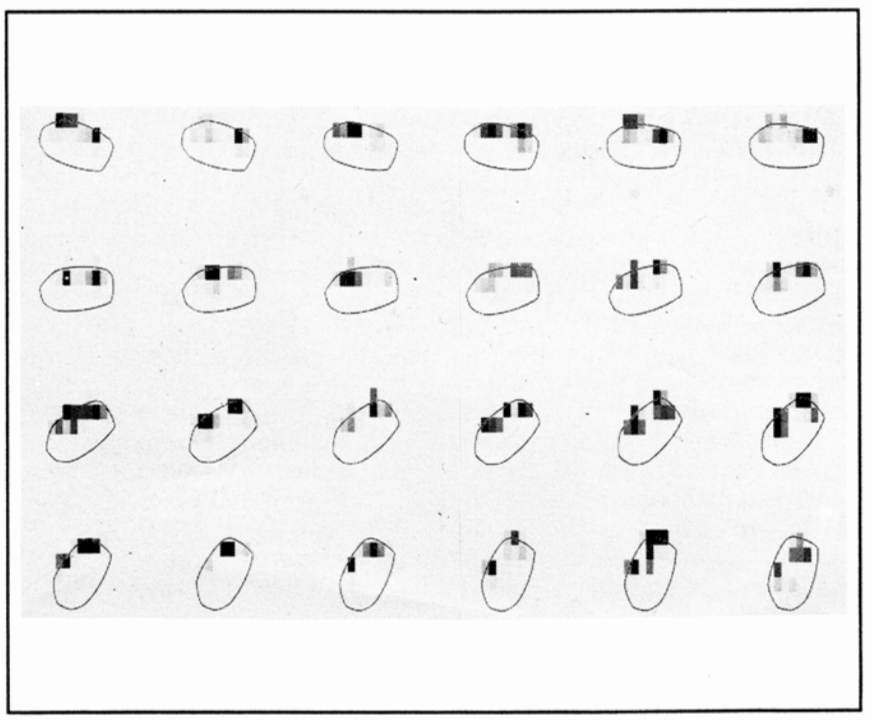
Such a Declaration would have seemed quite unnecessary not many years ago; times have changed. But - when will it happen?

Unusual asteroids

It seems a long time since an irritated German astronomer described asteroids as "vermin of the skies"; today they are assuming increasing importance. Very interesting papers were presented at a meeting of Commission 15 (Physical Study of Comets, Minor Planets & Meteorites) on Friday, 26 July. For example, Donald Yeomans read a paper by S.J. Ostro et al. concerning the curious body formerly known as 1989 PB, and now dignified with a number and a name: 4769 Castalia. It is one of Eleanor Helin´s numerous discoveries, and is an Earth-approach asteroid with a diameter of the order of 2 km. There seem to be two radar-bright lobes rotating around each other in a period of 4.1 hours (as shown in the accompanying illustration), and from this it is deduced that Castalia is a contact binary; the radar indicates that there is no actual separation.

T. Van Flandern then discussed the forthcoming encounter with the asteroid Gaspra by Galileo - the space-craft now on its way to Jupiter, admittedly by a somewhat circuitous route. The encounter is due on 29 October this year. Van Flandern expects that the images will show Gaspra to be surrounded by a cloud of débris, "rather like a faint comet halo", with larger pieces of material in orbit round the asteroid; if this is correct, it will support his contention that the asteroids originated from the break-up of a large body, rather than being merely primordial. Other speakers were doubtful about this; but if Galileo performs well, the answer should soon be known.

Unfortunately, Galileo´s high-gain antenna has still not deployed properly. Efforts are being made to correct this fault. If they fail, we will have to wait until Galileo again passes close to the Earth, on 8 December 1992, when the results from the low-gain antenna will be transmitted.



Radar images of Castalia, showing rotation: Arecibo, 22 August 1989.

International colloquium in Montevideo, Uruguay

From 16 to 20 July an international colloquium, "Astronomical Culture in Modern Society," was held in Montevideo, Uruguay, with more than 100 active participants and a large number of other people. Though this was not an official IAU colloquium, many IAU members were present, representing eleven countries. Messages from others were received, regretting their inability to take part.

Almost 60 papers were presented, all of which will be published in *Proceedings* in the near future. The colloquium was bilingual (English and Spanish) with simultaneous translation. Topics covered included the popularization of astronomy, ecological problems, the teaching of astronomy, and the rôle of the amateur in astronomy today.

GONZALO VICINO
Inspector of Secondary Education, Montevideo

Comet Halley erupts

During its brief return to the inner Solar System, comet Halley's dramatic performance was closely monitored by thousands of amateur and professional astronomers, as well as by five space-craft that flew past in March 1986. At its maximum activity level, 30 tonnes of gas and dust issued forth each second from the few active areas exposed beneath the surface crust. Halley's nucleus is composed primarily of dust and ices, with the latter being mostly water (80%) and carbon monoxide (15%). Shortly after reaching perihelion in February 1986, Halley's activity decreased rapidly. Even so, the comet's images in April-May 1988 and January 1989 were still diffuse, indicating some residual activity or perhaps a lingering cloud of dust. By February 1990, when its heliocentric distance was 12.5 AU, the comet's image was stellar with a visual apparent magnitude of 24.3. At the time, it was generally assumed that Halley´s next show of activity would not occur until its 2061 return to perihelion.

Beginning in 1982, European Southern Observatory (ESO) astronomers have been monitoring comet Halley's behaviour at large heliocentric distances. During the early morning hours of 12 February, 1991, ESO astronomers Olivier Hainaut and Alain Smette planned to take CCD images of comet Halley, using the Danish 1.54-metre telescope in La Silla, Chile. After a one-hour exposure to reach the expected 25th magnitude of comet Halley, a diffuse image of total magnitude 18.9 appeared on their computer screen, and subsequent images confirmed that the object was moving with Halley's predicted rate and direction. Comet Halley had been caught in the midst of an extraordinary eruption, and at a distance of 14.5 AU - half-way between the orbits of Saturn and Uranus. On 22 February, A. Smette used the New Technology Telescope at La Silla to obtain a spectrogram of comet Halley. The coma presented a solar-type spectrum with no emission features - strongly suggesting a dust composition.

Observations at several observatories during February, March and April indicated that structures within Halley's coma varied with time, while the central region decreased in brightness by about one magnitude per month. A preliminary analysis of the Halley outburst was completed by R.M. West, O. Hainaut and A. Smette; it is to be published as a letter to *Astronomy and Astrophysics*. These authors conclude that a fan-like structure, in the approximate direction of the Sun, reached a maximum radius of 61 000 km on 13 February and by 12 April, it had expanded to 142 000 km. They estimated that the expansion velocity of the coma material was approximately 14.5 m/s. Extrapolating backward in time, they suggest that the initial outburst took place on 17 December, 1990, and lasted possibly three months. A short explosive event is ruled out, because the very high production rates required would induce much higher dust velocities than those observed.

Why would comet Halley flare by six magnitudes at a heliocentric distance of 14.5 AU? A collision with an interplanetary boulder seems improbable, and all but the most volatile ices are frozen solid at the expected temperature.of 80 K. Possibly, a pocket of very volatile carbon monoxide ice was exposed to the feeble sunlight, and the vaporising gases carried away the dust particles from the nucleus. But why would not this ice pocket have erupted five years ago, when Halley was far closer to the Sun? If the nucleus of comet Halley is a very low-density object, it might flex back and forth as it rotates. Could this flexing open a new surface fissure and reveal a fresh pocket of volatile ices to the distant Sun?

Despite the efforts of thousands of astronomers and the data from five space-craft, comet Halley still retains more than a few well-guarded secrets. It may have left the centre of the stage in early 1986, but comet Halley can still present an impressive performance some five years later.

DONALD K. YEOMANS
NASA, Jet Propulsion Laboratory, USA

Invited Discourse III
Observational Problems in Extragalactic Astronomy
Monday, 29 July, Rooms A+B. at 6.00 pm (18:00).

Observations which contradict our current understanding of galaxies and quasars have been accumulating for over a quarter of a century. This presentation will review these major observational paradoxes in extragalactic astronomy, bringing them up to date with the newest observations which have been obtained. Some of the most interesting examples will be discussed as representative of the whole body of data. It is emphasised that the essential properties of these systems are repeated again and again - pointing to physical processes which are not usually contemplated.

In interpreting these observational discordances, it is useful to consider the current observational weaknesses in the Big Bang theory of the origin of the universe. For example, the ages of the oldest stars are older than most straightforward values of the age of the universe. Most importantly, the evidence of young galaxies strongly contradicts the origin of all the galaxies in an initial Big Bang.

Further investigation of the anomalous aspects of some nearby galaxies suggests a theoretical interpretation which gives quantitatively correct results over the entire range of discordant red-shifts of galaxies, as well as accounting for the conventional galaxy observations. Perhaps the principal value of the new theory is that it demonstrates that the observations do not need to be discarded because they disagree with current theory. Regardless of which theories ultimately turn out to be accepted, it illustrates the most important point of the Discourse - namely that careful study of these discordant phenomena can lead to richly rewarding new insights into the physical understanding of the universe.

HALTON ARP
Max Planck Institut für Physik und Astrophysik

COMMENT

Radio Interference and WARC-92

Radio astronomers, particularly those working at centimetre wavelengths, are well aware of the steadily-worsening worldwide interference situation. During the last two decades the spectrum has become increasingly crowded, with a particularly large increase in satellite-borne transmissions.

Frequency allocations are the responsibility of the International Telecommunications Union (ITU), a specialised organisation of the United Nations, with 170 member countries; its headquarters is in Geneva. Every few years, as the need arises, the ITU convenes World Administrative Radio Conferences (WARCs), at which either a portion, or the entire radio spectrum is re-allocated. The next of these, WARC-92, is scheduled to take place in February 1992, in Spain.

There is heavy pressure to allocate substantial parts of the spectrum for various purposes. Of special concern to astronomers are new allocations to satellite sound broadcasting, mobile satellites, radio determination satellites, and personal communication networks, all within the 500-3000 MHz range. The spectrum requirements of mobile satellites are about 200 MHz. Most of the new allocation to this service is expected to be in the I.5-I.6 GHz range, where the OH lines are found. The total stated requirement in the 500-3000 MHz portion of the spectrum is about 460 MHz.

New allocations will also be sought above 12 GHz for high-definition television, inter-satellite links, and other space applications.

At the WARC, frequency allocation matters are decided by a simple majority, on a "one country, one vote" basis. It is important, therefore, that astronomers should contact their telecommunication administrations to let them know about their continued need to access the radio spectrum, and, if possible, to participate in establishing the position of their country at the WARC.

Commission 50 (Protection of Existing and Potential Observatory Sites) will hold a session to discuss these issues (Sessions 1,2) on Tuesday, 30 July, in Room G. All IAU participants are invited.

TOMAS GERGELY,
National Science Foundation, USA.

Global Network

A Global Network of (Small) Automated Telescopes - GNAT - is an idea "whose time has come," according to David Crawford. Speaking at Joint Commission Meeting II on the subject of ´Automated Telescopes for Photometry and Imaging´, Crawford was described as the "evangelist" for a network of small automated telescopes, while Lou Boyd was the "father" and Russ Genet the "godfather" of the subject. Reports were presented on scientific results from, and operational experience with, several automated telescopes in the size range 0.4-0.9 metres, including one located at the South Pole.

As was pointed out by Chris Sterken, it takes considerable effort to "programme" the robotic operation of the observatory with sufficient knowledge to replace human instinct and experience. Yet it can be done, and, as was emphasised by Terry Oswalt, Ed Guinan and others, the availability of a network of small automated telescopes, which can be established at relatively modest cost by a consortium of two to four small colleges, opens up new possibilities for education and training in astronomy. Gene Milone described work toward an automated infra-red telescope, Davis Philip described a l-metre class automated imaging telescope, and Saul Adelman advanced the idea of a spectrophotometric telescope. All of us need more observing time, as David Crawford pointed out, and a l-metre telescope with a CCD detector on a good site is more efficient than a 5-metre telescope was two decades ago. Crawford appealed for a more formal structure for a global network of small automated telescopes, which would be a good catalyst and would surely stimulate international co-operation.

IAN S. McLEAN
University of California

The Rozhen Observatory, Bulgaria: ten years of work

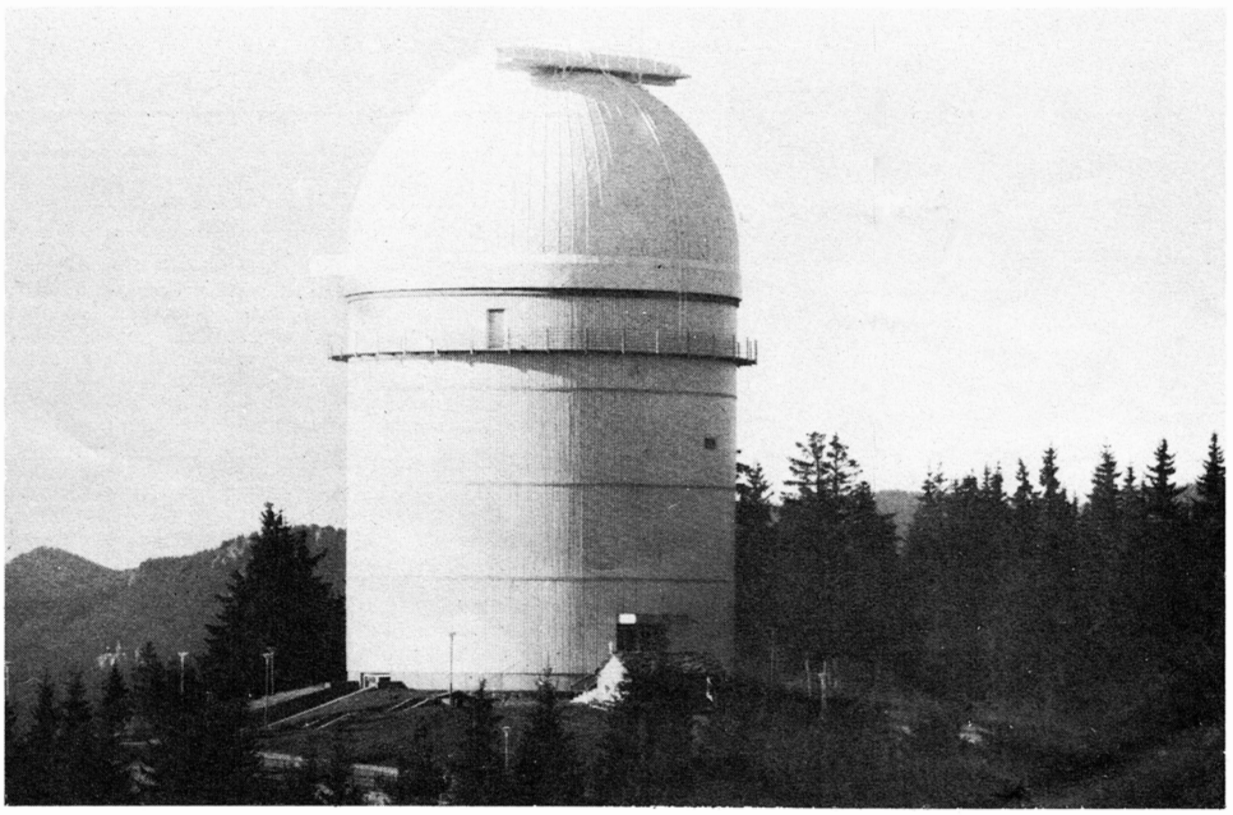
The Rozhen Observatory, brought into operation in 1981, lies 1750 metres above sea-level on Orpheus Rodopy Mountain, southern Bulgaria, 250km from Sofia. The main telescope is a 200-cm Ritchey-Chrètien-Coudé built by Zeiss; there are two smaller instruments, a 60-cm Zeiss reflector and a 50/70-cm Schmidt, moved to Rozhen from Potsdam Observatory. The 200-cm telescope is still used with photographic plates and films. As well as producing direct photographs in different colours (UBVRI), the Ritchey-Chrètien focus can be used with a Meinel camera and with a Zeiss spectrograph equipped with image tubes. The limiting magnitude is m(B) = 22.5. The Coudé provides high-quality spectrographic results with three Schmidt cameras and a set of Baush and Lomb gratings; dispersions of 4.2, 9 and 18 A/mm can be achieved, with a limiting magnitude of 11. The data from the observations are mainly processed at the Observatory.

The weather conditions at Rozhen are best in the autumn, with seeing of the order of 2-3 arcseconds and about 150 useful nights per year. 42 Bulgarian astronomers are members of the IAU; most of them work in the Department of Astronomy in the Bulgarian Academy of Sciences, Sofia, and in the Kliment of Ohrid Observatory. There are increasing links with observatories elsewhere in Europe.

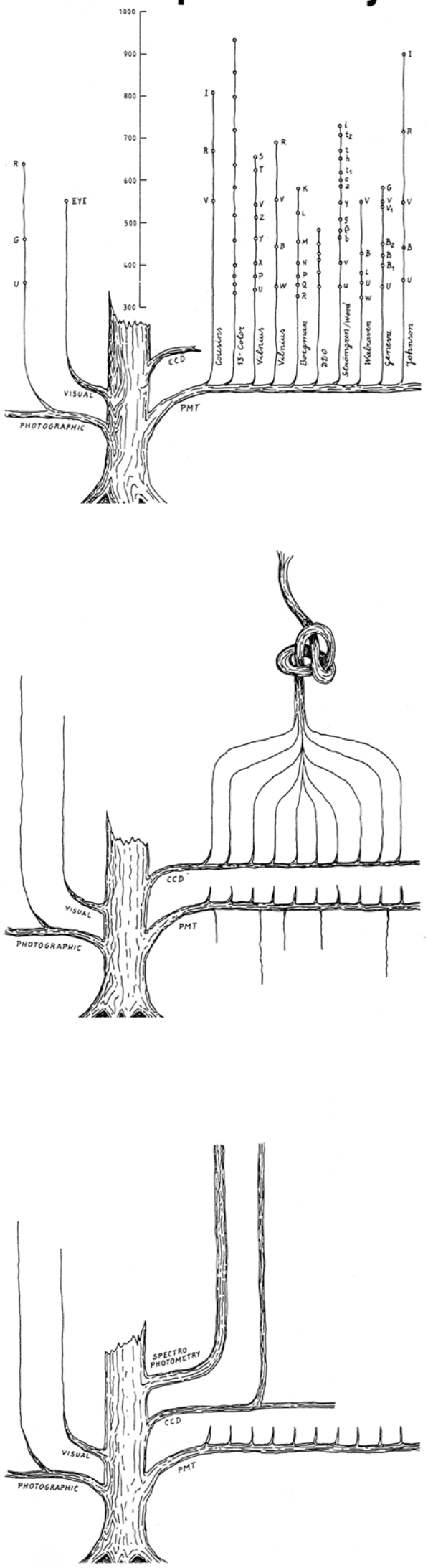
The main researches at Rozhen concern stellar evolution, non-stable stars, flare stars, and peculiar variable stars such as KR Aur and MWC 560. A group also participated in the International Halley Watch. Galaxies with active nuclei are also under investigation.

As you may know, Bulgaria is undergoing an economic recession, and this is bound to affect Rozhen Observatory. All possible help from IAU members would be appreciated.

M.K. TSVETKOV
Bulgarian Academy of Sciences



Crisis in photometry?



Astronomical photometry faces a crisis: every new detector has brought a proliferation of new photometric systems. This topic was discussed on Saturday, 27 July, in Commission 25.

Top: Some existing photometric systems. **Middle and bottom:** two possibilities for the future (from Chris Sterken, Belgium, "On the future of existing photometric systems").

Mozart Concert

On Wednesday, 31 July, at 6 p.m. (18:00 hours) in Rooms A + B, there will be a concert by the Permanent Orchestra of the Colón Theatre The principal work will be the Quartet K478 in E minor for piano, violin and violoncello, by Mozart; pianist, Cristina Filoso.

Six Presidents!

Commission 35 (Stellar Constitution) has six past, current or future Commission Presidents here in Buenos Aires. They are:
Leon Mestel (1976) • Arthur Cox (1985)
Daichiro Sugimoto (1988) • Andre Maeder (1991)
Pierre Demarque (incoming) • Cesar Chiosi (V/president now)
Is this a record?

UNESCO Meeting in 1992

Adverse Environmental Impacts on Astronomy

As was announced during the first session of the General Assembly (and will be at the closing session), there will be an IAU and UNESCO sponsored meeting in Paris during the middle of 1992. The aim of the meeting is to make our problems known to a wide audience, and to stress the need for action. The Organising Committee, chaired by Derek McNally, would greatly appreciate your comments about this meeting and the issues, so that it can be as effective as possible in reaching non-astronomical communities. In particular, any visuals or demonstrations which would help to illustrate the problems (and possible solutions) would be most valuable. Striking visuals are also needed to attract the attention of the public. If you can help in this important work, please contact either Derek McNally or David Crawford in the near future.

Women in astronomy

On Tuesday, 30 July at 6.00 p.m. (18:00), in Room E, there will be a panel discussion on the topic: "Status of women in astronomy"
Silvia Torres-Peimbert (Chairperson)
- Peter Boyce (USA)
- Sushma Mallik (India)
- Miriam Pastoriza (Brasil)
- Elena Terlevich (UK)

All IAU participants are invited.

World Astronomy Days

The International Space Year (ISY) – 1992 - will generate many activities, most of which are related specifically to science and technology outside the terrestrial atmosphere. It has been realised that the use of space-craft is important in astronomy, and that the co-ordination of space research methods with ground-based astronomy has enormous potential. Limited investigations have already been carried out successfully; examples of this are the micro-arc second resolution of active galactic nuclei, and the surface mapping and vertical atmospheric structure of RS CVn stars and other late-type binaries.

With the support of Resolution A4 of the 20th General Assembly, plans are proposed for organising a number of World Astronomy Days (WADs) during the second half of 1992. In these WADs, it is hoped that the full electromagnetic detection capability will be used to tackle problems which need so complete an organisation.

The organisation of the WADs was assigned to ESA by COSPAR. Current planning involves the submission of consistent observing proposals to all observatories willing to participate in this study, for peer reviewing. To begin the process of objective definition, and to clarify the organisational plans for the WADs, a meeting will be held on Monday, 29 July at 2.00 p.m. (14:00), in Room D.

To make sure that the procedures to be followed are correct, all those interested in WADs are asked to attend, as well as representatives of both common-user and restricted-access observatories.

The meeting on Monday, 29 July will be chaired by Willem Wamsteker, of the ESA/IUE Observatory.

Meeting programmes

Joint Discussion V, Monday, 29 July, 9:00 a.m., Room B

T. Owen, Planetary atmospheres and chemical constraints
A. Brahic, Planetary rings and dynamical constraints
A.C. Levasseur-Regourd, Comets and Solar System formation
P. Barge and R. Pellat, From planetoids to planets
R. Terrile, Search for extra-solar planets from space
B. Smith, The Beta Pictoris disk
T. Montmerle, Circumstellar environment of young stellar objects and magnetic activity around T Tauri Stars
L. Hartmann and M. Gómez, Circumstellar disks and star formation
R. Larson, Effects of interactions involving protostellar disks

Foundation meeting of a Latin-American Centre

Tuesday, 30 July, Room K, 11 p.m. (11:00 hours), session 2

At the IAU Latin-American regional meeting, held in Brazil in 1989, it was proposed that a Latin-American centre should be formed, to stimulate the growth of astronomy in Latin-America. This meeting will further consider the plans for such a centre.

Planetarium Shows

The following shows will take place at the Galileo Galilei Planetarium in Palermo Park:
Wednesday, 31 July
- 9.30 and 10.30 (6th and 7th grades) "The Universe."
- 11.30 (2nd and 5th grades) "The southern sky"
-14.30 and 15.30 (6th and 7th grades) "The Universe"

Tour programme

Local tours for Tuesday, July 30

8:50 a.m. (08:50)
Tour 5.9 Ecological Reserve
9:30 a.m. (09:30)
Tour 5.5 Colón Theatre and Museum
10:00 a.m. (10:00)
Tours 5.12 + 5.13 Antiques and Art Galleries
10:30 p.m. (10:30)
Tour 5.10: Buenos Aires Cultural Centre
2:40 p.m. (14:40)
Tour 5.4: Museum of Natural Sciences
2:50 p.m. (14:50)
Tour 5.1 National Historical Museum
5:00 p.m. (17:00)
Tour 5.12: Antiques

Meeting changes

Commission Meeting 33.6, Galactic Nucleus, is re-scheduled to Room G, session 4, Tuesday 30 July.

The business meeting of **Commission 16** has been postponed to Tuesday, 30 July, session 3, Room M.

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

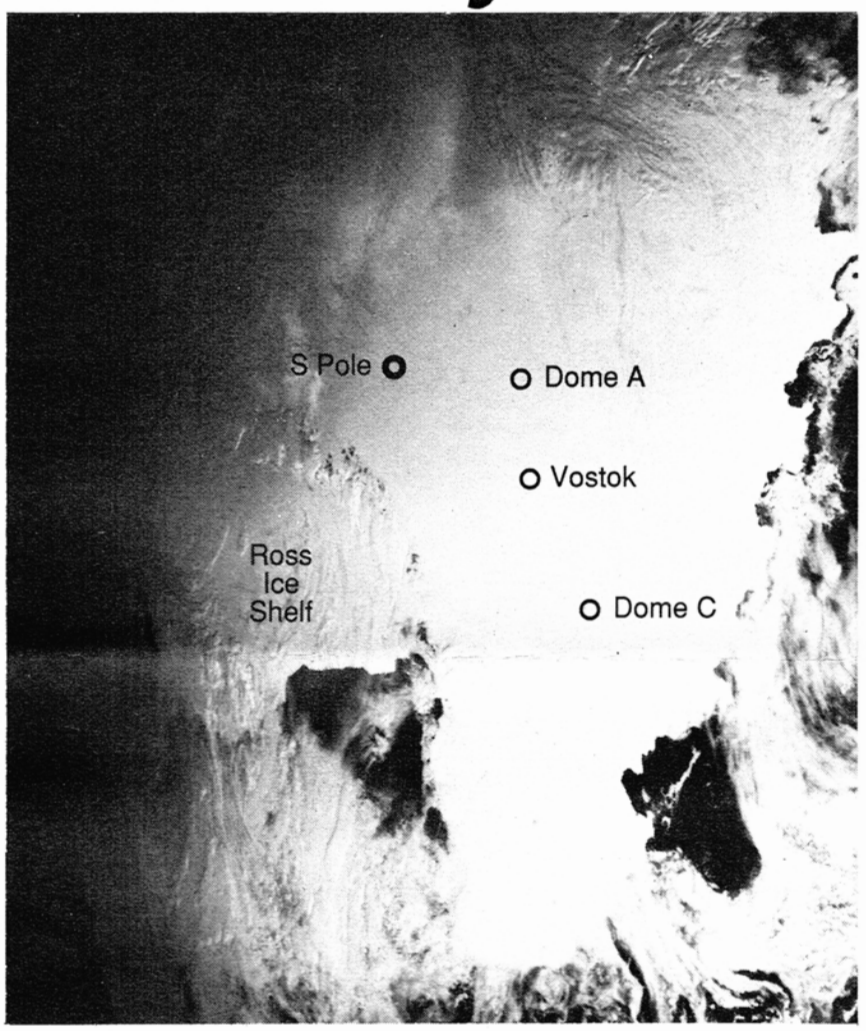
NO. 8 : TUESDAY, 30 JULY

New Observatory in Antarctica?

Saturday morning's Joint Commission Meeting, 'The Development of Antarctic Astronomy,' was addressed by 15 speakers from ten different nations. The aim of the meeting was primarily to acquaint astronomers with the promise Antarctica holds for greatly improved performance in infra-red, submillimetre, and millimetre astronomy and to present the case for establishing a new international observatory there, optimally located for astronomy.

The area in question, the highest part of the eastern plateau (at over 4000 metres altitude) differs in a few important respects from the popular conception of Antarctica. There is little wind (the year-round average is likely to be about 3 metre/sec) and very little snow-fall (roughly the equivalent of 10 mm rain). But it is cold - down to below -80°C!

Such a site, with its extremely low air temperatures and very little water vapour, offers far better transparency and lower backgrounds for infra-red and millimetre wavelength astronomy than even the highest mid-latitude sites. There are other observing advantages unique to a near-polar site: 24-hour access to most of the southern sky, a dark sky for months at a time, and the significant possibility, during the southern winter, that an ephemeral event might be observable in a dark sky nowhere else. There is also a chance that better seeing is attainable from an Antarctic site than from any other site on the Earth's surface. The maturing of infra-red and submillimetre technology makes the coming decade an especially propitious time to exploit the astronomical attributes of Antarctica.



Antarctic view from NASA's Galileo space-craft, taken during its fly-by of the Earth in December 1990, showing the highest part of the eastern plateau, Dome A, where the establishment of an international observatory is proposed. The USSR base, Vostok, is the highest base manned at present. The French propose a base at Dome C.

The meeting heard brief reports on several existing astronomical programmes, some of which have already yielded very significant scientific results, and on a number of plans for the future. The most outstanding recent development was the establishment early this year of CARA, the Centre for Astrophysical Research in Antarctica (a consortium of several US institutions with its base at the University of Chicago). CARA intends to encourage international collaboration. The very exciting possibilities for a new international observatory at a site chosen for the very best astronomical performance was outlined in a paper by a member of the US National Science Foundation.

A resolution to be submitted to the final meeting of the General Assembly was discussed at the conclusion of the meeting. If the resolution is adopted, national committees for astronomy and national Antarctic agencies will be urged to establish an international astronomical base on the high plateau, and a Working Group will be created to encourage international co-operation in site testing and in designing and constructing new Antarctic astronomical facilities.

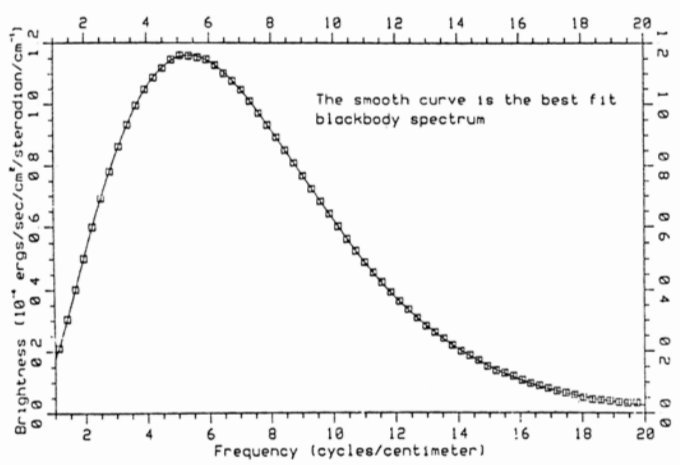
PETER GILLINGHAM,
Anglo-Australian Observatory

COBE: A success

The Cosmic Background Explorer (COBE), NASA's first satellite dedicated primarily to cosmology, continues to collect valuable data concerning the origin and evolution of the universe. In November 1989 a Delta rocket carried COBE and its instruments into a 900-km orbit.

The Far Infra-Red Absolute Spectrophotometer (FIRAS) quickly showed that the remnant radiation from the Big Bang now has a temperature of 2.735 ± 0.060 K, and has a black-body spectrum to a high degree of accuracy from 0.5 to 3 mm wavelength. No deviations greater than one quarter per cent of the peak brightness were seen.

The Differential Microwave Radiometer (DMR) investigation has demonstrated that the relic radiation has the same temperature across the sky to better than one part in 25 000 on angular scales as small as 10 degrees. This is in contrast to new measurements showing increased levels of fluctuations in the universe as probed through the galaxy correlation function.



Preliminary spectrum of the cosmic microwave background from the FIRAS instrument on COBE at the north Galactic pole, compared to a black-body.

The Diffuse Infra-Red Background Experiment (DIRBE) is searching for the cumulative emission from the earliest luminous objects in the universe. Covering ten wavelengths from 1 to 300 microns, strong foreground emissions from the Solar System and Galaxy must be modelled and subtracted to determine if a non-zero isotropic infra-red glow remains.

Four bands of the DIRBE instrument are still collecting useful data, and the DMR instrument continues to operate with full performance.

The first data products from the COBE mission will be made available to the public in the second half of 1993. The COBE results were presented by the three Principal Investigators - J. Mather, G. Smoot, and M. Hauser - at Joint Discussion Meeting IV on 'Cosmic Background' on Monday, 29 July.

CHARLES BENNETT
NASA Goddard Spaceflight Centre, USA

SETI in Argentina

The Instituto Argentino de Radioastronomía (IAR) was founded in 1962, though it was 1966 before the first instrument was completed. The Institute was officially opened on 26 March of that year. Since then, well over 300 papers have been published in both national and international journals, dealing with subjects ranging from stellar structure to the interstellar medium and galaxy formation; there is a staff of 40. The two large paraboloid antennæ are 30 metres in diameter; pointing accuracy is of the order of ±0.01 degrees, and the antennæ surfaces may be adjusted to within ± 3 mm of the ideal paraboloid.

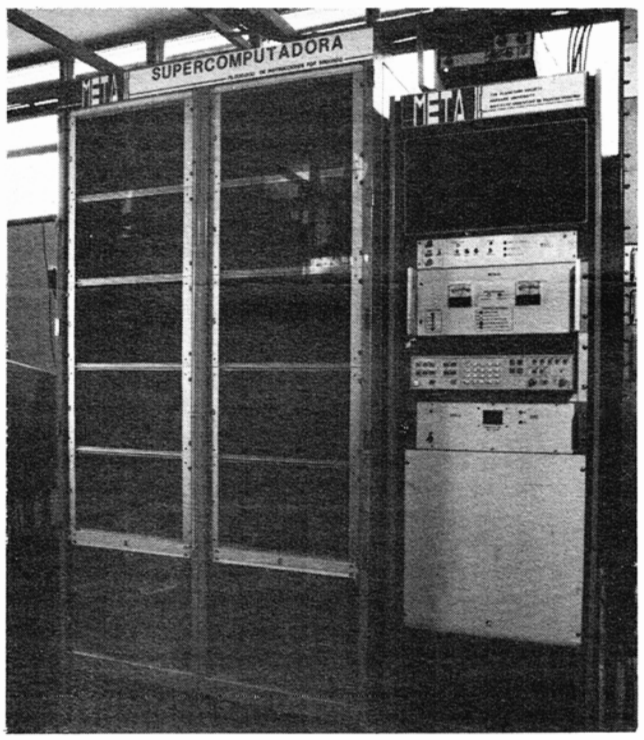
A new spectral analyser, known as META II (Mega-channel Extra-terrestrial Array), has now been installed at one of the 30-metre antennæ with the aim of joining in the search for intelligent life beyond the Earth. META II has been constructed following an agreement between the IAR and The Planetary Society in the USA., who provided the funds. It was built at Harvard University by E. Hurrell and J. C. Olaide, under the direction of Paul Horowitz.

META II simultaneously analyses 8.4 million channels with 0.05 Hz resolution, producing a sky profile every 20 seconds; it has a 'chirp' oscillator to eliminate both terrestrial interference and the effects of the Earth's rotation. The high resolution obtainable makes it possible to distinguish a natural signal from an artificial one.

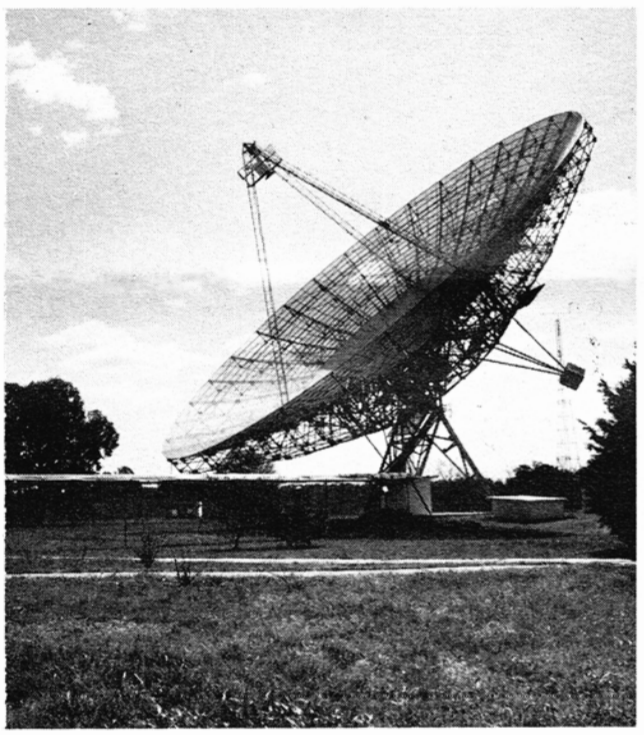
Observations are carried out at a frequency of 1420.4 MHz, corresponding to the wavelength of neutral hydrogen emission - and which will presumably be known to any civilisation whose level of technical development is similar to ours. This frequency also has the advantage of being in a region fairly low in cosmic noise. To avoid frequency shift due to the motions of celestial bodies, META carries out observations in three reference systems: (1) heliocentric, (2) with respect to the galactic centre, and (3) with respect to the 3 K cosmic background radiation. The observations cover the whole of the visible sky, and will be made with the IAR antenna from declination -10° to -90°, for at least three years. Subsequently, research will be carried out in other regions of the electromagnetic spectrum.

These observations are particularly important because they are the only surveys for extra-terrestrial life at present being carried out in the southern hemisphere. Moreover, together with the observations made by META I at the Harvard Observatory, it is possible for the first time cover the entire sky at the same frequency and with similar sensitivity. During next September, both META I and META II will be making observations of the same region of the sky.

Photographs courtesy of G. E. Sierra



The 8.4-million-channel spectral analyser, META II, installed at the IAR.



30-metre paraboloid antenna at the IAR.

Axial inclination of Ceres

The first determination of the rotation axis of an asteroid was reported by F. Rigaut at Joint Commission Meeting II on Thursday, 25 July. M-band images of Ceres with a resolution of 0.1 arc second showed an infra-red terminator dividing the cold night-side of the asteroid from the warm day-side. The infra-red terminator of Ceres leads the optical terminator, due to the thermal lag of the soil relative to the 9-hour rotation period. The images were obtained with an adaptive optics system called COME-ON, with 19 piezo-electric actuators adapting the incoming wave-front of the ESO 3.6-metre telescope at La Silla and correcting for atmospheric distortions. Ceres' rotation axis is inclined 20-30 degrees to the ecliptic plane. The distribution of the inclinations of the rotation axes of the asteroids may well have important implications for their original evolution.

Pre-Columbian American astronomy

One of the highlights of the meetings of Commission 41 (History of Astronomy) has been a film showing recent archæological work on some remarkable astronomically-orientated monuments in Tawanacu (Bolivia). The work was done primarily by Peter Parodi (Centre for Advanced Studies, Buenos Aires) and Horacio Tignanelli (La Plata Observatory). Their investigations reveal the use of sophisticated techniques for aligning on sunrise throughout the year in the pre-Columbian period. The investigators have put forward a calendrical hypothesis. For further information, contact either of the two authors.

JOHN NORTH
University of Groningen, The Netherlands
President, Commission 41

Early nucleosynthesis in galaxies

A full-day scientific meeting is scheduled for Tuesday, 30 July (co-sponsored by Commissions 28, 29 and 35), in Room C of the San Martín Centre. The aim is to bring together new observations and theoretical advances on the abundances, nucleosynthesis and stellar evolution in the early stages of galaxy development.

The growth of large ground-based telescopes and greatly improved detector technology have made possible high-resolution spectroscopy for Population II stars in our Galaxy and individual objects in the Magellanic Clouds. The abundance determinations in these objects show a number of marked differences with respect to standard ("solar") abundance ratios. Spectroscopy on H.II regions yields information on the helium and CNO abundances relative to other metal constituents. New photometric and spectroscopic observations in blue compact and starburst galaxies, and in young clusters and associations of nearby metal-deficient galaxies, provide further constraints on stellar and chemical evolution in the early stages of galaxies.

Measurements of the abundances of heavy elements in highly red-shifted galaxies also provide a picture of the early chemical history of galaxies. Absorption spectra of QSOs yield data on the element abundances in intervening material along the line of sight. These observations are a most powerful way to study the chemical evolution of the universe during early Hubble time.

Theoretical investigations on the nuclear networks operating at low metallicities have been undertaken in order to provide an understanding of the observed abundances. Models of intermediate mass stars (AGB stars) and of massive stars at low metallicities are currently being developed, and can be compared with the observational data. These various observations and models lead to a deeper insight into the early stages of the chemical evolution of our Galaxy and others. They also have a great cosmological impact with respect to the abundances of the primæval helium, and also to the evolutionary status of stars in blue compact, starburst and highly red-shifted galaxies.

This meeting will be an initial reconnaissance into problems of early nucleosynthesis in galaxies, both from the observational and the theoretical perspective. The format will be like that of a workshop, with talks from invited speakers with appropriate time for discussion; a full programme of the speakers at this meeting is given on page 4. There will be no published proceedings; the informal nature should encourage abundant exchanges of ideas and stimulation to future research.

GUSTAV TAMMAN (President, Commision 28)
PETER S. CONTI (Chairman) (President, Commission 29)
ANDRE MAEDER (President, Commission 35).

Asteroid (3717) Thoren

Minor planet (3717) = 1964 CG was discovered, during the Indiana Minor Planet Programme, on 15 February 1964. This gives Frank Edmondson the right to propose a name. He has settled on the name (3717) Thoren in memory of an Indiana colleague who was also a member of Commission 41 (History of Astronomy). Victor Thoren was an historian interested in all phases of the development of lunar theory. His crowning achievement was a biography of Tycho Brahe; a copy of this reached him only a few days before his untimely death earlier this year. Commission 41 heartily endorsed this proposal.

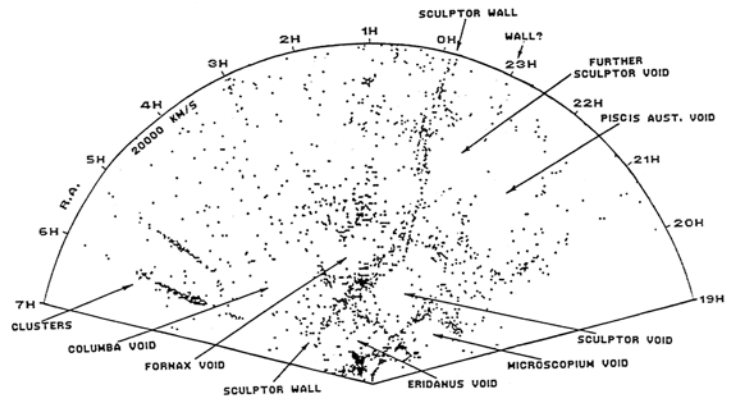
JOHN NORTH
President, Commission 41

Visual perceptions in cosmology

"Look at that galaxy," said Fritz Zwicky. I was working as a summer student with this pioneer of extra-galactic astronomy, and he had a job he wanted me to do. So I looked through the eyepiece of the plate viewer; it was a small compact galaxy, little more than the image of a star. "O.K., now follow me," and he led me out into the basement corridor of the CalTech department and into another room with another plate machine. "Now look again; you can see that it is brighter." It was the same galaxy, and it looked exactly the same to me. However, when I made quantitative measurements I found that Zwicky was right. He presumed that the brightness difference was due to a supernova, and he wanted me to extract the light-curve, but instead it turned out to be one of the first variable active galaxies to be found in the late sixties.

This reveals something of the extraordinary visual perception that Zwicky had. Not only did he use it to find interesting galaxies, but he scanned the Palomar Sky Survey in an attempt to see the three-dimensional distribution of galaxies. The outcome was his monumental *Catalogue of Galaxies and Clusters of Galaxies*. He was keen to point out to me that what others called clusters were simply the central condensations of very much larger structures. In short, he could perceive the existence of superclusters. Not everyone then took his ideas seriously because, sadly, much of his academic life was set in conflict with those researchers who should have been his colleagues. But what impresses me today is that he could distinguish three-dimensional superclusters on two-dimensional photographs - by eyesight alone!

In the years since Zwicky's death in 1974, it has become very much easier to see the three-dimensional distribution of galaxies. Distances to individual galaxies come from red-shifts, and red-shifts are now more readily obtained. This led to the major breakthrough in the late seventies, when Guido Chincarini and Herbert Rood found that galaxies segregated into superclusters, with empty spaces in between. Superclusters were not entirely unexpecteced - Gerard de Vaucouleurs had strongly advocated a local "supergalaxy" and C.D. Shane had described "galaxy clouds" - but the idea of voids was new. Since the formation of such large-scale structures, and empty spaces, was beyond the gravitational capability of the visible galaxies, its roots must trace to cosmological factors. I often wonder how Zwicky would have felt; I am sure he would have been pleased, since he had originally recognised the 'missing mass' problem in clusters of galaxies.



Today we view the three-dimensional structures by means of 'slices of the universe', such as the well-publicised one from the Harvard-Smithsonian Centre for Astrophysics. But once again, visual perception is playing a key rôle. The problem now is that although there are plenty of red-shifts, it is still impossible to have a red-shift for every galaxy, so what we see is only a sample. Visual perception and intuition can fill in the spaces. However, as in Zwicky's day, there are many who feel that this is dangerous - rather like staring into the fire, where one can imagine all sorts of shapes and figures.

In spite of all the quantitative analysis, the CfA slice is best known for its 'soapsud' texture, where all the voids and under-dense regions seem to be isolated by walls of galaxies. Elsewhere, the picture is not necessarily so convincing; it may be that no void is truly isolated from its neighbours - hence more bath-sponge than soapsud! But whilst some of the voids are quite spherical - like a bubble blown in the cosmic tapestry - it seems to me that in general the voids are more often the intervening spaces between larger wall-like structures. There seem to be thin walls and thick walls - thick like the Great Wall which passes through the Coma cluster, and its southern counterpart on the other side of the sky. But not every cosmologist yet seems to be convinced that these structures exist, because much depends upon visual perception. If we are finally to decide what sort of cosmological scenario can explain these structures, we must eventually come up with a precise mathematical formulation which describes them.

For now, the visual perception aspect is still essential and is, for example, the approach favoured by the many N-body simulations. The human brain still possesses image recognition beyond the range of computer software. Truly, the beauty of the universe is in the eye of the beholder!

TONY FAIRALL,
University of Cape Town

Astronomy in Perú

In 1984 a contract was signed between the IAU and the National University of San Marcos, in Lima, inaugurating a Visiting Lecturers' Programme. Up to that time there had been no organised astronomy in Lima; even now there is only one professional astronomer in Perú - Dr.María Luisa Aguilar.

The first Visiting Lecturer was Jorge Sahade, who gave a course on general astronomy; more specialised courses were subsequently given on subjects ranging from stellar evolution to solar physics. A second course on solar physics was given in 1988 by J.I.de la Rosa of the National Observatory of San Marcos. It is hoped that the IAU will arrange further lectures. Meanwhile, various projects are being planned, notably the construction of an optical telescope in Lima, and visiting lecturers will be welcomed: anyone interested is asked to contact Rafael C. Reyes, PO Box 11-04811, Lima, Perú.

At least there were three Perúvian representatives at this General Assembly - Rafael Torres, Rafael Carlos and José Hisacaya, shown here at the end of the eventful journey described in No. 5 of *Cruz del Sur*!

COMMENT

Is anybody there?

We have been hearing a great deal about the possibility of finding extra-terrestrial intelligence. Commission 51 has even drafted guide-lines to be followed when the discovery of 'other life' is made. But are we sure that there is life anywhere in the universe, except on the Earth - and in any case, what exactly do we mean by 'life?'

And for that matter, why do there seem to be no civilisations within reasonable distance of us? The Vela satellites detected one iron atom coming into the Solar System - but I have calculated that we should be able to detect something the size of the star-ship *Enterprise* out to 100 light-years at least, so where are all the others? It would be ironical if we eventually found out, after all our speculations, that we are indeed alone in the vastness of the universe.

Remember that in science, things have to happen at least twice before they can be accepted. We have only one case of life: ours. True, we are too improbable to be improbable, so that it may be claimed that other life exists; on the other hand, we must have a second case before we can be even reasonably confident, though of course it is great fun to speculate, and it makes students sharpen their scientific skills. Until we have our second case, the odds for or against extraterrestrial life simply cannot be calculated

Next, we have to look more deeply into the question of what 'life' is. Here, the biologists are much more critical than the astronomers. Viruses, for example, could be ubiquitous, but that does not mean that we would necessarily be able to detect them elsewhere. Biologists, in general, regard the possibilities of higher forms of life elsewhere in the universe as lower than the astronomers believe, but they are too smart to give probabilities - they think that in the present state of our knowledge, this is impossible.

This does not mean that we should not go on searching, because it is always important to try to find solutions to scientific problems of this kind, but the chances of success may be much lower than many people believe. Moreover, it is true to say that a signature of life will probably be detected - if it exists! - in a form which is so totally bizarre that we might not even recognise it. This is a point which should be borne closely in mind by those who are searching for extra-terrestrial intelligence, so that they can guard against the danger of detecting it and then losing it.

Of course, we have been transmitting powerful radio signals for years now, so that if there are any intelligent beings within range of us they will know where we are. There is always a chance that we will receive a reply in, say, fifty to a hundred years, but we will have to be content with that possibility. In former times, astronomers usually knew that they would die before knowing the full results of their work; today, we want everything 'at once', and in this case we are unlikely to get it. I appreciate that I very often find myself in the minority with regard to these questions. I believe that the pendulum has started to swing into a middle position. But that point of view does not sell textbooks!

DAVID MEISEL SUNY, Geneseo, USA.

JOINT DISCUSSION VII

"First results from the Hubble Space Telescope"
Wednesday, 31 July
Rooms A + B, 0900-1730
C. Norman and D. Macchetto (Chairmen)

SESSION 1

"Scientific results and status of the scientific instruments - 1"
D. Macchetto, Introduction
B. Campbell & E. Shaya, WF/PC results
D. Macchetto, FOC status: jets from AGNs
N. Panagia, SN 1987A

SESSION 2

"Scientific results and status of the scientific instruments - 2"
P. Crane, Imaging of the binary pulsar PSR 1913+16
G. Meylan, Blue stragglers in 47 Tucanæ
J. Brandt, GHRS status: absorption lines in 3C 273
K. Carpenter, Chromospheres and winds of cool stars
A. Boggess, Circumstellar lines in Beta Pictoris

SESSION 3

"Scientific results and status of the scientific instruments - 3"
D. Leckrone, The Ap star Chi Lupi
S. Shore, Massive stars in the LMC
J. Linsky, Deuterium abundance in the local ISM
J. Dolan, HSP status
P. Hemenway & O. Franz, FGS status: binary star observations

SESSION 4

"HST science programmes and data analysis"
N. Walborn, The GO and GTO programmes
R. Hanisch, HST data reduction and analysis
M. Rosa, HST image reconstruction
"Future perspectives"
A. Boggess, The HST Servicing mission
"Summary"
C. Norman, Summary of the Joint Discussion

Tour programme

Local tours for Wednesday, July 31

10 a.m. (10:00)
Tour 5.11: Promenade along Avenida de Mayo

10.20 a.m. (10:20)
Tour 5.3: Isaac S. Blanco American and Spanish Art Museum

10.40 a.m. (10:40)
Tour 5.6: Fine Arts Museum

Tours depart from the San Martín Cultural Centre at the indicated times; badges are required.

See section 5 (pages 12 to 15 inclusive) of the Final Programme for more details. For more information on how to apply for a place on any tour, see also page 4 of issue No. 2 of *Cruz del Sur*.

Planetarium Shows

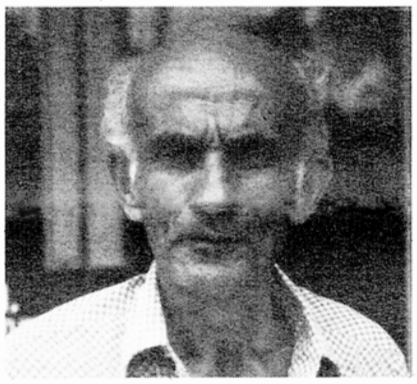
The following shows will take place tomorrow at the Galileo Galilei Planetarium in Palermo Park:
Wednesday, July 31
• **09.30 and 10.30** (6th and 7th grades) "The Universe"
• **11.30** (2nd and 5th grades) "The southern sky"
• **14.30 and 15.30** (6th and 7th grades) "The Universe"

Women in astronomy

On Tuesday, 30 July at 6.00 p.m. (18:00), in Room E, there will be a panel discussion on the topic: "Status of women in Astronomy"
Silvia Torres-Peimbert (Chairperson)
- Peter Boyce (USA)
- Sushma Mallik (India)
- Miriam Pastoriza (Brasil)
- Elena Terlevich (UK)

All IAU participants are invited

Jean Nicolini
1922 - 1991



A few days ago I was talking to the best-known amateur astronomer in Brazil: Jean Nicolini, of the Observatorio do Capricórnio - near the Tropic of Capricorn, at Sao Paulo in Brazil. Tragically, on Tuesday, 23 July, he lost his life in a car accident. All Latin-American astronomers, professional and amateur, are indeed sad.

He was born in Sao Paulo, and became interested in astronomy at an early age. He was an observer of the planets, and also made daily observations of the Sun for over forty years; he wrote books and articles, and above all made his telescope and observatory available to the public. In recent years he has been campaigning for the development of municipal observatories, to help in the popularisation of astronomy. He will be greatly missed.

JAIME RUBEN GARCIA, also representing:
Asociatión Argentina Amigos de la Astronomía,
Asociación Argentina de Aficionados a la Astronomía, Uruguay
Instituto Copérnico, Argentina.

Cartoon Corner!

A panel of humorous cartoons, drawn by some of the best and most famous Argentine humorists, and collected by Lic. Gerardo Milesi, is now on display in the San Martín Centre. It is situated on the landing half-way between the ground and first floors. From the entrance lobby, take the wide staircase to the left of the elevators, and ascend to the first landing. Don´t miss this excellent display!

Teaching astronomy
in the Asia-Pacific region

From March 1990, the Bulletin for the Teaching of Astronomy in the Asia-Pacific region will be published twice per year. We welcome papers related to the teaching of astronomy at all levels, from IAU members in all countries as well as those in the Asia-Pacific area. If you write to the editor, you will receive the bulletin without charge. Editor: Syuzo Isoke, National Astronomical Observatory, Mitaka, Tokyo, Japan.

Announcements

Commission 37 (Star Clusters and Associations) wishes to announce its sessions on Tuesday, 30 July, on the subject of "Ages and Abundances in Old Clusters", and on Wednesday, 31 July, on the subject of "Results of Investigations of Star Clusters". Speakers on Tuesday will include P. Demarque, M. Bessell, C. Pilachowski, and J. Hesser. The session will be held at 4:00 p.m. (16:00) in Room M. A schedule for the Wednesday session, at 9:00 a.m. (09:00) in Room F is posted on the Commission 37 bulletin board.

All remaining sessions of **Commission 48** (High-Energy Astrophysics) have been cancelled - i.e. 48.2, 3 , 4, 5 on Tuesday, 30 July and 48.6 on Wednesday, 31 July.

Comet Workshop

An International Workshop on Periodic Comets will be held in Montevideo, Uruguay from 5-7 August 1991. The aim of this workshop is to discuss dynamical as well as physical aspects of these bodies. Some of the topics we plan to deal with are: possible source regions of periodic comets (e.g. Oort Cloud, Kuiper Belt), orbital evolution of the Jupiter family of comets, non-gravitational forces, visual and infra-red observations, physics and chemistry of the nucleus and coma, and properties of cometary dust.

JULIO A. FERNANDEZ
Departamento de Astronomía,
Montevideo, Uruguay
(Mailbox 5315, San Martín Centre)

Meeting programmes

IAU Commission 28: Galaxies
(with Commissions 29 and 35)
Tuesday, 30 July
Room C, 0900-1730
"Early nucleosynthesis in galaxies"

SESSION 1

P. Conti, Early nucleosynthesis: nature of the problem
D. Lambert, Population II stars: CNO abundances and light metals
C. Pilaichowski, Abundances in old clusters

SESSION 2

M. Bessell, Stellar composition in the Magellanic Clouds
J. Bergeron, Abundances in absorption line systems towards QSOs

SESSION 3

B. Pagel, Helium and metal abundances in H.II regions
A. Maeder, Helium and metal synthesis in massive stars at low Z

SESSION 4

F. Thielemann, SN and chemical synthesis for metal-poor stars
M. Grenon, The sites of nucleosynthesis: halo and bulge
F. Matteucci, Chemical evolution in the early Galaxy

IAU Commission 51: Bioastronomy: Search for Extraterrestrial Life
Tuesday, 30 July
Room D, 14.00-1730
Fernando Colomb (Chairman)

SESSION 3

"Search for life in the Solar System and beyond"
L.R. Doyle *et al.*, Astrophysical and planetary constraints on exobiological habitats
M.D. Papagiannis, A search for a tritium line radio source near the plane of the ecliptic may reveal the presence of an alien observing station in our Solar System
J. Heidmann, Nançay radio telescope involvement in SETI
G. Swarup, Prospects for SETI in India

SESSION 4

"Search for technology beyond the Solar System"
F.R. Colomb, SETI activities in Argentina
S. Bowyer *et al.*, The Berkeley SETI programme: recent results on progress on SERENDIP III
K. Cullers, Targeted search signal detection from theory to practice
S. Gulkis *et al.*, Status of the NASA SETI sky survey observing project
J. Whiteoak, SETI activities in Australia: recent observations with the Parkes radio telescope

Do you want your picture taken?

As he has received many requests for group photographs from delegates here at the General Assembly, the official photographer Fabián Yahbes is willing to take any photographs required until midday on Wednesday, 31 July.

Pictures that have been taken during Commission meetings in rooms of the La Plaza complex must be collected from the photographer´s stand in the San Martín Centre. You will find Fabian Yahbes in the hall of Room C from 0900-1730 every day.

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • **Associate Editor:** *JOHN MASON*

NO. 9 : WEDNESDAY, 31 JULY

New results from adaptive optics

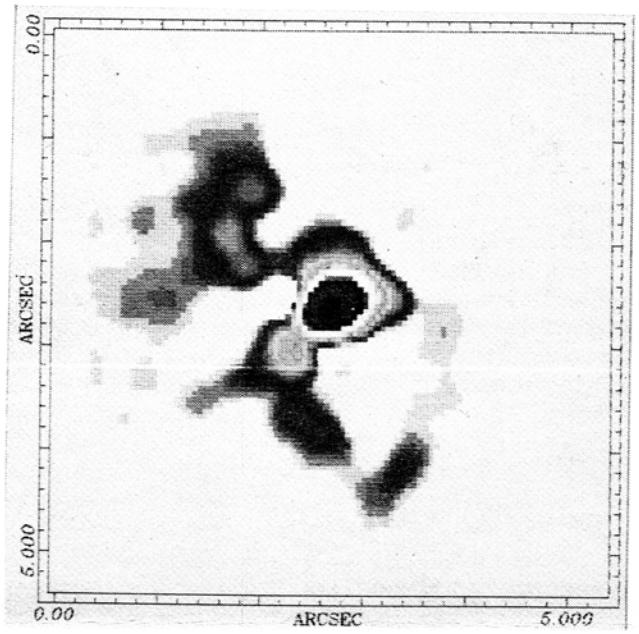
An adaptive optics system called COME-ON has now been operated five times on the ESO 3.6-metre telescope at La Silla, Chile. This system, with a 19-actuator deformable mirror and a Shack-Hartmann sensor to measure the wavefront, allows diffraction-limited imaging in the near infra-red for wavelengths of 2.2 microns and longer.

The system has twice been used by visiting astronomers, and the first results will soon be ready for publication, dealing with extended objects such as Eta Carinæ and NGC 1068, as well as Solar System objects such as asteroids and the Galilean satellites of Jupiter.

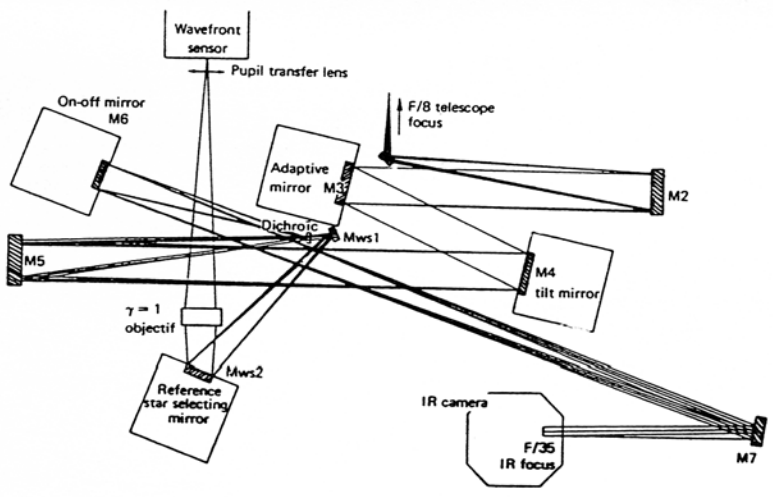
The system is currently being upgraded with a mirror having 52 actuators, an electron-bombarded CCD (EBCCD) as a photon noise limited detector for the wavefront sensing, and an improved control system giving a bandwidth of 35 Hz. This modification will allow diffraction-limited imaging from 1.6 microns upwards. With the new, improved sensor, the limiting magnitude will be improved from 13 to 14 for the visible reference sources, and for the full correction of atmospheric disturbances.

This system is the final prototype for the ESO-VLT adaptive optics systems - which will allow the same degree of correction for the four 8-metre telescopes, an essential feature for the interferometric operation of the VLT.

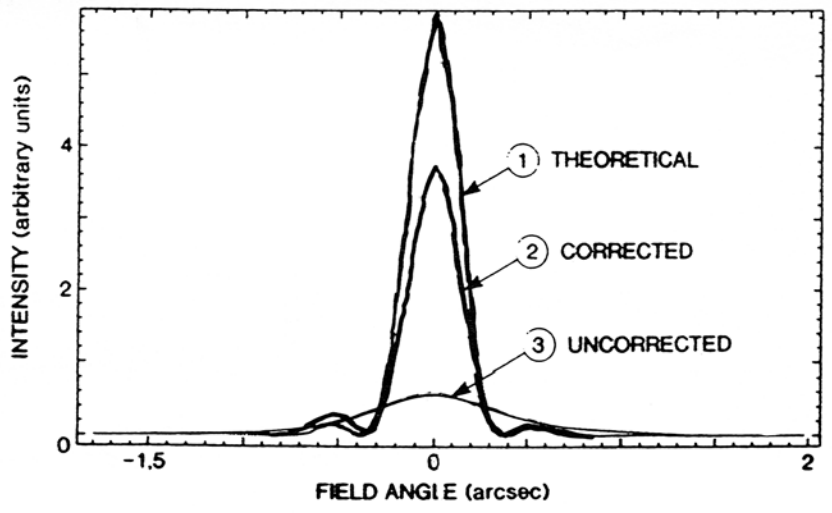
FRITZ MERTLE
European Southern Observatory



Right: An L-band/deconvolved mosaic image of Eta Carinæ obtained with the COME-ON adaptive optics system on the ESO 3.6-metre telescope at La Silla, Chile.



Schematic diagram of the prototype adaptive optical system, with a 19-actuator deformable mirror.



Cross-sections of K-band images. Curve 1: theoretical diffraction profile. Curve 2: profile with correction. Curve 3: profile without correction.

IAU Marathon runner

On Sunday, 28 July, one participant at the General Assembly - Roberto Viotti - decided to take part in the Third Buenos Aires Half-Marathon. Therefore, he eagerly joined the thousands of runners at the starting-point. Since he had had no time for training (because of the many interesting sessions at the General Assembly), it cannot be said that his finishing time was outstanding - but let us give him full marks for carrying the IAU flag!

Asteroid 5000 named for IAU

There are at present 4877 asteroids with permanent numbers, and most of them have names. As the 5000th discovery approached, Commission 20 (Positions and Motions of Minor Planets, Comets and Satellites) arranged among its members a competition to decide upon the name for this object. At a ceremony following the meeting of Commission 20 on Wednesday, 24 July, the ballots, previously received from the members by mail, were opened. Of the candidates which had previously been selected, the name IAU was the winner - by a small margin. Runners-up were Hipparch, Ptolemæus and Pascal. Since "IAU" is not a pronounceable word (in English, at any rate), the rule that names should be pronounceable was waived in this case. Of course, nothing is known about the orbit or the size of (5000) IAU, or even who discovered it. The Minor Planet Centre expects that the number 5000 will actually be assigned to an object next November.

BRIAN G. MARSDEN Central Bureau for Astronomical Telegrams

IMPORTANT NOTICE

There is some confusion about the time of the Closing General Assembly on Thursday, August 1.

The Closing General Assembly will begin at 10.00 a.m. (10:00 hours.)

Double star speckle interferometry

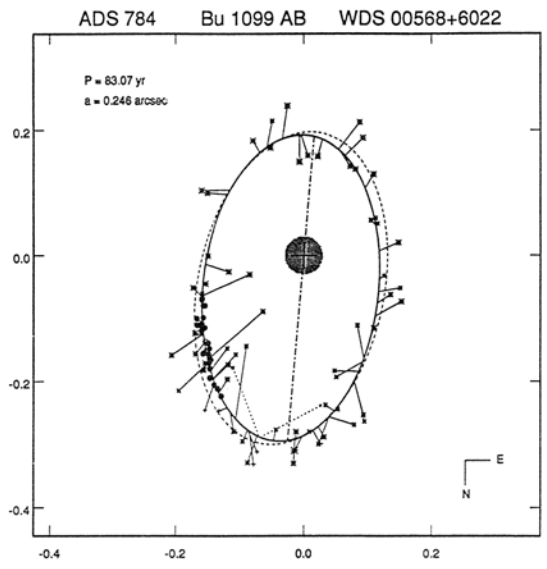
In 1970, the French astronomer Antoine Labeyrie announced the discovery of a simple method of overcoming image blurring from atmospheric turbulence. In the following two decades, speckle methods have been extended to the imaging of complex objects in the optical and the infra-red, but perhaps no field of research has benefited more from speckle efforts than that of double and multiple stars.

In this field, speckle interferometry brings dual enhancements of resolution and accuracy. With a 4-metre telescope, the diffraction-limited resolution of 30 milli-arc seconds is attained as a matter of routine, as well as an order of magnitude increase in accuracy over standard micrometer measurements. The upper limit in separation for speckle is set by the isoplanatic angle, as well as practical considerations, to about 3 arc sec. This gives access to thousands of binaries - more than enough to keep the few active groups busy.

Activities of the Georgia State University speckle group, established by the author in 1977, were reported in the scientific session of Commission 26 (Double & Multiple Stars) on Friday, 26 July. Joining the author in this work are William Hartkopf and William Bagnuolo of Georgia State University, and Otto Franz of the Lowell Observatory.

The GSU programme uses its own speckle camera system, based upon an intensified CCD camera which is read out at video rates, on the Kitt Peak 4-metre telescope. Started in 1975, this is the only one out of several speckle groups which sprang up after Labeyrie's announcement to maintain a double star programme. Some 13 000 measurements of more than 4000 systems, including 250 systems which have never before been resolved, have been published by this group. This represents about 85 per cent of all speckle data on double stars. An important achievement with speckle has been the resolution of a number of spectroscopic binaries, enabling mass and distance determinations to be made without the need for a trigonometrical parallax measurement.

Speckle interferometry has evolved from film cameras, from which some spectra were obtained by passing laser light through speckle images, to real-time digital processing of images captured by solid-state cameras. Inexpensive but fast pc's and frame-grabber boards have greatly reduced the cost and data-handling problems of speckle interferometry. For example, on a typical night on Kitt Peak, the GSU speckle camera will observe some 200 stars, recording 1800 pictures, each 256 x 256 pixels x 8-bits per pixel, of each system. This would be an overwhelming data-rate without fast hardware and algorithms. The analysis for angular separation and position angle is now being extended to differential photometry as well. This gives the exciting prospect of accurately measuring the magnitudes and colours of the individual components of double stars.



Speckle measures for the visual binary ADS 784 are shown as filled circles and plotted along with visual measures (as asterisks). An improved orbit (solid curve) is shown along with an existing one (dotted curve).

In 1988, the GSU programme was extended to the southern sky by twice-yearly trips to the 4-metre telescope at Cerro Tololo. The southern skies have been badly neglected for several decades, while their double stars continued in their orbital motions largely unobserved! It is hoped to continue this all-sky effort indefinitely, giving equal emphasis to both hemispheres.

A particularly significant event occurred in 1990, when Charles Worley and Geoffrey Douglas, of the US Naval Observatory, inaugurated a new programme of double-star interferometry, using a camera and data system based upon the GSU instrumentation. Worley's long-term visual micrometer programme has thus been extended to speckle observations at the USNO's 26-inch refractor in Washington, and in a presentation to Commission 26 Worley has reported that over a thousand measurements have already been made. With the adoption of this method by one of the world's leading observers of double stars, speckle interferometry can now be regarded as one of the standard techniques of observational astronomy.

HAROLD McALISTER,
Georgia State University, USA.

Automated photometry?

Joint Commision Meeting II was organised on the morning of Thursday, 25 July, to examine the problem of whether photometry could be automated. While at first sight seeming to be a natural extension of the increasing degree of robotisation throughout organised human activities of routine type, a number of cautionary tales coming from the last few years of experience with automatic photometric telescopes (APTs) were presented. These ranged from the simple "Murphy's Law" type breakdown of control cards at the vital moment, to more subtle problems connected with the limitations of computers - i.e. that they do exactly what the programmer tells them, such as observing stars which, even if above the horizon, are too close to it to be reliably observed. (In case some of our readers are unfamiliar with Murphy´s Law, it states, broadly, that if things **can** go wrong, they **do**!)

On the other hand, some of the more subtle problems which inevitably influence efforts to take the precision of astronomical photometry reliably beyond a one per cent accuracy level, could probably be better tackled by the greater inherent efficiency of retrieved data associated with APTs. One such point was raised by Andrew Young. He demonstrated the unexpected result that, due to their very complicated absorption-feature dominated spectra, the flux gradient over the wavelength range of the Johnson B filter for M stars actually decreases with wavelength, so that the standard linear calibration theory should not be applied to these stars. A better procedure would be empirically based, involving more filters on either side of Standard B. For this kind of dull and time-consuming job, which is nevertheless essential for milli-magnitude accuracy, APTs are a real step forward.

EDWIN BUDDING
Carter Observatory, New Zealand

Joint Discussion VII

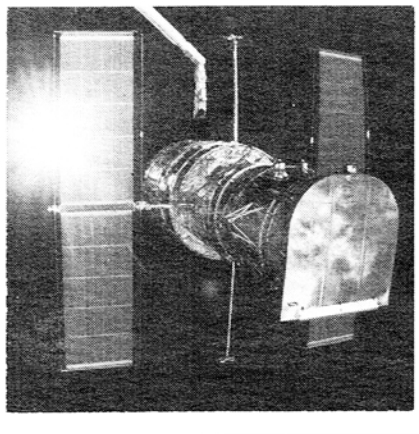
"First results from the Hubble Space Telescope"

Wednesday, 31 July, Rooms A+B, 09:00-17:30

The Hubble Space Telescope (HST) was launched in April 1990. Today´s Joint Discussion will comprise an all-day presentation of scientific results from HST, by representatives of the instrument teams. They will present the latest HST observations of Solar System, stellar, and extragalactic objects. Among the highlights will be video presentations of images of Jupiter and Saturn; high-resolution imagery of star clusters; SN 1987A; galactic nuclei and gravitational lenses; and ultra-violet spectroscopy of stars, AGNs and quasars.

There will be a description of the scientific programme planned for HST for the next few years, a review of the exciting plans for repairing HST during an upcoming mission with the space shuttle, and discussions of the improvements which can be expected from the second-generation scientific instruments.

In spite of the spherical aberration of HST's primary mirror, discovered shortly after launch, the Joint Discussion will make it abundantly clear that HST retains imaging and spectroscopic capabilities unmatched by any ground-based telescope. The Scientific Organising Committee for Joint Discussion VII is co-chaired by D. Maccheto and C. Norman, and its members are H. Bond, A. Boyarchuk, A. Davidsen, R. Giacconi and G. Miley.



Interstellar matter in early-type galaxies

A catalogue has recently been published of the interstellar content of all galaxies of types E, S0, or Sa, including peculiar and intermediate types listed in the *Revised Shapley-Ames Catalogue*. Values of H.I molecular hydrogen (from CO measurements), dust (from IRAS), optical emission-line gas, X-ray emitting gas, and radio continuum emission are given.

An analysis of this data base by Joel Bregman, David Hogg and Morton Roberts finds a variety of systematic trends. In elliptical galaxies the interstellar matter (ISM) is dominated by a hot gaseous component; in Sa's, cold ISM accounts for most of the gaseous mass; S0 galaxies are intermediate, with similar amounts of hot and cold material. Normalised by the optical luminosity, the atomic and molecular hydrogen masses decrease so sharply from Sa to E type galaxies that almost no (*Revised Shapley-Ames*) elliptical galaxies have detectable gas of this form. A similar but considerably less dramatic gradient is present between the normalised dust mass and galaxy type: A close relationship exists between the CO and IRAS 100 f fluxes.

In contrast to the cold interstellar components, the normalised X-ray emission is independent of galaxy type in E through S0/Sa systems, while the Sa's are slightly X-ray poor. The overall picture that emerges is one in which the cold gas is a disk phenomenon while the hot gas is a bulge phenomenon, with little interaction between the two. Progression of galaxy type E-S0-Sa is not only a sequence of decreasing stellar bulge to disk ratio, but also of hot to cold gas ratio.

MORTON S. ROBERTS
National Radio Astronomy Observatory, USA

Observatories under the Southern Cross:

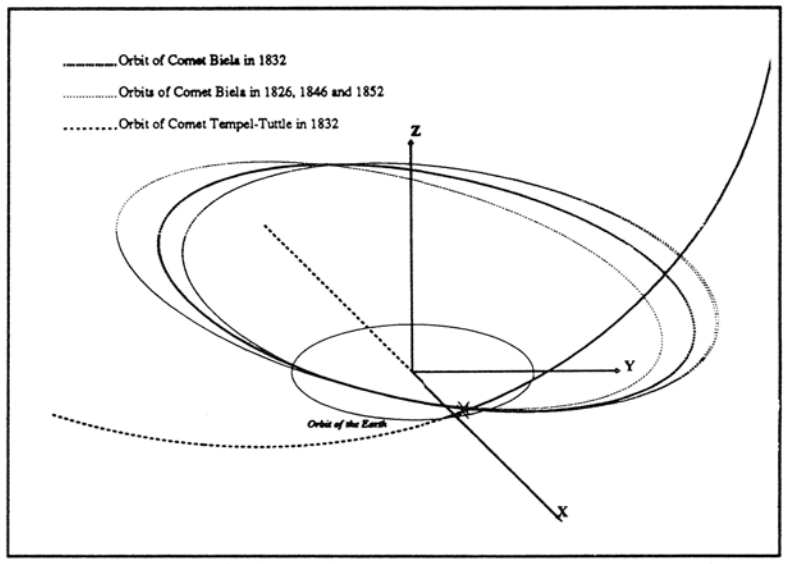
Instituto de Astronomía y Física del Espacio (IAFE)

The Instituto de Astronomía y Física del Espacio (Institute of Astronomy and Space Physics) dates back to 1969, when it was formed by the National Council of Scientific and Technical Research (CONICET). Since the 1960s, it has been located at the campus of the University of Buenos Aires, in Nuñez, Buenos Aires.

The earliest research was in connection with the ground-based observations of secondary cosmic radiation, and its variations dependent upon solar activity. During the International Geophysicial Year (1957-8) the research group set up a country-wide network of cosmic-ray observatories, equipped with neutron detectors and meson telescopes. Balloon-borne instruments to study X-rays and gamma-rays were developed, as well as a far infra-red telescope; some rocket experiments were also carried out.

The present staff is made up of about 20 researchers, together with 15 graduate students. Current subjects for research include space and cosmic plasma physics; very high-energy astrophysics; stellar evolution; models of peculiar stars; supernova remnants, and solar physics. Use will also be made of the SAC-B satellite -the first to be built in Argentina. It is a co-operative project with NASA, and includes equipment to study X-rays and gamma-rays. SAC-B is due to be launched from a Pegasus rocket in 1994.

Comet Biela and the Leonids



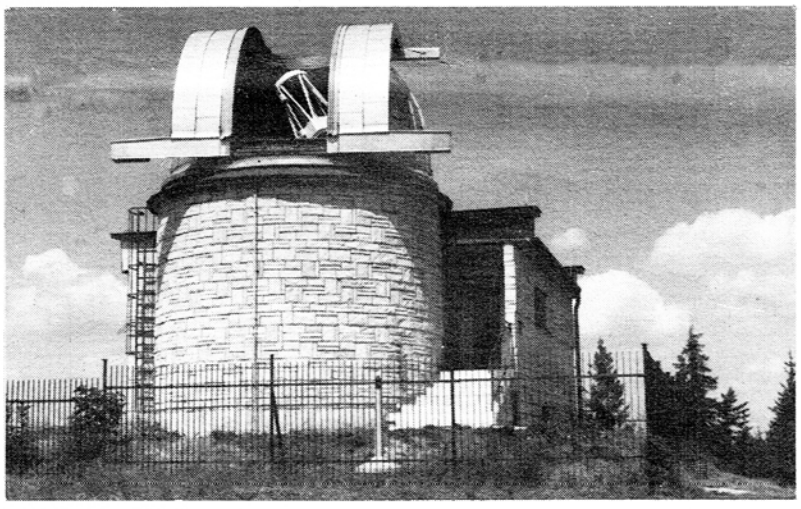
The spectacular displays of the Leonid meteors in 1799 and 1833, and the splitting of Comet P/Biela some time between its returns of 1832 and 1846, are generally held to be the two events responsible for the acceptance of the association between meteoroid streams and comets. Surprisingly, however, this historic connection is not the only commonality between the two. In 1832 - as shown in the accompanying diagram - Comet Biela appears to have actually passed through the most populous part of the Leonid meteoroid swarm!

IWAN WILLIAMS, PULAT BABADZHANOV, DAVID HUGHES, and ZIDIAN WU

The Mount Suhora Observatory

Poland's newest observatory, at Mount Suhora, was set up in 1987 in the Gorce Mountains, 1000 metres above sea-level and 70 km from Cracow. The main telescope is an 0.6-metre Cassegrain, used with a double-beam photometer and a CCD. Variable and binary stars are the main subjects of research.

J.M. KREINER, G. PAJDOSZ & S. ZOLA Pedagogical University, Poland



Astronomical Acronyms

Even a brief glance at astronomical literature shows the difficulties encountered by astronomers struggling to create new acronyms and decipher existing ones. The Commission 5 Working Group on Designations has therefore made some suggestions which may help.

1. Ambiguous abbreviations. - CS is a case in point. It may mean either carbon monosulphide, circumstellar, carbon star or central star.

2. Electronic access to avoid errors. - The *Dictionary of the Nomenclature of Celestial Objects* (A & AS **52**, 4, 1983) is now on-line within the Set of Identifiers for Measurements and Bibliography of Astronomical Data. Come and see the SIMBAD demonstration in the Orange Room!

3. Do's and Don'ts for new designations. - Consult the IAU-approved "Specifications concerning names, designations and nomenclature for astronomical radiation sources outside the Solar System" (PASP Dec. 1990, May 1991 supplement to A & A, and A.J. for July 1991.)

4. Confusion in co-ordinates. - Follow the "Specifications" guidelines for new designations involving co-ordinates. Use the prefixes G for galactic co-ordinates, B for Besselian 1950 equatorial co-ordinates, and J for Julian 2000 co-ordinates. Fictitious example: WGFIVE J203246+023356.

5. Take care! - When devising designations, dial the Clearing House and ask for advice. (Details are given at the end of the "Specifications" document.) You may also contact the Chairman of the Commission 5 Working Group on Designations.

6. Archiving and access will be discussed at Joint Commission Meeting VIII, ´Archiving of current observational data´, on Wednesday, 31 July.

F. SPITE (Mailbox 468) and
H. *DICKEL* (Mailbox 5638)
Commission 5 Working Group on Designations

COMMENT *Education in Astronomy*

The IAU is primarily an association of research astronomers, meeting to promote astronomical research and to plan international co-operation. Part of the international co-operation is to assist members with limited resources to join in front-line research away from home, either by attending conferences or, occasionally, by spending some time in a host observatory. Commission 38 has given twenty-five travel grants for this purpose since the last General Assembly. The IAU has had little difficulty in persuading member countries that part of their financial contributions may properly be used in this way.

A more contentious area of IAU activity and expenditure is directed towards education in astronomy in countries where there is little or no effective astronomical research. The intention is to encourage the teaching of astronomy, especially at a level which might produce young research astronomers. Commission 46 has had some success in this, through the Visiting Lecturer Programme and the International Schools for Young Astronomers. These programmes are, however, necessarily very limited in scope, and the IAU has to decide whether to continue providing finance for them.

Personally, I hope that the IAU will direct its efforts toward international organisations such as UNESCO, and toward the national adhering organisations, persuading them of the value of including astronomy as a part of education at all levels, from primary school to graduate research. It is the hard truth that we cannot ourselves have any significant impact on the world-wide need for education by sending our own astronomers out to teach. But we could, and should, make the case for astronomy in education on every possible occasion, both nationally and internationally.

Our practical programmes could then be in response to the needs of any organisation that is persuaded by our case. Rather than take on the burden of educating the world, we could demonstrate the way in which it should be done, perferably without adding to the financial burdens of the IAU.

F. GRAHAM-SMITH
University of Manchester, UK

SIMBAD demonstration

If you would like to find out any information about your favourite astronomical object, you can ask the database ´SIMBAD´. Continuous demonstrations are being given at the SIMBAD booth in the Orange Room, from 0900-1800, daily.

New Solar System names

Further names have been proposed by the IAU WGPSN. Since they have yet to be ratified, they must still be regarded as provisional, but their acceptance, unchanged, is very probable.

Saturn´s satellite 1981 S13 is now number XVIII, named Pan. Numbers have been given to the newly-discovered satellites of Neptune: III (Naiad), IV (Thalassa), V (Despina), VI (Galatea), VII (Larissa), and VIII (Proteus).

The rings of Neptune have also been given names. Ring 1989 N3R, at 41 900 km from the centre of the planet, is now called the Galle ring. Ring 1989 N2R, at 62 900 km, is Leverrier, and ring 1989 N1R, also at 62 900 km, is Adams.

PATRICK MOORE

Help needed!

The Perth Observatory in Australia, founded in 1894, is facing closure because of the lack of equipment and a drastic cut-back in funds. Unless action is taken, it may close by 1996. All those who feel able to give any kind of support are asked to contact the Director, Dr. Michael Candy, Perth Observatory, Walnut Road, Bickley, Western Australia 6076.

Planetarium Shows

The following shows will take place tomorrow and the day after at the Galileo Galilei Planetarium in Palermo Park:

Thursday, August 1
-09.30, 10.30, 11.30, 13.30, 14.30 and 15.30 (pre-school and 1st grade): "Travelling with Patatin"

Friday, August 2
-09.30 and 10.30 (4th and 5th grades): "The Sun and his sisters"
-11.30 (5th, secondary school): "The Universe from beginning to end"
-13.30 (5th, secondary school): "The Universe from beginning to end"
-14.30 and 15.30 (4th and 5th grades): "The Sun and his sisters"

An invitation

The General Director of the San Martín Cultural Centre, Sr. Alberto Fernández De Rosa, has pleasure in inviting all General Assembly participants to the Exhibition of ´Space Art´ by the Argentine artist Ana Kozel. The Exhibition is in Halls II and III, and will be open every day until Sunday, 4 August from 12 noon until 8 p.m. (12:00 to 20:00 hours).

Acknowledgement

The Local Organising Committee of the 21st IAU General Assembly wishes to express its gratitude to the well-known Argentine humorists Caloi, Crist, Fontanarrosa, Quino and Sendra for their invaluable collaboration in providing us with their best series of cartoons free of charge.

More presidents!

P.K. Seidelmann, President of Commission 4, informs us that Commission 4 beats Commission 35 on the number of Presidents here. They are:
J. Kovalovsky (1970), G.A. Wilkins (1973), V.K. Abalakin (1979), B. Morando (1988), P.K. Seidelmann (Current President), B.D. Yallop (Future President, H. Kinoshita (Vice-President, incoming)

Commission 42 (Close Binary Stars) has the following Presidents here: F.B. Wood (2 terms), T. Herczeg, J. Smak, A.H. Batten, R.H. Koch (outgoing), and Y. Kondo (incoming). M. Rodono (incoming Vice-President) is also here.

Working Group on "Archival and data bases for radio astronomy"

The poor archival status of radio source data (see also *Cruz del Sur*, No.5, page 2) motivated eighteen radio astronomers to discuss this issue, at an informal meeting on 25 July, chaired by myself. Consensus was reached that a new Working Group on "Archival and Data Bases for Radio Astronomy" should be formed, in order to:
(I) align ongoing efforts in source cataloguing,
(2) discuss the architecture of an all-encompassing source data base,
(3) motivate radio astronomers to contribute published source lists.

Candidate names of WG members are displayed on the Commission 40 (Radio Astronomy) board at the San Martín Centre, and further volunteers will be welcomed, preferably before the formal proposal of the WG during the Commission 40 business meeting to be held on 31 July, Session 4, in Room P.

HEINZ ANDERNACH, Mailbox 5170 at the San Martín Centre
E-mail HJA @IAC.DNET.NASA.GOV

An IAU Choir?

We intend to present a short performance of choral works at the end of the next General Assembly, in l994. Are you interested in joining this choir? If so, please leave your name and E-mail in Mailbox 771.

CHRISTIAN VEILLET E-mail VEILLET @FRONIS1

Cloudy mirrors
A request for information

Our telescope at the University of Western Ontario is 22 years old, and the primary mirror has developed "cloudy" areas in the aluminium coating. The cloudy areas have grown rapidly in the last three years.

We are seeking the cause and solution to the problem. If you have any information, please contact us at the Department of Astronomy, University of Western Ontario, London N6A 3K7, Ontario, Canada.

DAVID F. GRAY

Thank you!

F&M *Servicios de Comunicación en Ciencia Cultura y Sociedad* (who have been in charge of the IAU Press Office throughout the General Assembly, and have provided journalistic assistance to *Cruz del Sur*), and **GRAFIKAR** *Ideas Impresas* (who have been responsible for the layout and printing of the daily newspaper) would like to express their gratitude for the opportunity they have been given to share with Drs. Patrick Moore and John Mason, from England, and the Argentine astronomers involved, the experience of communicating the results of such an important scientific event to the astronomical community and mass media.

SNe Working Group Meeting
Wednesday 3l July,
Room D, 1400-1730

SESSIONS 3 and 4

"SN1987A Update"
N.B. Suntzeff, Bolometric light-curves
P. Bouchet, ESO observations: dust and line luminosities in the later phases
W.P. Meikle, IR spectroscopy
T.P. Stecher, Astro-1 resulis
N.Panagia, Résumé of HST results

"Current status of our understanding of SNe"
M.M. Phillips, Optical spectra
G. Dubner, VLA observations of SNe
J. Maza, SN searches and results
S. Van den Bergh, Rates, distribution
J.C. Wheeler, Theoretical spectra
N.N. Chugai, SNe II ejecta phenomena

Meeting programmes

IAU Commission 21:
Light of the Night Sky
Wednesday, 31 July
Room M, 1100-1230
"Interplanetary component of the light of the night sky"
H.Tanabe (Chairman)

SESSION 2

A.C. Levasseur-Regourd, T.B. Renard and R. Dumont, From line of sight observations to local properties of interplanetary dust
M.S. Hanner, Future studies of the Zodiacal Light; unsolved problems and future observations
K. Lumme and K. Muinonen, Light scattering by aggregates of spheres
C. Cesarsky, ISO, the infra-red space observatory

IAU Commission 27:
Variable Stars
Wednesday, 31 July
Room E, 1400-1730
"The rôle of rotation in stellar variability"

SESSION 3

"Stellar Pulsation" (John Percy, Chairman)
W. Dappen, Helioseismological diagnosis of the Sun's internal rotation
D.W. Kurtz, Rotational modulation of pulsational amplitude in rapidly-oscillating Ap stars
D. Baade, Observations of rotation and pulsation in OB stars

SESSION 4

"Activity in stars" (Marcello Rodono, Chairman)
L. Mestel, Angular momentum evolution and magnetic braking
L. Paterno, Rotation as an activity parameter
S. Catalano, Rotation and observed activity

IAU Commission 10/12, with Commissions 40, 48 & 49
Plasma Astrophysics Commission
Meeting on
"Non-linear and turbulent processes in solar and astrophysical plasmas"
Wednesday, 31 July
Room H, 0900-1730

SESSION 1

D. Melrose, Radio emission processes in astrophysics
T.G. Forbes, Reconnection processes in astrophysical plasmas

SESSION 2

B. Buti, Chaos in magnetoplasmas
M. Goldman, Strong Langmuir turbulence in the lower solar corona and other magnetised plasmas

SESSION 3

S. Inagaki, Gravitational clustering of galaxies
J. Cary, Stochastic acceleration and diffusion in a turbulent plasma

SESSION 4

S.R. Spangler, Interstellar plasma turbulence - observations and theory
B.T. Tsurutani, Cometary plasma waves and turbulence - observations

Cruz del Sur

XXIst IAU GENERAL ASSEMBLY • BUENOS AIRES 1991

Editor: *PATRICK MOORE* • Associate Editor: *JOHN MASON*

NO. 10 : THURSDAY, 1 AUGUST

Our new President

All Presidents of the IAU have been distinguished astronomers - and, surely, none more so than Alexander Boyarchuk, of the Soviet Union, who will lead us for the next three years.

Alexander Boyarchuk's main work has been on stellar atmospheres and non-stable stars, together with ultra-violet observations carried out from satellites. He has written more than a hundred and fifty scientific papers, as well as co-authoring several books, and has made outstanding contributions to astrophysical problems.

He graduated from the University of Leningrad in 1953, and then went to the Crimean Astrophysical Observatory, in 1956, to complete his PhD; the subject of his thesis was "The Spectroscopic Investigation of Be Stars". He then went to Pulkovo Observatory, where he completed his doctoral examination with his thesis on "Symbiotic Stars". For the following years he worked at Crimea, and it was not until 1987 that he moved to Moscow to join the Astronomical Council, which is now called the Institute of Astronomy.

He has received many honours during his career, and has served his science in many capacities. He is, of course, a member of the Academy of Sciences of the USSR, and President of both its Ground-based Astronomy and Space Astronomy Commissions. He is now Director of the Institute of Astronomy, and Professor at the University of Moscow; he edits the *Astronomical Journal of the USSR*, and makes many contributions to it.

He is not the only astronomer in the Boyarchuk family! His wife, Margarita, is herself a member of the IAU, and is a specialist in studies of stellar atmospheres; their son, Kirill, is a physicist working in Moscow.

Alexander Boyarchuk's election as President is a very wise step. We could not have a better leader in what are bound to be very crucial years for astronomical science.

A year of Hubble

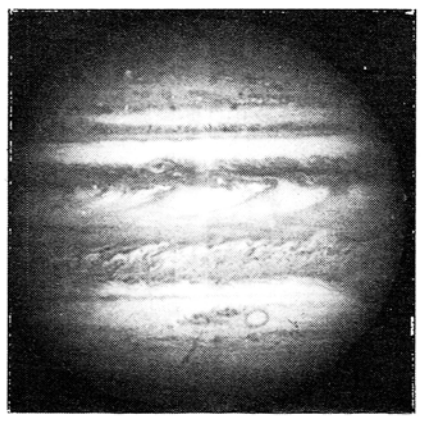
The Hubble Space Telescope (HST) has now been in operation for over a year. Despite the fault in the main mirror, it can still outperform any ground-based telescope in many ways, and all the other problems with it are relatively minor. For example, the pointing accuracy has now been improved to a level where most target acquisitions are successful.

Magnificient images of the planets have been obtained. Mars shows a mass of detail; Saturn's great white spot was photographed when at its very best, and the images of Pluto and Charon were far better than any previously obtained, while the best view of Jupiter is as sharp as a Voyager picture taken only five days before the space-craft's closest approach in 1979. At the moment, no planet apart from Venus is being monitored from space, so that HST reigns supreme.

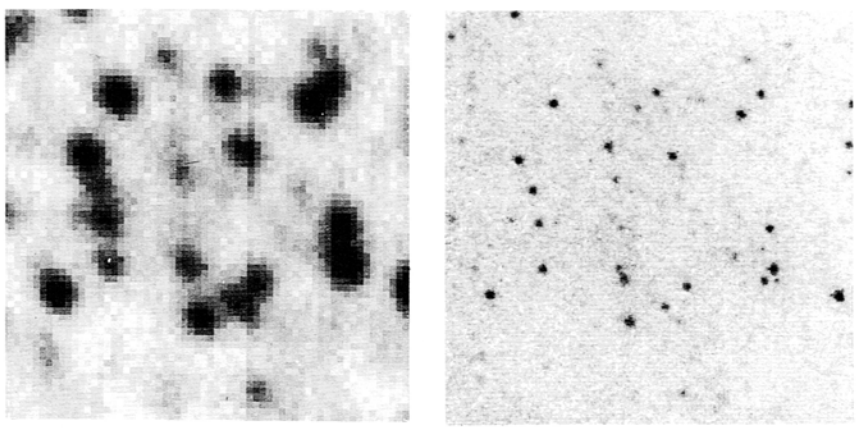
Of special interest are the pictures obtained of Supernova 1987A, which flared up in the Large Cloud of Magellan in February 1987. The precursor star was a blue supergiant which produced a stellar wind, compressing the hydrogen shell into a well-defined ring. During the outburst, an outward blast of radiation ionised and heated the ring, which appears elliptical because it is inclined along the line of sight. The HST picture brings this out far more vividly than any Earth-based telescope can do. Look, too, at the picture of the Einstein Cross, the multiple image of a remote quasar due to the gravitational lensing effect of an intervening galaxy. The very sharp HST images provide astronomers with the means of making measurements more precise than has ever been possible before.

Perhaps the power of the telescope can be best illustrated by comparing HST and ground-based pictures of a crowded region, the centre of the globular cluster 47 Tucanæ. The apertures of the telescopes concerned are almost the same, but the great superiority of the HST image is obvious.

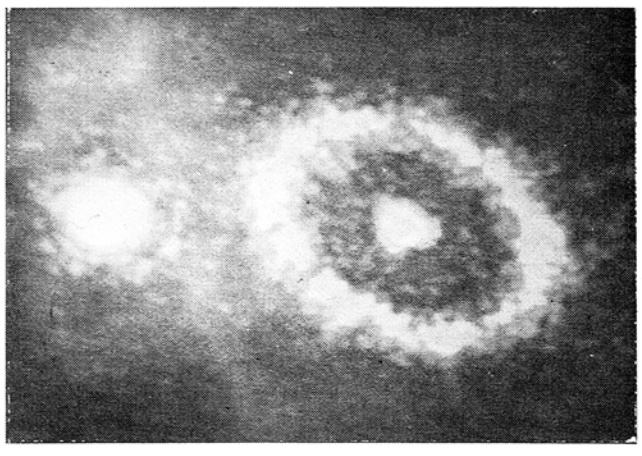
Even in its present imperfect state, the HST is producing superb results; when the planned modifications are made, it will no doubt realise its full potential.



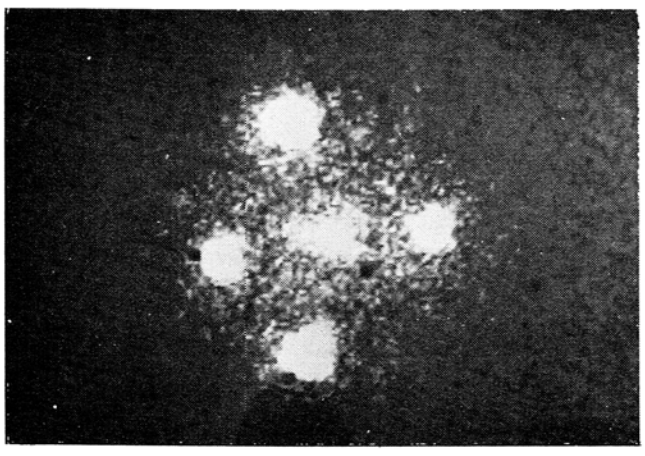
Right: This image of Jupiter, taken in green light by the WF/PC on the HST, shows a wealth of fine detail in the clouds that cover the planet. The Great Red Spot is seen at lower right. On the right, near the equator, the satellite Europa is just disappearing behind the planet's limb.



The high resolving power of the HST is clearly illustrated here by comparing one ground-based and one HST image of the core of the globular cluster 47 Tucanæ. **Left:** A 15" x 15" portion of a CCD frame obtained with the ESO 2.2-metre telescope at La Silla, Chile; exposure time is 2 seconds through a B filter, seeing 0".8 FWHM. North to the top, east to the left. **Right:** The same area, from an HST image taken in UV at 200 nm, with the f/36 mode of the Faint Object Camera. Exposure time is 39 minutes. The sharp cores of the stars are about 0".07 FWHM. North to the top, east to the left.



An image of the gaseous ring around the supernova 1987A, acquired by the Faint Object Camera of the HST on 23-24 August 1990.



The gravitational lens G2237+0305, known as the "Einstein Cross", captured by the Faint Object Camera of the HST.

Newly-recognised dwarf carbon stars

It is widely accepted that carbon stars are giants, whose atmospheres have been enriched by products of nuclear burning within their interiors. However, in 1977 Dahn *et al* announced the discovery of the carbon nature of G 77-6l, and found it to have M_v = +10, placing it 1 to 2 magnitudes below the main sequence at T≈4100K. In the ensuing fourteen years no more members of this interesting class were announced, but the situation changed drastically last month, when three more were found. Working independently at first, Bruce Margon and his student Paul Green, of the University of Washington, and D. Jack MacConnell of the Computer Science Corporation at the Space Telescope Science Institute, found that the proper-motion stars LP 328-57 and LHS 2075 are identical to the faint, high-latitude carbon stars CLS96 (Sanduleak and Pesch, Ap.JS. **66**, 387, 1988) and C22 (Bothun et al, A.J. **101**, 2220, 1991) respectively. MacConnell used the digital scans done for the HST Guide Star Catalogue and those done for the original Palomar Sky Survey to prove that these carbon stars had indeed moved, and confirmed Luyten's proper motions. A peculiarity in the JHK colour of these two stars, G 77-61 and another in the CLS list, No.31, led Margon and Green to suggest that this also be measured for proper motion. With an epoch difference of 30.7 years, this star was found to have moved nearly 4 arc sec, thus making it a new member of the group.

Such stars are expected to be in binary systems, where the original primary dumped its carbon-enriched atmosphere into the secondary; the primary might now be a white dwarf. G 77-61 is a single-line binary with a period of 245 days. Dwarf carbon stars might be nova precursors, because they provide a source of carbon to be dumped on to the white dwarf component, if the system is a close one.

Details of this work will be published shortly in the *Ap.J. Letters*. Meanwhile, the search for these interesting stars will continue.

JACK MacCONNELL,
Computer Science Group, Space Telescope Science Institute.

COMMENT — *Halt Space Pollution*

At the time of the 20th General Assembly in Baltimore, it was known that near-Earth space had become a junk-yard, with the threat of a collision-induced dust-cloud creating a hazard to future space operations, not to mention scientific exploration. The matter was raised in a business session of Commission 22 (Meteors and Interplanetary Dust), with a view to forestalling similar pollution problems in the pristine expanse of interplanetary space, especially near other planet-satellite systems.

Commission 22 set up a Working Group, convened by Iwan Williams, which canvassed the views of a wide cross-section of space scientists. The result was a "Summary of Areas of Concern", which included such problems as propellant poisoning of environments, nuclear-explosion effects and discarded nuclear waste, unwise impact experiments (a one-tonne vehicle impacting a retrograde comet nucleus could double the density of dust in the inner Solar System), and dangers of scattered material from poorly-conducted mining schemes.

A draft resolution was prepared and knocked into shape by the reactions of a number of Commissions at this 21st General Assembly. The definitive wording calls for the creation of an IAU Working Group to consult widely on this important matter. Invited inputs from COSPAR, the UN Committee for the Peaceful Uses of Outer Space, and other relevant bodies should ensure full co-operation between planetary astronomers and all other interested parties.

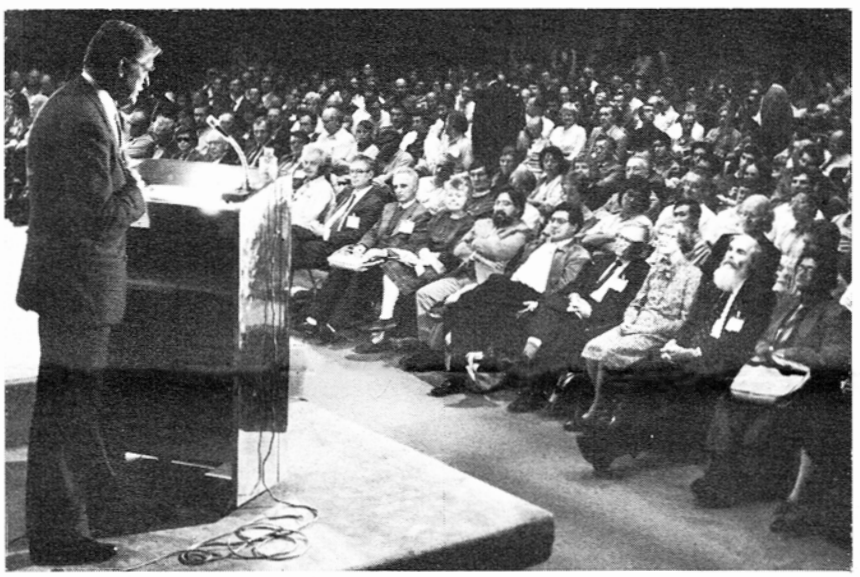
Mankind has polluted the Earth and near-Earth space. Perhaps we may head off the degradation of the rest of the Solar System.

COLIN KEAY
President, Commission 22

Large-scale structures and motions

Much of observational cosmology centres on the interpretation of red-shifts. On Monday evening, in his Invited Discourse, Halton Arp reviewed his misgivings on the well-known Hubble relationship between red-shift (velocity of recession) and distance. His work is respected, but few investigators would go along with him; in particular, the mapping of large-scale structures is very dependant on the Hubble relation giving distances. Yet even within that interpretation, controversy surfaced last year when Broadhurst *et al* claimed to find periodicities in their deep red-shift surveys - as though galaxies had condensed into concentric rings, centred on our Milky Way.

Not so, said Neta Bahcall in the opening presentation of Tuesday's Joint Commission Meeting on "High Red-shift Galaxies and Large-scale Structure". In promoting a unified view on large-scale structure, she showed how all the nearby peaks in the Broadhurst histogram coincided with known superclusters. Bahcall has long championed the use of rich clusters of galaxies (particularly Abell clusters) which act like mountain peaks in identifying where superclusters are present. Both the real data and random simulations of the distribution of such clusters could produce quasi-periodicity in red-shift plots, when sampled in chosen directions. From the early plots of Rood and Chincarini, Gregory and Thompson, Einasto *et al*, a unified picture has developed. Even the northern "Great Wall" is seen by Bahcall as a combination of two superclusters. As one goes to richer systems, there are stronger correlations with the structures, she reported.



Halton Arp addressing a crowded hall during his Invited Discourse, ´Observational problems in extragalactic astronomy´, on Monday, 29 July.

A complementary view was presented by Luiz da Costa, who reviewed the various surveys of individual galaxies to controlled limits. Detailed maps show that the same type of structures can be seen in both northern and southern skies, while deeper surveys offer hope of seeing the cellular textures out to scales far beyond the maps that originally revealed them.

But while there is consensus on the nature of the large-scale structure, debates on large-scale motions persist. Independent means of determining the distance of relatively nearby galaxies have revealed velocity flows over and above the cosmological expansion. As reviewed by O. Lahav, there seems to be large-scale flow towards the Centaurus direction, in agreement with indications from the cosmic microwave background radiation. The real question is whether there is convergence towards a particular place, especially the "Great Attractor". D. Mathewson presented observational data, based on 1300 southern spiral galaxies, to dispute the finding by Dressler and Faber that they were seeing infall on the far side of this region.

It seems as though getting both galaxies, and opinions, converging on the Great Attractor is, perhaps, more difficult than resolving other red-shift controversies.

TONY FAIRALL
University of Cape Town

EDITORIAL

Cruz del Sur was born less than two weeks ago; now it has come to the end of its short but, I hope, useful career. This has been a gathering which has been exceptional in many ways - not least for the announcement of the discovery of a new planet; there was also a memorable address by the President of Argentina. The 21st General Assembly will not be forgotten by any of those who have been fortunate enough to attend it.

Our thanks are due to all those in Argentina who have made us so welcome; we have enjoyed our time in Buenos Aires "under the Southern Cross". And as Editor, this is the moment for me to express my gratitude to all those who have helped in the production. Carlos Mammini has been a truly splendid designer; the fact that he speaks no English, and I speak no Spanish, has not mattered in the least, and we could not have had a more skilful colleague. Sergio Federovisky has also been of tremendous help throughout - and, of course, I must not omit the printers at La Plata, our many friends and colleagues in the Press Office, and the Local Organising Committee.

Finally, and most certain of all, I must stress that this newspaper could not have been produced without John Mason, whose rôle has in fact been much more important that mine. He has seen and checked every issue through the press, as well as helping with the copy-editing, keying-in much of the material into the computer, and working closely with Carlos Mammini on the design.

And so - au revoir, until we all meet again at The Hague in three years' time. Argentina, thank you!

PATRICK MOORE

IAU Reminiscences

IAU General Assemblies have, in general, grown over the years. More speakers and more scientific content have had to be compressed into the same amount of time. Still, the ability to meet with colleagues for a span ranging over the most of two weeks has continued to be worth-while.

I went to my first General Assembly in Hamburg in 1964, when I was a Harvard graduate student working for the summer at l'Institut d'Astrophysique in Paris. I remember the thrill of meeting so many of the people whose work I had read about. I remember the struggle of living in a country whose language I spoke not at all, and the triumph of small successes in communication. I remember the variety of cultural activities that were organised for us, including an excursion to Lubeck, where I learned to love marzipan. I remember stopping at Gandersheim, where I asked the guide if this was the Gandersheim where Roswitha -the first German woman poet- had lived about a thousand years ago; just this week I recommended her name to the group choosing names for features on Venus. And I remember an informal excursion to view the infamous Reeperbahn, which I now understand is all but closed because of AIDS.

The 1967 General Assembly in Prague was particularly memorable, not only for the beautiful city but also because of encounters with life behind the Iron Curtain, even during that Prague "spring" of liberalism. Only one year later, Soviet troops were to invade. The Old Town Square, the Castle, and wine bars like the Green Frog are among the sites that are still clear in my mind, as well as gathering to see the astronomical clock go through its paces. I remember, too, the mostly futile attempts of many of the American astronomers to get the International Herald Tribune, *to get the baseball scores. Also, probes had reached the Moon, and there were new craters to name. Martin Ryle and Allan Sandage told us about newly discovered objects: radio galaxies and quasars.*

In 1970, we met in Brighton, on the coast of southern England. The Royal Pavilion from a century ago showed us what luxury had been. Our work on Earth brought us stories of moon landing, of Uhuru X-ray data, and of other new contacts with space. Pulsars had been newly discovered, and Anthony Hewish and V.L.Ginzburg told us about them. Bart Bok and C.C.Lin told us about spiral structure. Interstellar molecules were newly discovered, as were pulsars.

In 1973, Sydney brought many of us to the southern hemisphere. The beautiful city by the bay gave pleasure to all those attending. Satellite symposia afterward included the solar one at Surfers Paradise, a town whose name required much explaining away at home. As always, I remember friends I met there. I enjoyed travelling to and from via Fiji outward and New Zealand homeward. Invited discourses at the General Assembly told us about the Sun, the early universe, interstellar matter, galactic nuclei and Copernicus.

In 1976, we enjoyed the mountain region around Grenoble. Perhaps it is not unusual that I remember the food especially well. One 'surprise' patisserie my wife and I bought on the street was the most delicious I have ever eaten - and we spent days wandering the streets trying to locate the store at which we had bought it. I remember the excursion we took with the Menzels to La Pyramide, the 3-Michelin-star restaurant in the region, and the feast they served us for lunch. Even our 18-month-old knew that something special was being served. My wife didn't eat again for almost two days. Intellectual feasting included Jean-Claude Pecker's Invited Discourse on infra-red astronomy, Philip Morrison's on the laws of physics, and Carl Sagan's on the exploration of the planets.

In Montreal, in 1979, we celebrated Einstein's centennial with a discourse from S. Chandrasekhar. Gerard Herzberg told us about molecular sprectroscopy, and B.Paczynski about binary stars. We enjoyed a bilingual city, and wandered around the old town when we weren't on the new university campus. We heard for the first time about IUE observations - and are still hearing about them.

In 1982, we travelled to Greece. I remember wonderful week-ends in Athens to and fro; Patras may be on a beach, but it isn't Athens. We heard an Invited Discourse about astronomy in ancient Greece, and many of us visited Delphi or other ancient sites. In other Invited Discourses we learned about the origin of planetary systems, cosmology, and solar flares.

I broke my string of IAU General Assemblies in 1985, when the meeting was moved out of the summer to the middle of an academic semester. I was sorry not to be able to be in India again, where my eclipse work had taken me for several weeks five years earlier. Still, I had a souvenir of Delhi - I wound up being Chair of the Local Organizsing Committee for IAU Symposium No. 105, held in 1988 in Williamstown, Massachusetts - my home location.

In 1988, the North American astronomers were disappointed by having the General Assembly close to home - in Baltimore. Once, like Hamburg, Baltimore was famous for activities that are not too polite, but now it is a modern city in which I can eat soft-shelled crabs three times every day, in season. We Americans (or at least, the baseball lovers among us) paid pilgrimages to Babe Ruth's house, just a few blocks from the Convention Centre. And we all went to the aquarium. The meeting was not to be memorable for the Hubble Space Telescope data we had hoped for, and which had brought us to Baltimore, but at last we shall have some to discuss.

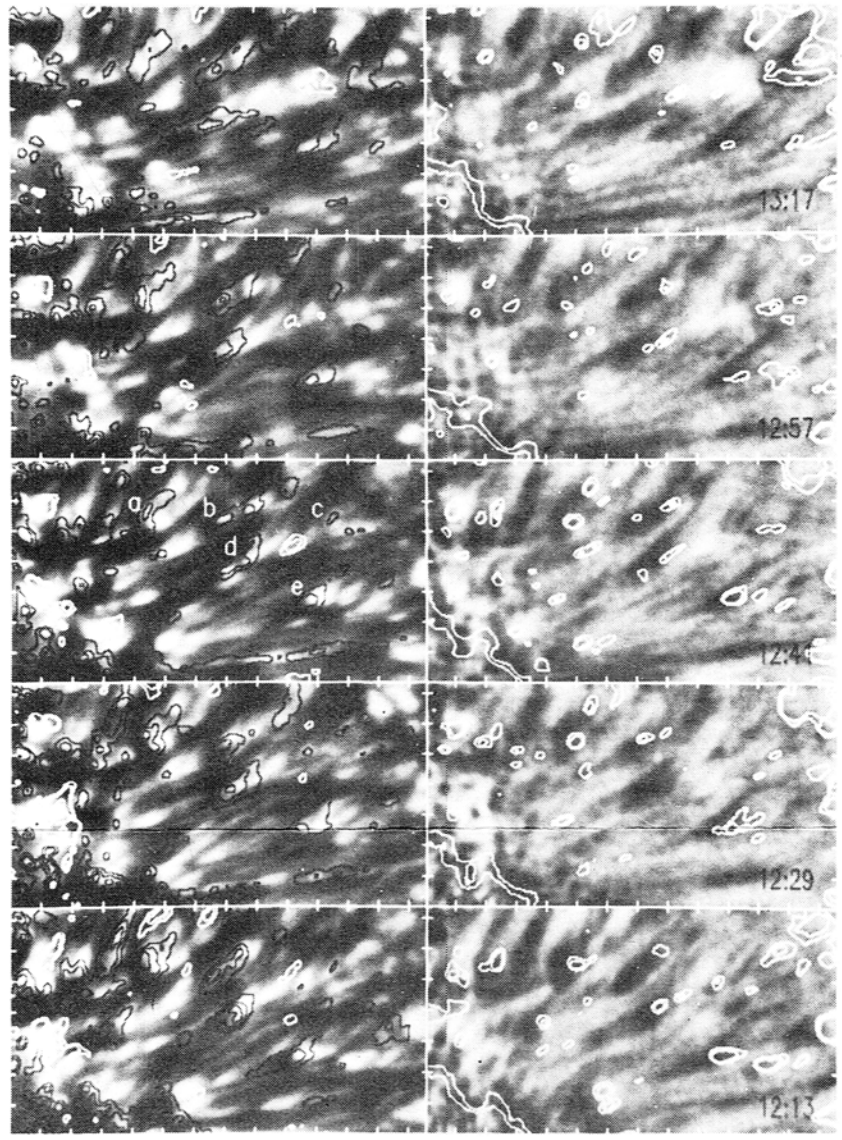
Now my wife and I look forward to being in Buenos Aires, where we had the pleasure of visiting briefly in 1987, when we came to see Supernova 1987A with the naked eye. Though I can't reasonably hope for another naked-eye supernova, I look forward to spectacular announcements of exciting discoveries and to renewed companionship with my friends from all over the world.

JAY M. PASACHOFF
Hopkins Observatory, Williams College, Williamstown, USA.

Sunspot penumbra

A one-hour time sequence of a sunspot penumbra obtained by G.B. Scharmer and C.U. Keller with the 50-cm Swedish Vacuum Solar Telescope at La Palma, Canary Islands (time increases from the bottom to the top). The use of an active mirror and real-time frame selection leads to 0".3 diffraction-limited images. The intensity is shown on the left, while the longitudinal magnetic field with superimposed intensity contours is shown on the right. The tickmarks have a separation of 1".

The observations were reported at the session on High Resolution Observations and Theory of Solar Magnetism and Convection of Commissions 10 and 12 on 29 July by Christopher U. Keller, Institute of Astronomy, ETM Zürich, Switzerland.



The International Earth Rotation Service

The International Earth Rotation Service (IERS) is responsible for defining and maintaining a conventional terrestrial reference system based on observing stations which use high-precision techniques in space geodesy; defining and maintaining a conventional celestial reference system based on extragalactic radio sources, and relating it to other celestial systems; and determining the Earth orientation parameters connecting these systems, i.e. the terrestrial and celestial co-ordinates of the pole and universal time.

Several institutions and agencies contribute to the work of IERS by analysing Very Long Baseline Interferometry (VLBI) observations on the basis of common and state-of-the-art physical models and constants. The Central Bureau of IERS performs a global combination of these results with those obtained by laser ranging to the Moon (LLR) and to artificial satellites (SLR). By the nature of the observing techniques, the celestial frame realised by this global analysis is based solely on VLBI, while the terrestrial frame and the EOP include a large contribution from satellite geodesy.

The celestial reference frame of IERS is based on compact extragalactic objects observed with VLBI. It is maintained on the basis of several independent Earth rotation observing programmes analysed at various centres.

The IERS celestial system thus enables us to monitor the Earth's orientation at a level better than 0".001. It contains at present 400 objects, of which over 100 have position uncertainties better than 0".001 (for some sources better than 100 micro-arc seconds).

The contribution of Earth rotation observations to the extragalactic celestial frame includes the long-term monitoring of radio sources. In the near future, as a consequence of the extension of the networks in the southern hemisphere for a better global coverage, the sky coverage in the southern hemisphere will be considerably improved, and the systematic errors due to uneven latitude distribution of stations will be diminished.

Fire over the IAU!

The 21st General Assembly ended in a way which is surely unique in the history of the IAU - and may never be repeated. The Conference Centre caught fire!

We had left the San Martín Centre at 2.00 a.m. on the morning of Wednesday, 31 July. All the IAU Resolutions were due to be printed in No. 10 of *Cruz del Sur*, and, naturally, they were not ready on the previous evening. Therefore, we decided that we would plan, key-in, and design Pages 1 and 2 of this, our last issue, and then add the Resolutions as soon as we were given them next morning. We finished our work, and then, pausing only for a quick glass of the excellent Argentinian wine, returned to our hotel.

We had planned to be back at the Centre by 8.00 a.m. the following morning and, as usual, walked there (it took only a few minutes). As we came down Sarmiento Street, we saw clouds of smoke billowing up ahead of us. "I hope that isn't the Centre on fire," one of us said jokingly. But it was - and as we arrived we saw crowds of people milling around, fire-engines pumping water into the basement, and a general scene of utter chaos. There were even firemen scaling up and down ladders with cat-like agility.

Our first instinct was to find out whether anyone had been trapped when the fire started. Mercifully, few people had been inside, and there were no casualities (though later, we heard that two fireman had been rendered unconscious by smoke). Our second thought was: "What about Issue No. 10?" We had the first part ready for printing; all we needed to do was to salvage it from the Newspaper Office on the second floor.

Outside the San Martín Centre.

We separated; it was essential to cover both the emergency meeting called in the La Plaza auditorium (the information was passed round mainly by word of mouth; what we really needed was a megaphone) and the scene at the Conference Centre. Next, we tried to rescue our precious material. The first attempt was abortive, as there was too much toxic smoke. The second attempt succeeded, largely because one of the main Civil Defence men was an ex-pupil of one of our Argentinian colleagues, and because the Director of the Centre, Alberto Fernández de Rosa, was giving all possible help. By noon, all members of the Editorial team were standing forlornly on the soaking steps of the Centre, with two computers, a mass of sodden papers and miscellanous pieces of equipment.

Meanwhile, at the Plaza - now the IAU headquarters - the General Secretary had been making emergency announcements, rescuing as much of the programme as was possible. Remember, the main presentation on the final full day was to be given by the Hubble Space Telescope team.

Our main concern was to produce No. 10 - so at length we managed to carry everything back to one of the bedrooms in our hotel, and then set to work to finish the issue. The Resolutions, of course, could not be included, because the main IAU computer was still in the smoke-filled Centre.

It was an eventful finale to an eventful General Assembly. Never again can it be suggested that IAU meetings are dull!

PATRICK MOORE
JOHN MASON

The General Secretary addressing the emergency meeting at La Plaza. Right: the President, Y. Kozai, Past President, J. Sahade and Chairman of the LOC, R. Méndez.

Closing General Assembly

Session 2 of the 21st General Assembly
1 August 1991

13. Report of the Finance Committee
14. Financial Resolutions of the Executive Committee
    a. Acceptance of the Accounts 1988, 1989 and 1990
    b. The Residual Budget for 1991
    c. Acceptance of the Unit of Contribution for 1992, 1993 and 1994
    d. Acceptance of the Budget 1992-1994
    e. Other financial resolution(s) not a part of the Union Budget
15. Resolutions submitted by the Executive Committee
16. Resolutions proposed by the Resolutions Committee
17. Recommendations of the Resolutions Committee on the Resolutions submitted by Commissions
18. Appointment of the Special Nominating Committee 1991-1994
19. Nomination of New Members of the Union
20. Applications for IAU Membership
21. Changes in Commissions
    a. Presidents and Vice-Presidents of Commissions 1991-1994
    b. Organising Committes of Commissions
    c. Change of Name and/or Functions of Commissions
22. IAU Representatives to other organisations
23. The Place and Date of XXIInd General Assembly
24. Election to the Union of a President, a President-elect, six Vice-Presidents, a General Secretary and an Assistant General Secretary
25. Address by the President 1988-1991
26. Address by the President 1991-1994
27. Closing Ceremonies

Agenda for Closing General Assembly

The Agenda for the Closing General Assembly on Thursday, August 1, commencing at 10:00, requires the following amplification.

1. The national representatives wish to amend the proposed change of Bye Law 24 as follows:

The essence of the amendment refers to the definition of unit of contribution payable in each category of adherence. The national Representatives propose the scheme below:

Category of Adherence
I II III IV V VI VII VIII VIII1/2 IX X
Unit of Contribution
1 2 4 6 10 14 20 27 30 35 45

If Additional Categories of Adherence are deemed necessary, the relevant units of contribution shall be increased in steps of 10 units.

The Executive Committee concurs with the proposed amendment.

2. Commission 12 has proposed a change of name. The proposed change has the agreement of Commission 35 - Stellar Constitution - and the Exceutive Committee.

Commission 12 is currently named: Radiation and Structure of the Solar Atmosphere.

The new name proposed by Commission 12 is: Solar Radiation Structure

D. McNALLY
General Secretary, IAU
30 July 1991

IMPORTANT NOTICE

Closing General Assembly

The Closing General Assembly will take place between 10:00 and 13:30 in the CASACUBERTA ROOM of the General San Martín Theatre, which is at 1530 Avenue Corrientes, in the same building as the Conference Centre, but with the entrance in Corrientes Avenue.

Thank you

The Editorial team of *Cruz del Sur* would like to thank the newspaper's official photographer, Osvaldo Marcarian, for his services during the General Assembly, and for the way in which he has produced the pictures we requested.

Tribute to André Danjon

A Colloquium was held in Paris, on 28-30 May 1990, to pay tribute to André Danjon, President of the IAU from 1955 to 1958 and Director of the Paris Observatory from 1945 to 1963. The Proceedings of this Colloquium were published in November 1990 by the Paris Observatory.
S. DEBARBAT Observatoire de Paris

From the Resolutions Committee:

Some members of the Resolutions Committee claim that they do not really understand what some Commissions actually want, but that nevertheless they do agree with what they believe is implied. Could we have clarification before 10.00 a.m. on August 1st!

From a member of the Resolutions Committee