

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General Assembly of the International Astronomical Union

Brighton, Sussex

18th August 1970

WELCOME

The Local Organising Committee welcomes all participants in the XIV General Assembly to Brighton and to the University of Sussex. We hope that you will have an interesting scientific programme, will meet old friends and make new ones and will also see something of the English countryside on the excursions. The Local Organising Committee and its staff and the Ladies' Committee are here to help you; please consult them if you have any problems.

BIENVENUE

Le Comité Local d'Organisation souhaite la bienvenue à tous les participants à la 14e Assemblée Générale à Brighton et à l'Université de Sussex. Nous vous souhaitons un programme scientifique intéressant et espérons que vous reverrez de vieux amis et en ferez de nouveaux et que les excursions vous donneront l'occasion de voir un peu le paysage environnant. Le Comité Local d'Organisation, les membres de son personnel ainsi que celles du Comité des Dames seront heureux de fournir tous renseignements.

MINISTER TO DECLARE GENERAL ASSEMBLY OPEN

Although for many participants, the XIV General Assembly has already opened with the Civic Reception given by the Mayor and Mayoress of Brighton in the Corn Exchange last night and with the meeting of many old friends, the Assembly will formally be declared open by the Secretary of State for Education and Science, Mrs. Margaret Thatcher, M.P., at the Inaugural Ceremony this morning. Mrs. Thatcher's Ministry is responsible not only for the whole of the educational system from nursery schools to universities, but also for the Arts and Pure Scientific Research. Other speakers at the Inaugural Ceremony will be the Mayor of Brighton, Alderman H. Nettleton, and the Vice-Chancellor of the University of Sussex, Professor Asa Briggs, who will welcome participants on behalf of the town and University, Lord Blackett, President of the Royal Society, which is the body which adheres to the I.A.U. on behalf of the U.K., Professor Sir Bernard Lovell, Chairman of the National Committee for Astronomy and Professor Otto Heckmann, President of the I.A.U. who will reply to Mrs. Thatcher's speech. Dr. D.H.Sadler will preside and organ interludes will be played by Susi Jeans.



The Dome, left, was built as a stable for the horses of the Prince Regent later King George IV when the Royal Pavilion was his summer palace

THE DOME, BRIGHTON scene of today's Inaugural Ceremony

Opposition In Taurus?

It is understood that the arrival of many delegates at the Assembly Centre was delayed by a cow on the main railway line from London.



FALMER HOUSE-ASSEMBLY CENTRE



THE MEETING HOUSE scene of this evening's orchestral concert

The Assembly Times is edited by Professor R.J. Tayler, Dr. F.E. Clifford and Dr. R.C. Smith of the University Astronomy Centre, and production is in the hands of Mr. F. Newman, Miss S. Cline and the University Printing Unit. The editors have no wish to write everything that appears and they would, therefore, welcome letters, articles and other items of interest from participants. Please hand these either to the Editorial Office (University Arts Building, Room C339) or to the registration desk in the Assembly Centre, or leave them in the mail box of one of the editors.

concert tickets

All participants who were successful in the ballot for seats for this concert should note that tickets must be collected from the cultural events desk in the Registration Office by 14.00 today, at the latest. After that time, tickets will be issued to persons who were unsuccessful in the ballot, or who did not apply for tickets, on a first come first served basis.

The concert will consist of Sir William Herschel's second organ concerto and a movement from his first organ concerto with Susi Jeans as soloist; Bach's violin concerto in E major with Eduard Melkus as soloist, and Telemann's suite in A minor for recorder and strings with Katharine Jeans as soloist.

Please note that, as most members of the orchestra have to return to London tonight, the concert must start promptly at 20.00. Persons attending the concert may find it most convenient to eat at the University Refectory where dinner is served between 18.00 and 19.30. Meal tickets purchased at the Registration Office are valid for either lunch or dinner.

Sir James Jeans

Susi Jeans's late husband, Sir James Jeans, was one of the leading figures in theoretical astrophysics during the first quarter century of the existence of the IAU. He is, perhaps, best known to younger members of the Union for his criterion for gravitational instability, which has been so often applied in problems of both star and galaxy formation, and for Jeans's theorem which relates to the possible equilibrium configurations of stellar systems. He did distinguished work in most other branches of theoretical astronomy, but possibly his most lasting influence on British astronomy was a series of popular books including "The Universe Around Us" and "The Stars in their Courses" which gave many young people (and future astronomers) their first introduction to astronomy.

From tomorrow The Assembly Times will be distributed at Falmer House

AFTER PRAGUE: SPOTLIGHT ON PULSARS AND THE MOON

As delegates are assembling for the XIV General Assembly, it is of interest to ask what have been the principal developments in our subject in the three years since the Prague Assembly. Here is one person's view; obviously other astronomers might have very different opinions.

In the first place, samples of material have been brought back from the Moon and we now know something definite about the chemical composition and age of samples from one part of the Moon's surface. A special evening meeting on Friday, 21st August will be devoted to a discussion of the knowledge that has been obtained from manned missions.

The single event which has led to most discussions and conjecture is the discovery of pulsars. Overnight they displaced quasars as the objects of greatest speculation and they made the idea of neutron stars seem really respectable for the first time. Most workers in the field now seem agreed that pulsars are rotating neutron stars, but there are still many detailed difficulties in understanding them and these will be discussed in invited discourses by A. Hewish and V. Ginzburg tomorrow. Another very important development has been the discovery of radio frequency radiation from several molecules (ammonia, formaldehyde, water vapour) which has considerably increased knowledge of the composition of the interstellar gas. The realization that these molecules exist must give rise to much interesting work concerned with the formation and dissociation of the molecules and their relation with free atoms and interstellar grains. A joint discussion on Interstellar Molecules will be held on Monday, 24th August.

infra-red

The frequency range for which considerable observations have been made has been further extended and this must have removed any lingering feelings that the visible universe, with which naked-eye astronomers are so familiar, is the real Universe. Perhaps the major development in the past three years has been the infra-red observations. It is now known that the major energy release from some galaxies is in the infra-red and that there is a very intense infra-red source in the centre of the Galaxy. There is still considerable discussion about whether most of the radiation arises from non-thermal processes, or whether it is starlight thermalized by grains. Several of the disputes of three years ago have still not been completely resolved. There is still some argument about the position of quasars and about the distribution of faint radio sources and its consequences for cosmological theories. Although there have been some hints that the microwave background radiation might depart significantly from the black body form, there is still no definite agreement about this and further measurements at wavelengths below the believed maximum in the black body curve are eagerly awaited.

solar oblateness

The measurement of a solar oblateness and its interpretation in terms of a rapidly spinning solar core, with important implications for the motion of the perihelion of Mercury and the General Theory of Relativity, has led to much work on stellar hydrodynamics. So many means of mixing angular momentum inside stars or of preventing the mixing have been proposed, that it seems clear that it will be some time before there is general agreement on the subject. Studies of stellar chemical compositions suggest that the view that old stars are deficient in metals and young stars are not, is probably seriously oversimplified. It now seems possible that substantial element production has occurred in massive objects preferentially near the centres of galaxies in agreement with increasing evidence for violent events in galactic nuclei.

Finally, in this very subjective survey of recent developments in astronomy, mention must be made of the possible detection of gravitational waves which could have a profound influence on our estimates of the energy balance in the Universe, if it is confirmed.

STRANGE JOURNEY....

Did you have a good journey to the General Assembly ?

We hope that you did. We do not imagine that any of you travelled in so unconventional a manner as did the French astronomer J. Janssen when he wished to observe a total solar eclipse a hundred years ago. He left Paris, which was then in a state of siege, by balloon. In his own words: "I set out on the 2nd of December at 6 a.m., the day of the Battle of Champigny. A sailor travelled with me to help with the navigation but I piloted myself. We crossed the enemy lines at a height of 800 m but the Sun soon had its effect on the gas in the balloon and we gradually rose to 2,000 m. The compass showed us the way to Brittany. By 11 a.m. we were at the mouth of the Loire, facing the ocean. A rapid descent enabled us to land in time. We had covered the distance from Paris to Nantes in five hours."

Janssen then continued his journey to study the eclipse in Oran in a more conventional manner. (Extract quoted from A. J. Meadows, *Early Solar Physics*, Pergamon Press 1970.)

....and did you bring your reprints with you ?

In 1879, J. N. Lockyer (the leading British solar physicist) wrote to C. A. Young (the leading American solar physicist) and asked him whether he had seen a recent paper in the *Philosophical Transactions*. Young replied: "I fear I shall not until we get our copies of the *Transactions* two or three years hence."

LOC Notices

A Book Exhibition opens at 09.30 tomorrow (Wednesday) in the Orange Room North on the mezzanine floor of the Refectory at the University, and it is at present planned that it should remain open from 09.30 until 17.30 on each day (except Saturday afternoon and Sunday) until Wednesday, 26th August. All publishers of astronomical books were invited to contribute to this Exhibition and more than 500 books on astronomy and related subjects are on display. The books in the Exhibition are not for sale, but some astronomical books are on sale in the University Bookshop, which is on the ground floor of the Refectory Building.

Tickets for any one of eleven Saturday afternoon excursions can be obtained in exchange for a voucher which is in every portfolio. The excursions leave the University at a variety of times between 13.15 and 14.50. There is a full programme of scientific meetings on Saturday morning which only ends immediately before the first excursions set out. Participants are therefore advised to study the Saturday morning scientific programme before deciding which excursion to take.

The Local Organising Committee offers its apologies to Members and to Invited Participants for the mutilation of the name-cards inserted in the holders of their portfolios. The cards were designed to fit the holders and all had been typed before the portfolios were delivered, but the manufacturers had changed the shape and size of the holder! The cards have thus had to be cut down in size, in a few cases cutting through the names.

Will participants please correct the following errors:

- Final Programme pages 11 (English) and 9 (French) G.P.O. Extension number for the Secretaries, Miss G. Drouin and Miss C. Sachs, for 545 read 546.
- Daily Programme for Tuesday, 25th August 1970. Insert: 21.00 Apollo Films Room (Salle) II

IAU Notices

The President of Commission 46 on the TEACHING OF ASTRONOMY announces that due to the extended programme of the Commission's Third Session there will be a Fourth Session on Friday, 21st August right after lunch in room II.

This will allow more ample time for the communications and discussions on ASTRONOMY EDUCATION AT ALL LEVELS.

Main Session of Presidents and Vice-Presidents will take place on Wednesday, 26th August in Room A 5 instead of Monday, 24th August. This shift in date had to be made with respect to the Honorary Degree Ceremony.

The programme for Joint Discussion F was not available in time to be included in the Final Programme. It is:
Joint Discussion on Pulsars, Background Radiation and Cosmic Rays.
Speakers: Dr. B. Peters - Cosmic Rays,
Dr. M. Rees - Cosmological Background Radiation,
Dr. L. Woltjer - Astrophysical Implications of Pulsars.

URGENT! full timetable of feeder services (autocars de ramassage)

TIMETABLE OF MORNING COACHES TO STATION

King Alfred			08.00	08.10			08.35
Adelaide Crescent			08.10	08.20		08.40	08.45
Metropole	08.00	08.10	08.20	08.30	08.40	08.50	08.55
Brighton Station	08.10	08.20	08.30	08.40	08.50	09.00	09.05
To connect with train	08.12	08.25	08.44	08.50	09.05	09.05	09.14
Eastern Terrace		08.00	08.10		08.25	08.30	08.35
Royal Crescent		08.05	08.15		08.30	08.35	08.40
Lower Rock Gardens		08.10	08.20		08.35	08.40	08.45
Palace Pier	08.00	08.15	08.25	08.30	08.40	08.45	08.50
Brighton Station	08.15	08.30	08.40	08.45	08.55	09.00	09.05
To connect with train	08.25	08.44	08.50	08.50	09.05	09.05	09.14

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19th August 1970

'FULL OF HEALTHY PROBLEMS'

says President at IAU Opening Ceremony

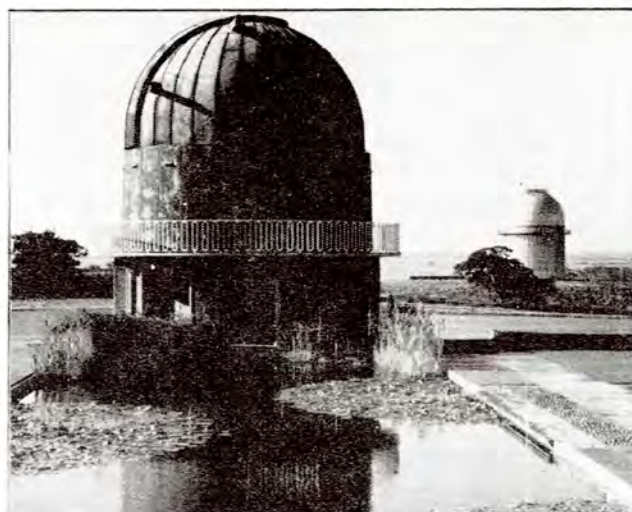
At yesterday's Inaugural Ceremony, delegates were first welcomed by the Mayor of Brighton. Echoing this welcome, on behalf of the University of Sussex, the Vice-Chancellor, Professor Asa Briggs, mentioned the University's close links with the Royal Observatory at Herstmonceux. Delegates were also welcomed by Lord Blackett, President of the Royal Society, and Sir Bernard Lovell, President of the RAS and of the National Organising Committee. Both mentioned the only previous meeting of the Union in the U.K., in Cambridge in 1925, when, as Lord Blackett said, the subject was in a state of flux due to the discoveries about the extra-galactic nebulae. This state is present again today, when the whole electromagnetic spectrum is becoming accessible. Sir Bernard reminded delegates of the 150th Anniversary of the RAS this year, and of the contribution of the Society to the work of the Union.

In her speech declaring the General Assembly formally open, Mrs. Margaret Thatcher, Minister of Education and Science, summarised recent developments in astronomy and stressed the



Mrs Margaret Thatcher addresses the delegates at the Inaugural Ceremony

contributions made by Government-supported establishments such as the Royal Observatories at Herstmonceux and Edinburgh and the theoretical groups at Cambridge and Sussex. She also mentioned various new projects, such as the Anglo-Australian 150-inch telescope. Professor Otto Heckmann, President of the Union, replied to the speeches of welcome. After thanking the speakers, he summarised the aims and activities of the IAU, which he believes to be one of the most alive and active of the Unions. "full of healthy problems - as it should be." Professor Heckmann then surveyed the history of astronomy in the U.K., mentioning particularly its practical origins in navigation and the theoretical developments due to Eddington, Jeans and Milne. A typical feature of British astronomy was, and is, the important contribution from amateurs. Professor Heckmann concluded by recalling that the first observations in the Southern Hemisphere were by British astronomers. In the two intervals between the speeches, which were also read in French, by Professor J.-C. Pecker, Susi Jeans gave an excellent organ recital of music by Herschel, Bach and Rinek. The latter was particularly apt, being variations on a theme known better in this country as "Twinkle, twinkle, little star."



The Carte-du-Ciel Refractor at Herstmonceux with the Isaac Newton telescope in the background

DAILY VISITS TO THE ROYAL OBSERVATORY

From today until Wednesday, August 26th there are visits to the Royal Greenwich Observatory at Herstmonceux on every afternoon except Sunday. On Sunday itself there is a day trip to the original Royal Greenwich Observatory at Greenwich near London.

The visits to Herstmonceux are free. Every participant and registered guest has received a voucher which he can exchange for a ticket for the day of his choice. Coaches will leave the University between 13.30 and 14.15 each day and they will return about four hours later. The Sunday excursion to Greenwich is by special train from Falmer at 09.08 and Brighton at 09.19. Visits will be made to the Old Royal Observatory, the National Maritime Museum and the Royal Naval College and lunch and tea will be served at the National Maritime Museum. There will also be



The 98-in Isaac Newton Telescope as arranged for direct Cassegrain photography

a journey of 5 miles along the River Thames by launch. The price per person is £2.10s. and some tickets are still available in the Assembly Centre. At first sight Herstmonceux Castle looks like a typical mediaeval castle but it is unusual in several ways. In the first place it is made of brick rather than stone and it is one of the earliest large brick buildings in England. It was not really built as a fortified castle and it has not been the scene of any battle or siege. Finally it was in ruins for about 150 years until it was restored in this century; only the towers, gatehouse and outer walls of the original castle still remain.

It was in 1441 that Sir Roger de Fiennes, who was treasurer of the household of King Henry VI and Lord of the Manor of Herstmonceux, began to erect the castle at a cost said to have been about £3,800. The castle remained in the possession of Sir Roger's descendants until 1708, although they almost lost the estate in 1541 when Thomas, Lord Dacre, was executed for the murder of one of his servants. The last Lord Dacre married an illegitimate daughter of Charles II but later he had to sell the castle to pay off his debts.

A member of the family, to whom the castle was sold, demolished the interior of the castle in 1775 in order to enlarge a nearby house known as Herstmonceux Place. The castle remained a ruin until it was bought and partially restored by Colonel Lowther in 1911. Sir Paul Latham completed the restoration at great expense. The castle was bought as the headquarters for the Royal Greenwich Observatory in 1946. The Astronomer Royal made his home in the castle in 1948 and the main part of the move from Greenwich was completed by 1957.

Adapted from a pamphlet published by the Royal Greenwich Observatory.



The inner court of Herstmonceux Castle

The Royal Observatory

The Royal Observatory was set up by King Charles II in 1675 and John Flamsteed was appointed the first Astronomer Royal. A site for the observatory was chosen in the royal park at Greenwich and Sir Christopher Wren was asked to design the buildings. Wren is best known for all of the buildings he designed in London after the Great Fire of 1666, in particular many churches including St. Pauls Cathedral. Before he took up architecture, Wren was himself an astronomer and he was Professor of Astronomy of Oxford and Gresham College, London. He was a contemporary of Newton and Halley and was one of the early members of the Royal Society. The Observatory was moved from Greenwich to Herstmonceux because of the increasing disturbance to its work from atmospheric pollution and the lights of London. Most holders of the office of Astronomer Royal have been long-lived and there have only been eleven in almost 300 years.

ASTRONOMY AT SUSSEX UNIVERSITY

It must be unique for the I.A.U. to hold a General Assembly at a University with such a new department of astronomy as the Astronomy Centre of the University of Sussex. In fact the decision to invite the I.A.U. to come to Sussex was taken before the Astronomy Centre was fully in operation. The astronomy group at the University was established because of the nearness to the Royal Greenwich Observatory at Herstmonceux and from the outset, members of the staff of the R.G.O. have played an important part in the Astronomy Centre, both as teachers and as students. Four members of the R.G.O. (Professors Sir Richard Woolley, B.E.J. Pagel and D. Lynden-Bell and Dr. R.G. Bingham) hold visiting posts in the University and many junior members of the staff study part-time for Master's and Doctor's degrees in Astronomy.

The Astronomy Centre was set up with the aid of a grant from the Science Research Council which, since 1966, has supported a small group headed by Professor W.H. McCrea. The Director of the Astronomy Centre is Professor R.J. Tayler and other faculty members are Drs. J. Hazlehurst, F.E. Clifford, R.C. Smith, J.C. Jackson and A.C. Edwards. The group based at the University is entirely composed of theoretical astronomers and students who wish to take degrees in observational astronomy work at the R.G.O. At present, including part-time students, there are eighteen students working for Doctorates and seven working for Master's degrees. In the past three years, seven Doctorates and twenty-six Master's degrees have been awarded. There is no undergraduate degree in astronomy, but an astronomical option exists in the third year course for mathematicians and physicists and this has proved very popular.

DIAMOND-STUDED CAST

The Assembly started successfully with a Civic Reception on Monday evening. After the Mayor's welcome, Professor Heckmann, replying for the IAU, recalled that Brighton was used to visitors, "from Norman Conquerors to astronomical invaders." The "star" of the evening was Bernard Pagel, who "assisted" magician Alan Saxon in his card-tricks. Singer Doreen Lane and the Band of the Coldstream Guards completed the programme with music from Schubert to Sousa. The evening concluded with refreshments in the Corn Exchange, giving delegates an opportunity to renew old acquaintances and make new ones.

CALLING ALL TEENAGERS!

We would like to organise some form of activity for the teenagers present here. Will anybody who is interested in participating please leave their name and local address in the pigeon hole of my father, F.D. Kahn, 9260. Suggestions would also be very welcome.

Judith Kahn.

ASTRONOMICAL EXHIBITION

A small exhibition, mainly of models and photographs of astronomical apparatus and of results obtained with it, opens today in rooms A100 and A102 in the Arts A Building at the University. It will be open from 09.30 until 17.30 each day (except Saturday afternoon and Sunday) until Wednesday, 26th August. Three astronomical groups are exhibiting: the Max Planck Institut of Heidelberg, the Institut d'Astrophysique of Liège and Observatoire de Paris, Meudon,

Developments in Science Teaching

During its 12th General Assembly (1969) the International Council of Scientific Unions decided to form a new committee which was to deal with all aspects of the teaching of science. This new ICSU Committee replaces the previously existing Inter-Union Commission on Science Teaching and it is hoped that it strengthens the organisation within ICSU of the teaching of science.

The main objectives of the ICSU Committee on Science Teaching are:

- (1) to further on an international scale progress in the teaching of science at all levels;
- (2) to co-operate with other organisations concerned with any aspect of the teaching of science;
- (3) to facilitate co-operation among the teaching committees of the individual scientific unions.

The Committee consists of the chairman and six members appointed by ICSU and of one representative of each Scientific Union member of ICSU interested in the teaching of science. Some observers of the UNESCO Division of Science Teaching are invited to attend the Committee's meetings and to collaborate with the Committee in the programmes which are of mutual interest. The C.S.T. met twice since its foundation, in order to discuss and plan its work and future programmes. The following are some of the

interests of the Committee which will serve as guide lines for the programmes to be developed:

- The integrated science teaching, including not only biology, chemistry, and physics but also astronomy, geology and other sciences at the school and college levels.

- The improvement of the standard of teaching at universities.
- The training, supply and recruitment of science teachers.
- The role of the laboratory in science teaching.
- Modern teaching aids.
- Involvement of high school teachers in university research.
- Interfaces between school and university, and between university and industry.

A major conference on science education is envisaged for the fall of 1972 or spring 1973 which will be concerned with the various aspects of the supply and training of science teachers. Before this major conference one or two symposia on specific topics are planned for 1971 and 1972, which will be devoted to special aspects of science teaching.

Edith A. Muller,
Nominated Representative of
the ICSU Committee on
Science Teaching.

COMMISSION NOTICES

A hitherto unannounced scientific meeting will be held on Saturday 22nd August at 11.15 a.m. It is the Commission 28 Working Group on Magellanic Clouds and will be held in Room V.

The proposed Commission 44 meeting on the 1970 Eclipse results has been cancelled.

There will be no Solar session of Commission 44 today (Wednesday, 19th August). The first will be on Thursday, 20th August.

The Radio Astronomy Session of Commission 44 planned for 14.15 on Tuesday, 25th August has been cancelled. Radio results will be included in the session from 11.30 - 13.00 on Tuesday, 25th August.

LOC NOTICES

Although the Assembly has only just opened, it is not too soon to think about the closing buffet supper and dance. If you have ordered tickets, please collect them from the Assembly Centre as soon as possible. If you have not ordered tickets, but would like to attend the buffet supper, there are still tickets available. The buffet supper is in the Metropole Hotel at 20.30 on Wednesday, 26th August and there will be dancing to Victor Sylvester and his Orchestra and the Bobby Fallow Band until 24.00. Tickets are on sale at £3 each.

ROYAL PHILHARMONIC CONCERT

Will all participants who wish to attend this concert in the Dome on Thursday, August 20th, please exchange their vouchers for tickets at the Assembly Centre as soon as possible.

CHANGES IN LIST OF PARTICIPANTS

(arranged in alphabetical order of countries)

Additions:

5159 Inmanen; 5158 Petrie, J.K.; 0105 Larragoiti, L.; 3226 Blamont, J.; 3227 Courtes, G.; 5209 Swarup, G.; 7308 Alter, G.; 6364 Rodono, Mrs.; 6363 Nieuwenhuyzen, H.; 7418 Pekol, S.; 7416 Pekol, Mrs.; 8805 Ewing, M.; 8803 Ramaty, R.; 8801 Reigel, K.; 8802 Simon, M.; 8802 Simon, Mrs.; 8804 Usher, P.D.

Deletions:

5109 Burke-Gaffney, M.W.; 5135 Fahlman, Mrs.; 5102 Thomson, M.M.; 4119 Andrie, P.; 4133 Bumba, V.; 4101 Chvojikova, E.; 4107 Jappelova, Mrs.; 4129 Hekela J.; 4115 Kriz, S.; 4115 Koubsky, P.; 4141 Lala, P.; 4135 Neuzil, L.; 4132 Onderlicka, B.; 4188 Rajchl, J.; 4145 Rajska V.; 4127 Ruprecht, J.; 4117 Ruzickova-Topolova, B.; 4111 Simek, M.; 4113 Tlamicha, A.; 4136 Vetesnik, M.; 4118 Webrova, L.; 4118 Ptacek, V.; 6117 Hilberg, C.; 6211 Tuominen, Mrs.; 3119 Fournier d'Albe, E.M.; 2103 Sandig, H.U.; 2239 Baschek, Mrs.; 2224 Schwesinger, G.; 2224 Schwesinger, Mrs.; 5203 Vardya, M.S.; 7203 Sobouti, Mrs.; 3420 Barbon, R.; 3452 Bernacca, L.; 3425 Fracassini, M.; 3445 Zagar, F.; 3445 Zagar, Mrs.; 6348 Heintze, Mrs.; 6309 Minnaert, M.G.J.; 6523 Alfven, H.O.G.; 8202 Tsai, C.H.; 9202 Hawking, S.W.; 9202 Hawking, Mrs.; 9018 Spencer-Jones, Lady; 8363 Colgate, S.A.; 8363 Colgate, Mrs.; 8499 Fomalont, E.B.; 8374 Glaser, H.; 8614 Greenberg, J.M.; 8614 Greenberg, Mrs.; 8765 Mitchell, W.E.; 8710 Wagner, W.J.; 4526 Dibay, E.A.; 4530 Eelsalu, H.T.; 4542 Khromov, G.; 4544 Kisljakov, A.G.; 4550 Linnik, V.P.; 4550 Linnik, Mrs.; 4561 Radnova, L.; 4573 Tzesebich, V.

Future of the General Assembly?

For the first time recently, the total attendance at this General Assembly is not greatly in excess of the attendance at the previous one. There are several reasons for this, but one is that for the first time the number of Invited Participants has been restricted by a decision of the Executive Committee of the Union. As a result, although the number of members of the Union present at Brighton is greater than at Prague in 1967, the number of Invited Participants has been considerably reduced and the total attendance is slightly lower. Although there may be special circumstances leading to smaller attendances in the future, the number of scientists interested in astronomy is still growing and there seems no doubt that the present restriction of the number of Invited Participants can only cause a temporary check in attendance at meetings, if they are to remain true General Assemblies.

What should be done about the General Assemblies? Should they cease to be held, except as formal business meetings with small delegations from each adhering country? Should they be held less frequently? Should they become purely scientific meetings without accompanying programmes of excursions and cultural events? What do YOU think? The editors would welcome letters from participants at this General Assembly saying how they think future meetings of the Union should be organised.

Although only a small number of members of the Union can now remember the time when almost all participants in General Assemblies knew one another personally, there must be many who would be genuinely sorry if it proved impossible to continue to treat astronomy as a single subject and to hold meetings with all types of astronomer present.

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COLLOQUIUM ON ASTRONOMICAL CONSTANTS

IAU Colloquium No. 9 on 'The IAU System of Astronomical Constants' was held at Heidelberg on 11th to 14th August, 1970 at the invitation of Professor W. Fricke, Director of the Astronomisches Rechen Institut. Unfortunately he was unable to participate directly in the proceedings as he had received a spinal injury in an accident a few weeks ago. We were, however, relieved to find him in good spirits, although he will be confined to hospital for several weeks yet; we all wish him a full and early recovery. The Colloquium was convened by Commission 4 to discuss the desirability or otherwise of adopting new values for the precessional constants and for the planetary masses that were left unchanged when the IAU system of astronomical constants was adopted at Hamburg in 1964. Astronomers representing all aspects of astronomy that might be affected by any such changes were invited to attend. A report of the Colloquium will be given at TODAY'S MEETING of Commission 4 at 14.15 in Room IX, when all participants are invited to attend.

Brighton, Sussex

20th August 1970

PULSARS STILL A PROBLEM!



Professor Ginzburg makes a demonstrative point at a Press Conference before last night's discourse

Two invited discourses on Pulsars were given in the Dome last evening by V. L. Ginzburg and A. Hewish. Hewish described the observations of pulsars. He explained that to study their periods and period changes it may be necessary to know the position of the earth to within a few kilometres. For 15 pulsars measurements have already indicated period increases with a characteristic time of between 10^3 and 10^9 years. The two most rapid pulsars have both undergone sudden period decreases. Although there is great variation in the shape of individual pulses, over many periods there is usually a stable envelope and double peaked envelopes are quite common. The envelope is only weakly dependent on wavelength. The average of many pulses often shows significant linear polarisation; individual pulses frequently show elliptical polarisation. The pulsars are clustered towards the plane of the Galaxy and are apparently associated with Population I. From this and from dispersion measurements it appears that they typically lie within a few kiloparsecs. It is difficult to obtain reliable spectra for pulsars but all sources show a steepening spectral index at high frequencies and

many have a low frequency cut-off. Hewish concluded by making some remarks on the interpretation which led naturally to Ginzburg's discussion of theoretical problems. Ginzburg said that the possibility that pulsars were binaries could not be excluded but it did not seem possible that they could be rotating or pulsating white dwarfs or pulsating neutron stars. It seems most likely that they are rotating neutron stars with strong magnetic fields and that there are reasons for believing that the axes of rotation and magnetic field need not be parallel. The equation of state of matter at neutron star densities is still highly uncertain but it is probable that the neutrons form a superfluid and that those protons present are superconducting. An oblique rotator radiates electromagnetic waves of low frequency and also ejects charged particles. As a result the rotation slows down. The optical and X-ray radiation is non-coherent emission by an assembly of particles but the radio emission must be coherent because of the high brightness temperatures. The main problem in theories of pulsars appears to be obtaining the properties of their plasma atmospheres.

precession in error?

Evidence that the adopted value of the general precession in longitude is in error by about 1.1 seconds of arc per century was given in a review paper prepared by Dr. Fricke, but others suggested caution in adopting a new value. Firstly a more accurate value may be obtained within a few years by new methods (such as use of reference frame defined by extra-galactic nebulae or by long base-line radio interferometry of quasars). Secondly, there are reasons for suspecting that the agreement between the current determinations may not be indicative of the true uncertainties, since it was claimed that our present knowledge of stellar dynamics does not provide an adequate model against which to match the observations of stellar motions. Thirdly, it was claimed that the disadvantages of changing from a long-established conventional value to a new value, even though it might be significantly more accurate, are too great to justify such a change. Eventually it was agreed, however, that the reasons in favour of change are sufficiently strong to justify further studies of the problems and implications of adopting a new system of precessional constants so that the Union will be in a position to make a decision at its next General Assembly in 1973.

space research

The techniques of space research have given us much more precise determinations of the masses of Venus, Earth and Mars but for the other planets we cannot claim a similar significant improvement over currently adopted values. It was considered, however, that it is desirable to obtain agreement on the basic parameters of new ephemerides to replace those at present in the almanacs and to try to make available separately a standard set of improved ephemerides as soon as possible. Although no revision of the new values adopted in 1964 was demanded, suggestions for revising the form of the present system were made. The definition of ephemeris time, and even its use, came in for strong criticism and it was agreed that the definition and determination of ephemeris time needs close examination, especially as an atomic time-scale of high precision is available for current use. No change in the IAU system of astronomical constants will be made at this General Assembly, but the discussions of the Colloquium showed that it may be possible and desirable to adopt changes in 1973 so that the next generation of fundamental catalogues and ephemerides may be based on a more accurate set of parameters.

G. A. Wilkins

NOTICES

Excursions:

Please exchange your vouchers for tickets for all excursions as persons without tickets cannot be allowed on the coaches.

Saturday Afternoon Excursions:

There are still a few tickets available especially for the excursions to Penshurst, Petworth and Danny House.

Stonehenge:

There are still a few tickets available. Apply soon.

Jodrell Bank Open Day:

Participants and their families who intend to visit Jodrell Bank on Friday, 28th August, should collect their admission cards from the desk on the 1st Floor of Falmer House (turn left at top of stairs) by noon today.

Will participants please note that the Open Day on Saturday, 29th August, has been cancelled.

The Gardner Centre for the Arts at the University still have some seats available for tonight, Friday and Saturday for the play 'Bloomers' by Carl Sternheim. Tickets may be obtained from the Box Office at the Arts Centre.

In addition the Arts Centre announces that the licensed bar is also open for sandwiches and coffee from 12-2.30 p.m. and 6-7.30 p.m.

Will all participants please note that each commission has a notice board in the cloisters outside the Assembly Centre?

Will all presidents of commissions please see that details of programmes and changes of programmes are put on their board?

Commission 28 The Working Group on Galaxy Photometry will meet on:

Friday, 21st at 11.15 in Room VI

Monday, 24th at 9.15 in Room VI

G. de Vaucouleurs, Chairman of Working Party.

The Working group on Supernovae will meet on

Tuesday, 25th at 11.15 in Room II.

F. Zwicky, Chairman of Commission.

Susi Jeans and Edward Melkus and the Herschel Chamber Orchestra were given a standing ovation at the end of the Orchestral Concert in the Meeting House on Tuesday.

The programme for this concert included an article by Susi Jeans on William Herschel as a musician and this contains previously unpublished information. There are still some copies of this programme available and they can be collected from the Cultural Events Counter in the Assembly Centre.

Practical help for God, Gamow and Hoyle ?

This afternoon at the meeting of commission 47 in Room VII, P.J.E. Peebles will report on "Recent work on galaxy formation at Princeton."

THE ASTRONOMICAL SIGNIFICANCE OF STONEHENGE

The official guidebook, a copy of which is being provided for each participant on the excursion to Stonehenge on Sunday, August 23rd, refers briefly to the recent work by G.S.Hawkins, F.Hoyle and others on the possibility that Stonehenge was used to predict eclipses. Unfortunately it has not proved practicable to arrange a discussion meeting on this subject; and a talk on site during the excursion is impossible, largely because there will be too many other people there at the same time. Dr. Hawkins has, however, supplied a number of reprints of his papers and these will be available for distribution in the Reading and Writing Room at the Assembly Centre; in addition there will be a set of other reprints for consultation only.

Dr. Hawkins has also kindly contributed the following short note which summarises, in a non-controversial manner, the present state of the general theory.

I restrict myself to the following comments. There can be no doubt of the astronomical significance of the alignments in respect of the extreme positions of the risings and settings of the Sun and Moon; and consequently in the effect of the motion of the nodes of the moon's orbit. Those of us who have predicted eclipses by conventional methods, or have studied the various eclipse cycles based on relevant mean motions, have had our interest excited by the knowledge that neolithic man was aware of the effect of these cycles. It seems, unlikely however that (as Hoyle conjectures in his 1966 article in *Nature*) he may have associated this with the existence of an invisible all-powerful god, instead of the more solid dragon of later times that gave his name to the draconic month.

D.H. Sadler

recent advances

In recent years the archaeological knowledge concerning Stonehenge has reached a level of detail sufficient to encourage other disciplines to attempt to investigate the purpose of the structure. Radiocarbon dating and other archaeological evidence indicate that the work at Stonehenge began around 2000 B.C. with the digging of a ditch and holes. The erection of the stone parts of Stonehenge, the trilithon archways, sarsen circle, etc., commenced about 1700 B.C. I have shown that the post holes, stones, and archways align approximately with the rising and setting of the extreme positions of the sun and moon on the horizon. The sun, of course, would touch 4 extreme positions during one tropical year, but the moon would require 18.6 years to complete a cycle. There are 8 extrema for the moon in its rising and setting. Thus it seems evident that Stonehenge, built and rebuilt by different cultural groups, had a consistent astronomical building plan throughout the period. Archaeological excavations established the number of holes in the various circles that had been dug and subsequently refilled, either by natural causes or by man. The numbers in the circles are very significant from the astronomical point of view. A circle of 29 holes and a circle of 30 holes seem to represent the long and short synodic months of ancient calendars. The 56 Aubrey holes could well represent three complete cycles of moon extrema, and/or a seasonal eclipse cycle. I therefore suggested that the circles at Stonehenge were used for marking the phases of the moon for counting off the interval between the extremes of the moon, and also for predicting the year in which solstice eclipses might take place. subtleties. I reply that the work may be regarded as no more than empirical observation of events marked by a simple counting technique based on the circle. R.J.C. Atkinson, although conceding I have been supported by Hoyle, Newham, and others, and criticized by archaeologists and by Emanuel Velikovskiy. Jaquetta Hawkes argues that the intellect of secondary neolithic man was not sufficient to comprehend these astronomical



Stonehenge

that the structure does have an astronomical basis, questions the accuracy of the alignments and wonders whether some of them are due to chance. Admittedly the errors in some instances amount to several diameters of the sun or moon, but Hoyle has suggested that some of the off-sets are deliberate. For the sarsen circle, the sun or moon, despite the error, is always observable within the narrow archway.

Concerning the element of chance it is hard to produce a valid, rigorous statistical argument. Perhaps it is sufficient to say that for the past three years I have measured hundreds of ancient lines in the desert of Peru because they purported to be "astronomical". I have completed the analysis using the Stonehenge program and find no significant pattern of sun or moon alignments within these lines.

Gerald S. Hawkins

ALL ABOUT TONIGHT'S ORCHESTRAL CONCERT IN THE DOME

Tonight the Royal Philharmonic Orchestra conducted by Norman del Mar and with Malcolm Binns (Piano) as soloist gives a concert of British music by Sir Edward Elgar, John Ireland and Ralph Vaughan Williams in the Dome.

Edward Elgar (1857-1934) was born at Broad heath, near Worcester. He at first studied law but his love for music soon caused him to give up his studies and accept the post of bandmaster at the county lunatic asylum at Worcester. He met with such an unusual combination of instrumentalists at the asylum that he was forced to make his own arrangements of much of the music they performed, and this played an important part in developing his capabilities as an ochestrator. His recognition as one of his country's most outstanding composers came only after his composition of the "Enigma Variations" in 1899. He is perhaps best remembered for his mystic and poetic oratorio "The Dream of Gerontius", his nationalistic "Pomp and circumstance" marches and his romantic and intimate violin and cello concertos.

Ralph Vaughan Williams (1872-1958) was born at Down Ampney in Gloucestershire. He began his musical studies under Parry and Stanford at the Royal College of Music, where he later served on the faculty for forty years. He continued his education in Germany with Max Bruch, and in 1908 he spent eight months with Ravel - an experience which considerably strengthened his own orchestral technique. He was deeply interested in the carols, madrigals, folk-songs and dances of the Tudor period and many of his major orchestral works are themselves elaborate settings of these previously neglected works. As a consequence of his interest and research into English folk music, his own work derives many of its qualities - qualities such as modal writing, robust rythms transparent counterpoint and serene melodic lines - from these sources.

John Ireland (1879-1962) was born at Bowden in Cheshire. He had a very literary background: his father was editor of "The Manchester Examiner and Times" and his mother was a writer. Early in his life he showed a marked talent for music and at the age of fourteen he entered the Royal College of Music where he studied under Stanford and

THE GOOD (?) OLD DAYS

In his report on the meeting of Commission 35 at the 1935 (Paris) Assembly of the I.A.U., Sir Arthur Eddington writes; "The Commission spent an hour (sic!) in a general discussion of problems of stellar constitution." Nowadays there is rather more to talk about and commission meetings last a little longer.

EVEN HOMER NODS....

"As regards white dwarfs...the so-called relativistic degeneracy formula is altogether fallacious, and...the ordinary formula is correct." A.S. Eddington - presidential report, Commission 35, 1938.

"...white dwarfs, where the theory of relativistic degeneracy appears to be adequate". H.N. Russell - presidential report, Commission 35, 1950.

Moral. Don't believe everything you are told, even if the teller is usually right.

CAT NAP

A non-registered participant was asleep at the local information desk. "Why isn't he wearing a name badge" asked a Polish delegate.

The reply was:

"That is George, the Royal Pavilion cat, who is named after the Prince Regent."

The Prince Regent, who made Brighton famous, later became King George IV of England.

where he was later to train many young composers, including Benjamin Britten. His misplaced sense of self-criticism prevented the publication of many of his earlier works but he gradually began to gain recognition as a distinguished composer of songs, piano pieces and chamber music - some of which



Malcolm Binns

won important prizes in international competitions. Unlike his contemporary, Vaughan Williams, Ireland was largely unaffected by the revival of English folk music and his work is very personal and individualistic. Norman del Mar is a former assistant of Sir Thomas Beecham, has held positions with the English Opera Group, Yorkshire Symphony Orchestra and the BBC Scottish Orchestra and does much work for the BBC. He has a prodigious knowledge of 19th and 20th Century Music and he is also a scholar. He is at present writing a large scale study of Richard Strauss; two of the three volumes have already been published. His recent visits to East and West Germany, Switzerland and Cuba have been most successful and in Sweden he is now conducting his own series of concerts every year.

Malcolm Binns studied at the Royal College of Music and made his London recital debut in 1956. He has since played with many orchestras in Britain and Europe and has made frequent appearances in the Henry Wood Promenade Concerts. He has a fine duo-partnership with Manoug Parikian and they have recently completed a successful concert series of music for piano and violin at the Queen Elizabeth Hall, London.

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General Assembly of the International Astronomical Union

Brighton, Sussex

21st August 1970

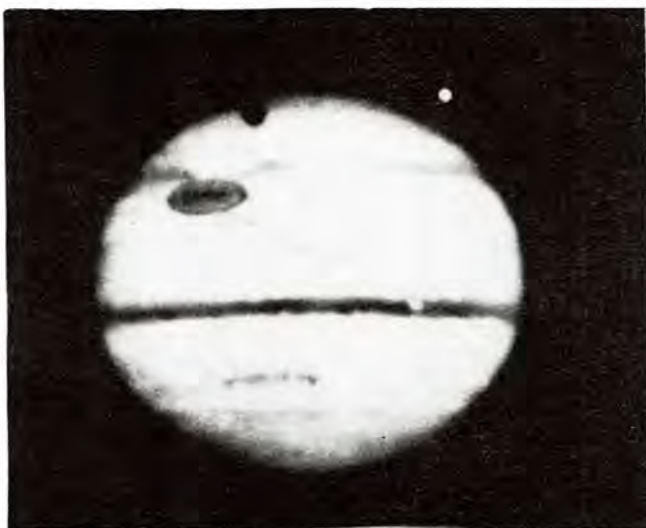
TODAY: LUNAR EXPLORATION AND PLANETARY ORIGINS

In the past few years astronomers have been taking a renewed interest in the Solar System and today might well be called the Solar System Day of this General Assembly. Throughout the day in Meeting Room I there will be a Joint Discussion about the Origin of the Earth and Planets, while this evening in the Dome there will be a special meeting "Results from Direct Exploration of the Moon and its Implications on Lunar Knowledge."

There is still considerable argument about the origin of the Solar System, although today most workers in the field accept that the Sun and the planets had a common origin and support some version of the solar nebula theory. Early difficulties, which arose because of apparent difference in chemical composition between objects in the Solar System, seem to have been cleared up. Recently a discrepancy in metallic abundances between the solar photosphere and meteorites has been resolved and it is now believed that the giant planets have essentially solar composition and that the terrestrial planets have lost most of their light volatile gases. There are still some problems in the precise comparison of chemical composition between the giant planets and the Sun and Mercury appears as an odd object amongst the other terrestrial planets, but it is not implausible that these difficulties can be cleared up.

controversy

There is still much more controversy about the exact method of formation of the planets. Some workers believe that they were all formed by the aggregation of small solid particles which first condensed out of the nebula but others think that they evolved from primary gaseous sub-condensations and that in some cases such a primary body may have fragmented to form two or more planets or



Jupiter and Ganymede

satellites. The old suggestion that the Moon was formed by fission from the Earth has recently been supplemented by the suggestion that the Earth, Moon and Mars may have been formed from one parent body.

One problem, that never seems to have been fully discussed in any theory of planetary formation from a primitive solar nebula, is how the material in a ring in an approximately axially symmetric solar nebula is collected together to form a planet on one side of the Sun. If the centre of mass of the Solar Nebula coincided with the centre of mass of the primitive Sun, what process caused it to move



Lunar landscape

to its present position close to the solar surface? The renewed interest in the solar system has certainly been stimulated by the recent space missions to the Moon, Mars and Venus. From the Moon, we now have lunar samples which give us information about such things as chemical composition, crystal structure and thermal and magnetic properties of the material of part of the Moon's surface. In the case of Mars, the long discredited network of canals has been replaced by a system of craters very similar to those on the Moon and this has perhaps led to thoughts of a common origin for the Moon and Mars. Space probes have penetrated the opaque atmosphere of Venus and have given information about the surface of the planet beneath. More information has probably been gained about the planets in the last ten years than was previously known and today's meetings will give us an opportunity to decide exactly what has been learnt.

R.J. Tayler.

ANNOUNCEMENTS

Carl Zeiss, Oberkochen (GFR) have opened a temporary office during the General Assembly in Norfolk Hotel, Kings Road, Brighton. Tel. 738201.

If you wish to have a discussion on astronomical instruments and equipment, please contact the office or give a message to C. Kuhne, 2233.

The Managing Director of Baytree House, specialists in early scientific instruments invite participants to come and look at their display. At present, they have a number of 18th Century reflecting telescopes, together with a number of 19th Century observatory reflecting telescopes. Also available are a number of other early optical instruments.

Baytree House is open every day of the week or an appointment may be made by telephoning M. Lovett (Managing Director) at Brighton 724688. Baytree House is situated at 19 Middle Street, Brighton.

Church Service, 23rd August, 1970. The University Chaplain, the Rev. M.D. Jacobs, will conduct an Anglican Service of Holy Communion in the University Chapel (in the Meeting House) at 10.00 on Sunday, 23rd August, 1970. I. A. U. participants and others interested are cordially invited to attend.

I A U NOTICES

- Joint Meeting of Commissions 29 and 36
Tuesday, August 25th, 09.30 and 11.30, Room VIII.
How to determine abundances (Chairman, Greenstein)
Underhill: "What does one need to know to determine abundances?"
Griffin: "How accurate are measurements of equivalent widths and line profiles?"
Pagel: "Uses and limitations of the differential curve of growth method"
Aller: "Use of line profiles in abundance work"
Cayrel: "Comparison of high dispersion studies with scanner work"
Unsold: "General survey of recent experimental and theoretical work on the abundance problem".

- Commission 29 (President, M.W. Feast)
Tuesday, August 25, 14.15, Room XI
Bell: "Spectrum Synthesis with a computer"
Conti: "Spectroscopic studies of O-type stars"
Searle: "Spectra of horizontal branch stars"
Seveiney: "Measurements of weak magnetic fields"

- Commission 47
This commission has been formed at this General Assembly. Proposals for membership of the Commission and its Organising Committee and full details of the programmes of its meetings can be obtained from the notice board or M.S. Longair, 9074.

Additional Meetings:

- Commission 16
Monday, 24th August, 16.00 Room V
Commission 20 - Minor Planets Comets and Satellites - Additional Meeting (c)
Wednesday, August 26th, 11.15 Room IV.
Commission 29
Monday, 24th August, 11.15 Room V

BOOK EXHIBITION

The range of abstracts, journals and "rapid listing of titles" (current awareness) journals published by INSPEC (United Kingdom) is displayed at the entrance to the Book Exhibition. Free literature about these and other INSPEC services is available there.



Do you recognise Meeting Room I?
This is how the Sportcentre looks during the rest of the year

THE CRAB NEBULA: MANY NEW OBSERVATIONS

IAU Symposium No. 46

One of the meetings held shortly before the General Assembly was IAU Symposium No. 46 on the Crab Nebula, at Jodrell Bank between August 5th and 7th. Here is a report of the symposium from one of those present.

IAU Symposium No. 46 on the Crab Nebula was held under the joint auspices of the University of Manchester and the Nuffield Radio Astronomy Laboratories. The topical nature of the subject made for an extremely crowded programme and it was a pity that the lack of time required so many interesting, and potentially useful discussions to be cut off in their embryonic stages.

It is evident that the observational problems provided by the Crab are now being attacked on the whole spectral front. X-ray searches have as yet provided only upper limits and it is not clear if these lie above or below the extrapolated X-ray spectrum.

New high resolution radio maps from Cambridge at one and six centimetres were presented and seemed to show a good correlation with photographs in the optical continuum. Areas of low polarization correspond with the positions of negative velocity wisps, and it was suggested that this implied large Faraday Rotations with consequent depolarization.

Professor R. Minkowski questioned the observations of the pulsar proper motion and said that he did not think it moved very much with respect to the convergence centre of the nebula. The value of 0.009 seconds of arc per year was probably influenced by the presence of a fast moving wisp close by.



The Crab Nebula

There was extensive polarization data given for both the nebula and the pulsar. Professor F.G. Smith commented that the technique of recording the Stokes' parameters averaged over many pulses might lead to a misinterpretation of the amount of circular polarization present. V could very well average to zero and it would thus be more meaningful to look at individual pulses. It was pointed out that the linear polarization in the pulses was at the same position angle as in the closely surrounding part of the nebula.

Timing observations of the pulsar period show some anomalies which remain after all local corrections

have been taken into account. It was tentatively suggested that they could be explained by the existence of a planet or planets moving in highly eccentric orbits. It is even possible in this way to explain sudden period changes like that observed in September, 1969.

The equation of state for neutron star material provides a theoretical problem of some magnitude. Professor W.A. Fowler commented that there was no hope of getting this from Nuclear Physics. He suggested calculating the effective ratio of specified heats after constructing a particular model. One relation was arrived at very readily; it takes the form

$$H \sim \exp \rho$$

where ρ is the density of the star and H the 'horribleness' of the theory.

Radiation mechanisms in the pulsar and the electrodynamic link with the nebula were discussed from many points of view, sometimes with the realization that there is a large and rapidly increasing fund of observational data to explain. Throughout the Symposium speakers stressed the relations between the Crab and other supernova remnants and pulsars. Dr. S. van den Bergh discussed in particular Cassiopeia A, the youngest known supernova remnant. The discovering of a pulsar here would be particularly exciting, but if it exists it is suggested that its detection might be hindered by it having a very short period. Credit is due to the organisers for providing an excellent venue for the Symposium.

R. A. E. Fosbury

WHAT IS THE DISTANCE TO GALACTIC CENTRE?

One subject which has been much discussed at previous General Assemblies of the I. A. U. is the shape and size of the Galaxy and its mass distribution. Two meetings at this Assembly will be particularly concerned with the distance of the Sun from the centre of the Galaxy, about which there is at present renewed conjecture. The I. A. U. recommended value for this distance is at present 10 kpc.



Bright idea: one American delegate who solved the baby-sitting problem

This afternoon at 14.15 in Meeting Room XI, a joint meeting of five commissions (24 Stellar Parallaxes and Proper Motions, 27 Variable Stars, 30 Radial Velocities, 33 Structure and Dynamics of the Galaxy and 37 Star Clusters and Associations) will be concerned with the absolute magnitude of the RR Lyrae stars. One estimate of the distance to the galactic centre was made by Baade, who measured the apparent magnitude of RR Lyrae stars in a region of relatively low interstellar absorption near the galactic centre. He obtained a value of 8.2 kpc for the distance to the centre by using the then believed value for the absolute magnitude of RR Lyrae stars. This method is uncertain, not only because of errors in the absolute magnitude but also because of difficulties in estimating the absorption. Baade's method was subsequently used by other workers who obtained a distance of 9.9 kpc, close to the adopted "best value" of 10 kpc.

suggestions

Recently there have been suggestions that the absolute magnitude of RR Lyraes deduced from statistics of radial velocities and proper motions should be greater than was previously believed. If the stars are fainter, the distance to the galactic centre is less than 10 kpc. One commission which is not directly concerned with the organisation of today's meeting but which will be closely interested in its results, is Commission 35, Stellar Constitution. As any revision of the absolute magnitude of the RR Lyraes in globular clusters would also change the main sequence magnitudes, this might have important effects on the comparison of theory and observation for low mass stars, in such matters as the determination of chemical composition and ages of star clusters. On Wednesday, 26th August at 09.30, also in Room XI, Commission 33 will meet alone to discuss the distance scale of the Galaxy. Here other methods than the use of RR Lyraes will be considered and it will be interesting to see whether any case is made out for a change in the adopted "best value" of 10 kpc. Whatever is the result of these meetings, it should be clear that there is a continuing need for careful work in those less exciting branches of astronomy which lead to our knowledge of distance scales not only in the Galaxy, but also throughout the Universe.

R. J. Tayler.

LOC NOTICES

Song Recital - Tuesday, August 25th - 20.30 in the Meeting House.

There are still tickets available for this recital of songs by Schumann, Schubert, Britten and Finzi by Ian and Jennifer Partridge. Tickets will now be issued to all those wishing to attend, whether or not they have vouchers.

Railway Season Tickets

Will all participants who do not need their season ticket please return them to the Assembly Centre. These are valuable!

Slide Making: All participants who need to have slides produced should hand in their material before 10.00 if required for the afternoon session of the same day and before 14.00 for the following morning.

LOST PROPERTY

Monday:
Gold Plated Ball Pen, 'Papermate' - Wellgate, 9196

Tuesday:
Round Modern Metal Gold-framed Spectacles (in Pavilion) - Silk, 8581
Participant's Portfolio - Ardelberg, 6508

Wednesday:
Participant's Portfolio (left in Dome) - Lausberg, 3016

Thursday:
Gentleman's raincoat dark green/tan (left in Brighton) - Wackernagel, 8437
Tie clasp, phi beta kappa key - Wentzel, 8352
also small tie clasp in purple plastic - Alley, 8783

If these articles are found they should be given in at the Porter's desk, Falmer House.

TAIL-PIECE

Overheard outside the Dome before the Opening Ceremony:

1st long-haired youth: "What's going on?"
2nd long-haired youth: "Dunno, but its worth demonstrating against it."

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General Assembly of the International Astronomical Union

HOYLE ON THE ORIGIN OF THE EARTH AND PLANETS

Brighton, Sussex

22nd August 1970

EXPLAINING SOME OF THE MYSTERIES OF RADIO GALAXIES

by J. and S. MITTON

The opening sessions of Commissions 40 (radio astronomy) and 28 (galaxies) have particularly emphasized the large number of observational and theoretical topics to be attacked in the near future.

Evolution of Radio Galaxies

On Thursday Dr. Peter Scheuer of the Mullard Radio Astronomy Observatory reviewed recent progress in unravelling the knotty problems associated with the evolution of radio galaxies. New general relativistic calculations indicate that it is possible to turn gravitational energy into radiant energy, with an efficiency of 40 per cent, with a supermassive, rotating "black hole" at the galactic centre, and thus go some way towards accounting for the enormous energy requirements of radio galaxies. A unified picture of each stage in the evolution is now emerging from recent high resolution observations. The compact plasma clouds with diameters of 0.01 arc sec formed in several radio galaxies have physical sizes as small as 3 light years. The yearly outbursts observed in these sources are probably caused by the injection of new, dense plasma clouds. Further evidence for numerous clouds of matter, ejected from galactic nuclei at a speed approaching that of light, comes from the multiple absorption line redshifts of quasars.

plasma clouds

Evidence of the Intergalactic Medium ?

During the latter stages of evolution more problems arise: one is that the plasma clouds remain quite compact even when they are well outside the parent galaxy. Possibly a hydrodynamic shock wave in the circumgalactic medium prevents them from expanding at high speeds. If this shock wave is responsible for the tight containment, it may also lead to replenishment of energy in the radiating plasma cloud.

New Microwave Receiver Developed

Exciting observational developments are also in progress. A bright future for microwave and infrared astronomy is predicted by Dr. B.T. Ulrich of the U.S.A. He described a new type of detector for the 200 to 3000 GHz region. His wideband video receiver exploits the d.c. Josephson effect to detect radiation in this previously inaccessible frequency band. Design is also in progress for a superheterodyne system based on an a.c. Josephson junction. As the peak of emission from quasars and galactic nuclei is in the infrared, these new receivers are an invaluable tool for astronomers.

gravitational waves

UK Gravitational Wave Experiment

The UK now has its own gravitational wave experiment. Dr. J.V. Jelley of Harwell explained that if Weber's gravitational waves are really extra-terrestrial, then powerful pulses of radio emission will also be present. Five widely



Monitoring an incoming time signal in the Control Room at Herstmonceux

separated stations in the UK are searching for strong, pulsed, 151 MHz radiation from the galactic centre. Five events, coincident at three stations, have turned up so far; these include some strange multiple bursts of unknown origin. Further experiments are in progress.

The first session of yesterday's joint discussion on the Origin of the Earth and Planets was concerned with the Solar Nebula.

F. Hoyle reviewed the subject. He explained that, if the planetary material originally had solar composition, the original masses of the giant planets and terrestrial planets were comparable. The concentration of angular momentum in the planets could be explained if the sun shed about one per cent of its mass when its radius was the present size of Mercury's orbit. He believed that a magnetic transference of angular momentum was essential and that this needed a field of 100 gauss. The outermost planets would lose their light elements because their velocity of sound exceeded the escape velocity and the condensation of refractory metals to form the terrestrial planets would be possible even at the very early stages. He concluded by saying that it appeared likely that the formation of the solar system was immediately preceded by a burst of element synthesis by rapid neutron capture.

discussion

In the following discussion, Schatzman stressed that the collapse from the radius of Pluto's orbit to that of Mercury took place in a few centuries. Herbig said that observations of T Tauri stars, chromospheric activity and infra-red objects should give useful information. Gold thought that the present regular arrangement of the planets must have been preceded by a long period of formation of small primary objects, collisions and further aggregation. Cameron presented a view of the formation of the solar nebula which differed considerably from that of Hoyle and led to the formation of hot planets.

THE GALAXY MACHINE: a new development from the Royal Observatory, Edinburgh

A recent instrumental development at the Royal Observatory, Edinburgh is the GALAXY machine which is a system for measuring the positions, sizes and densities of spot-like images on photographic plates.

GALAXY has four main features:

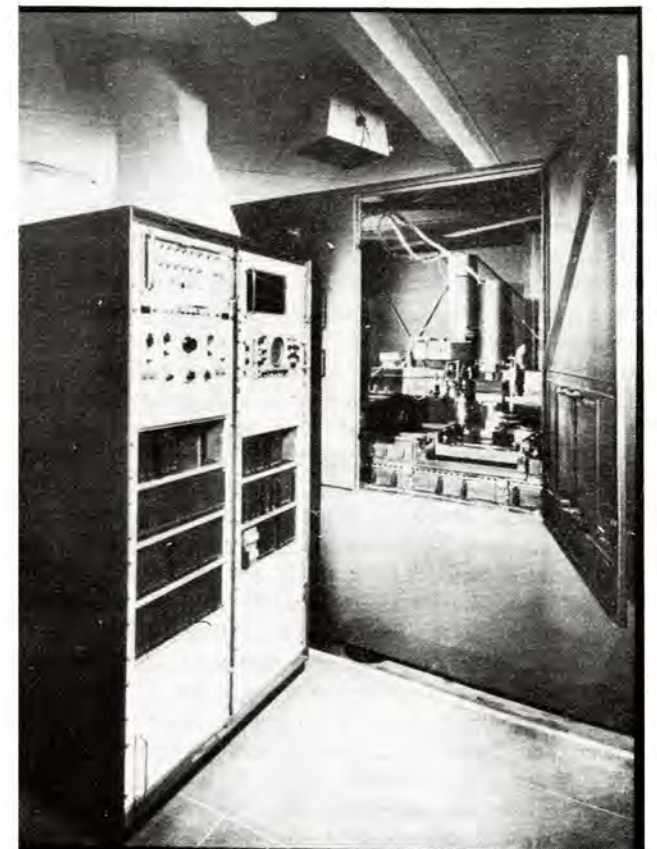
- (1) A precise mechanical carriage to hold the photograph to be measured.
- (2) A moiré fringe system for measurement of the carriage position.
- (3) Flying spot scanners to find and measure star images.
- (4) An electronic system to control the operations and to optimise the measurements.

The machine has two modes of operation, search and measurement.

In the search mode the spot scans a line at a rate of 80,000 spot areas per second and so resolved images can be detected at rates up to 40,000 per second. At present the machine takes 0.28 seconds to step from one scanning line to the next, but a much more rapid search mode will be able to be obtained with continuous carriage drive and magnetic tape output. A finding list of images on the plate is produced.

In the measurement mode, the scanner uses a 1 micron spot and makes a series of concentric decreasing circles, 1/8 micron apart, from a radius of 128 microns to 2 microns, closely representing an inwardly spiralling scan, 30 complete scans being made each second. Variation in transmitted light with azimuth gives centering information - the carriage moves until the image is centred on the spiral scan and the position of the carriage is measured by the moiré fringe system in increments of one micron.

Simultaneously transmission through the image is measured as a function of radius and the measured image profile is weighted and integrated. GALAXY has a wide range of possible applications.



The GALAXY machine

The first model was developed jointly by the manufacturers Faul Coradi, Scotland, Ltd., of Haddington and the Royal Observatory, Edinburgh. The Royal Observatory, Edinburgh has already undertaken to measure photographs supplied by six foreign and four U.K. observatories, in addition to its own intensive programme.

REPORTING ON COMPACT GALAXIES AND QUASARS

This report on IAU Symposium No. 44 which was held in Uppsala between August 10th and 14th has been received from one of the delegates.

Some 160 astronomers spent a busy week presenting or listening to a dozen survey lectures and almost 70 shorter papers.

The first series dealt with the stellar and gaseous contents of galaxies. These are subjects to which the observers are currently devoting massive efforts. One special interest concerning the gas is that it is helping to show that certain small groups of galaxies in the sky really do form physical systems since the members are seen to be connected by some of the gas.

The second and longest series was on "compact objects" (quasi-stellar objects, compact galaxies, Seyfert nuclei and galactic nuclei generally). It is surprising that it is possible to proceed so far in treating these objects as forming a single category for the purpose of many observational and theoretical studies. The theoretical ideas that find a measure of support at the present time treat some of the objects as rather like very large versions of the Crab Nebula; angular momentum, magnetic fields, gravitational collapse and "black holes" are all involved.

redshifts

The third series of papers were about observational cosmology. Several dealt with small groupings of galaxies that show disparate redshifts; two different interpretations each found some observational support - in certain cases two or three more numerous groups, each with its own quite well-defined redshift, occupy overlapping regions of the sky and so fortuitously give rise to small apparent groupings; in other cases of groupings, where there is good supporting evidence for physical connexions, there remain unexplained differences in the redshifts. A curious historical "anti-parallel" concerns the vexed problem of intergalactic matter: when interstellar matter was first studied, astronomers were reluctant to accept the evidence for its existence because it seemed to upset current theories of the Galaxy; today astronomers seem reluctant to accept the evidence for the non-existence of much intergalactic matter because this would upset some well-known theories of the universe! Cosmologists are still busy trying to find values for the

acceleration-parameter, and the density-parameter for some acceptable cosmological model. In doing this, they are driven more and more to examine evolutionary effects of all kinds. However, at least one cosmologist considers the most important problem at present to be that of the relationship, apparently involving fundamental concepts of



M 87 showing jet

quantization, between the arrow of time and the expansion of the universe.

While it would be invidious to single out some speakers for individual mention, all participants would wish to record their deep appreciation of the splendid arrangements made by Professor Erik Holmberg and his colleagues for a wonderfully happy and successful meeting.

W.H. McCrea.

NEW PHOTOMETER

Ten-channel photometer: K. Serkowski has reported the development of an instrument which has been used both for observing the polarization of starlight in five colours simultaneously, and for observing with two apertures in five colours simultaneously. In this way, a continuous correction is obtained for fluctuations in the background sky brightness. Stellar colours may be measured on nights of variable transparency; the correction to a colour index is only 0.7% of the visual extinction due to clouds, up to at least 9 magnitudes of extinction.

NOTICES

Commission 8 will meet on Tuesday, 25th August at 11.30 in Room XI.

Commission 22 (Meteors and Meteorites) Meetings b and c will take place in Room VI on Monday, August 24th at 14.00 and 16.00. No meetings on August 26th.

Commission 28 will meet on Monday, 24th August at 09.15 in Room VI.

Commission 33 The meeting on 'Selected Areas' will be on Wednesday, August 26th at 11.30 in Room XI (not Room III).

Commission 36 will meet on Wednesday, 26th August at 09.15 and 11.15 in Room II.

Telegrammes and long-distance telephone calls.

Please apply at local information office, or transport office (Mrs. K. Meletiou, Falmer House ground floor) Interpreters available.

Télégrammes et appels téléphoniques à l'étranger. Adressez-vous au bureau d'information local ou au bureau de transport (Mrs. K. Meletiou, Falmer House au rez-de-chaussée). Il y a des interprètes

PHOTOGRAPHS of delegates are on view in Falmer House opposite the L.O.C. desk. These may be purchased and delegates are asked to place their orders at the earliest opportunity so that photographs may be completed before their departure.

CATHOLIC MASS

(at the University Chapel)

Sat, Mon, Tue, Wed, at 12.40; Sunday at 19.30.

Lost: D.A. Mendis, 8591, lost a brown wallet containing visa etc., in the Sportcentre (Meeting Room I) on Friday morning.

A l'attention des Participants Français !

Tous les participants Français au Congrès de l'UAI sont invités à une réunion sur les orientations scientifiques du Laboratoire d'Astrophysique de Meudon (en construction) qui aura lieu le Lundi, 24 Aout à 17 heures 45. Salle IX (Physics Building).

U. Frisch,
R. MacCarroll,
E. Schatzman.

Mrs. A. Rakos of Austria, who speaks German and English would like to meet another lady wishing to go sightseeing in London on Monday, Tuesday or Wednesday. Contact at box 2001.

DO WE UNDERSTAND THE ROTATION OF STARS?

Most people would probably agree that the general structure of spherical stars is now well understood, although details of particular models cannot be trusted until there is a definitive solution to the problem of stellar opacity. By contrast, our understanding of rotating stars is still at a much more primitive stage. Nonetheless, there has been a tremendous resurgence of interest in the effects of rotation in the past five years or so, and it may be that at this Assembly someone will produce some new unifying idea. For the moment, I shall attempt to summarise the present state of confusion.

It has been known since the pioneering work of von Zeipel that real stars could not rotate uniformly unless there were some constraint, like viscosity or a magnetic field, which would prevent the Coriolis forces due to the thermally driven meridional circulation from redistributing the angular momentum. However, the mathematical problems involved in finding a general steady state solution with circulation present are so great that attention has tended to focus on uniform rotation, or particular laws of non-uniform rotation, with a tacit neglect of the upsetting effect of circulation. Alternatively, models of stars in circulation-free differential rotation have been studied.

However, even if such steady states can exist, there can be no guarantee that they will until their stability is examined. First reports of detailed stability analyses were made at the Prague meeting of the IAU, and for a time the situation seemed quite hopeless, as a fair summary seemed to be: (a) all steady states are unstable; and (b) all stable states are unsteady (i.e. will be changed by circulation).

by R.C.SMITH

Recent investigations of the timescales of the instabilities, however, have made it less certain that instabilities will have an important effect in determining the actual rotation law of a star, particularly in view of the recent suggestion of a new "damping instability," since it now seems possible that the effective timescales may be at least as long as the evolutionary timescale. There still remains the problem of circulation. Although, for uniformly rotating stars, the timescale of circulatory mixing is very long (except near the surface), it is not known whether that remains true for differentially rotating stars, since no-one has made a detailed study of circulation in the presence of strong differential rotation. (In evolved stars, where molecular weight gradients will form a barrier to circulation, the effects of circulation can probably be neglected.)

observations

In this situation, even the most convinced theoretician must appeal to the observer for help. It is one advantage of the equations of stellar structure that the structure equations decouple from the equations for the circulation, so long as the

circulation velocities are small enough. This means that most of the observable quantities can be determined for a particular rotation law without explicitly calculating the effect of circulation. It is therefore possible to make a grid of theoretical predictions and to ask whereabouts the observations fall. Unfortunately, there are two snags to this procedure at present. First, theoretical calculations have tended, to result in predictions of, for example, total luminosity, whereas the observable quantity, the absolute magnitude, depends also on the direction from which the star is viewed. More relation of theoretical predictions to directly observable quantities is needed. However, some results exist and it should be straightforward to obtain more.

The more difficult problem is that there is a serious lack of data of sufficient accuracy. At present, only statistical arguments can be used, since there is, in general, no direct way of discovering the orientation of the rotation axis of a star, and there are just not enough stars for which we know the colour, absolute magnitude and projected rotation speed with sufficient accuracy to make a reliable statistical analysis. The observational problems in obtaining accurate data in the quantity required are formidable.

We must conclude that the only star for which we know anything about its rotation law is our own Sun - and even in that case there are fierce arguments about what is happening in the interior! The answer to the question in the title is - at present, we just don't know.

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General Assembly of the International Astronomical Union

Brighton, Sussex

24th August 1970

THE MOON: MISSIONS, GEOLOGICAL STRUCTURE AND AGE

Friday's special meeting at the Dome was opened by Captain Lee Scheerer, Head of NASA's Space Exploration Unit in Washington, who described the previous manned missions to the Moon and plans for future missions. The useful weight of scientific equipment carried increased significantly between Apollo 11 and 12 and will be roughly doubled again on Apollo 14. Apollo 16 will carry a vehicle and this will enable greater journeys to be made. Regions with a variety of surface features are being chosen for landing sites and special attention is being given to obtaining a good network of scientific stations with seismometers, magnetometers, laser reflectors and other equipment. Captain Scheerer also discussed the scientific results briefly and indicated that the sizes of lunar craters were now known to range from about 10^{-6} to 10^5 m. At present 139 groups of scientists are analysing lunar samples but there will be need for further groups when later samples are received.

G. Fielder discussed lunar geology. There is evidence of widespread igneous activity including volcanic flows near Tycho which are 12 km wide and 20 km long. There are much larger lava flows in maria. He showed a film of an experiment in which rock placed in a vacuum "frothed up" as its gases escaped. Subsequently hard impacts produced marble-like fragments similar to those found on the lunar surface.

mascons

These "marbles" are good insulators and would float on the lava and prevent it from cooling rapidly. Large concentrations of dense lava in some maria might account for mascons.

There is certainly movement of lunar material occurring today. Surveyor 3 was covered with fine dust in $2\frac{1}{2}$ years and there is evidence of material moving down slopes. In some regions the surface has a criss-cross raked over appearance which is correlated with large scale features. As the timescale of mixing in the top few centimetres of the lunar surface rubble is only a few million years, this grid must be regenerated. The rubble must be coupled to the bedrock and faults must have developed in the last few million years.

P. Gast discussed measurements of ages and chemical composition of lunar samples. For both Apollo 11 and 12 samples the Rb/Sr ages for the crystalline material are about 3.5×10^9 years and similar results are obtained using other radioactive isotopes. The lunar soil gives a different value lying between 4.0 and 4.5×10^9 years. The reason for this difference is not clear but it is possible that the soil has been produced from bedrock which did crystallise before the surface rocks. There are considerable differences between the solar chemical compositions and that of the lunar samples studied to date. With abundances normalised at silicon, lunar values range between 10^2 and 10^{-2} of solar values. The rare earths all show similar behaviour, with the exception of europium; the iron group is abundant but oxygen and heavy metals are not and the overall abundances are very different from chondritic meteorites. The low abundance of heavy metals suggests that the moon was hot when it formed but the iron values do not support this and a serious puzzle remains.

(Unfortunately our reporter fell asleep before the two final papers).



WHAT THE IAU HAS BEEN DOING FOR THE EDUCATION OF ASTRONOMERS

Six years ago the IAU formed Commission 46 for the Teaching of Astronomy. Its task, which is of great importance, is manifold because it is concerned with both education of astronomers and education in astronomy.

Astronomers involved in the teaching of astronomy are well aware of the importance of the development and improvement of the training of young astronomers. Probably there are as many ideas of how to do this as there are astronomers in the world. The problems are certainly different from one country to another and even from one group to another within one country. By exchanging our ideas and experiences we may learn and hopefully improve our teaching and training methods.

We also must be aware of the importance of giving some basic knowledge in astronomy to the general public; the educated citizen and the school children, some of whom might become astronomers but all of whom will become tax payers.

future plans

What work has the Commission done and what are its future plans? One of our most successful projects was the organisation of International Schools for Young Astronomers. Once a year for two months, ten or twenty young scientists from small universities are given a concentrated training on some specific topics in modern astronomy. Thanks to the enthusiastic work of the organiser of these schools, Dr. J. Kleczek, the great financial and teaching efforts of the host observatories (1967: Manchester, U.K., 1968: Arcetri/Florence, Italy, 1969: Hyderabad, India) and the generous financial support of UNESCO, our Schools have been very successful. I have no doubt that our 1970 School in Cordoba, Argentina, will be just as useful for all participants. Though UNESCO support for our Schools has become scarce, we hope to continue this or a similar project in the years to come. Our Visiting Professors project exists mainly to help countries which are remote from the main centres of astronomical research. We need to discover which universities would like to have a visiting professor for a limited period of time and also which professors are willing and able to spare some time to teach for a couple of weeks or months at one of the interested universities. Obviously both the language and the teaching of the subject have to be considered in our coordination.

To-night's Honorary Degree Ceremony In The Dome

Tonight at 20.30 in the Dome in Brighton, the University of Sussex will confer the degree of Doctor of Science (Honoris Causa) on four members of the I.A.U. They are Professor Dr. O. Heckmann, President of the I.A.U.; Professor Sir Richard Woolley, Astronomer Royal; Professor E.M. Burbidge of the University of California, La Jolla, and Academician V.L. Ginzburg of the Lebedev Institute of Physics, Moscow. The degrees will be conferred by the Vice-Chancellor, Professor Asa Briggs and the honorary graduands will be presented to the Vice-Chancellor by four members of the University: Professor Heckmann by Professor W.H. McCrea, S.R.C. Research Professor of Astronomy; Professor Woolley by Professor D. Daiches, Professor of English; Professor Burbidge by Professor J.C. West, Pro Vice-Chancellor and Dean of the School of Applied Sciences; and Academician Ginzburg by Professor R.J. Tayler, Director of the Astronomy Centre. These will be the first honorary degrees to be conferred on astronomers by the University. The degree ceremony will be immediately preceded by a procession of the Vice-Chancellor, Honorary Graduands and University Officers into the Dome and it will be followed by the Invited Discourses on Galactic Spiral Structure by B.J. Bok and C.C. Lin. As the evening's meeting will be very long, it is important that it starts on time and all members and guests are particularly requested to be in their seats by 20.15.

For the benefit of institutions which are endeavouring to build up astronomical libraries the Commission has prepared a list of Astronomy Education Material available throughout the world, which may be particularly useful for the teaching of astronomy at all levels. The 'second approximation' to this A.E.M. list is on display at the book exhibition on the upper floor of the Refectory. Some of the projects envisaged to be developed by the Commission are the following:

(i) We should like to organise a service through which small colleges and universities could obtain used or discarded observational material from larger centres which could be used to train young astronomers.

(ii) We should like to help institutions in countries short of 'hard' currency to build up small but useful modern astronomical libraries. For this we shall need the financial help of the IAU as well as the goodwill of larger astronomical centres and of individual astronomers who might be willing to provide some basic modern textbooks in astronomy and astrophysics for distribution to needy institutions.

(iii) We should like to help science teachers (in particular physics teachers) in secondary and high schools, who have had no astronomical training (as is generally the case), to integrate some basic knowledge of astronomy in their courses. It is up to us astronomers to help the teachers to acquire the basic astronomical knowledge, by organising teachers' training courses, by preparing leaflets on astronomical topics that can easily be used by science teachers and by other means.

Any astronomer who has any idea or suggestion concerning the teaching of astronomy and the work and tasks of Commission 46 is invited to contact the President or the Secretary (Dr. T.L. Swihart) of the Commission.

Edith A Muller (3504)

President of Commission 46.

ANNOUNCEMENT

Mullard Radio Astronomy Observatory, Cambridge and Cambridge University Observations.

Open Days: Friday, 28th August and Saturday, 29th August.

Visitors can still be accepted if forms (available at Excursion Desk, 1st floor, Falmer House) are returned by 17.00, Monday, 24th August.

WHITE DWARFS: PROGRESS REPORT ON THEORY AND OBSERVATION

Twenty-seven visiting participants attended the IAU Symposium No. 42 on "White Dwarfs" held on 11th to 13th August in the University of St. Andrews. The symposium brought together, for the first time in this field, both observational and theoretical astronomers, and in roughly equal numbers. The twenty-five papers presented also reflected the same approximate participation between observation and theory. A direct result of limiting the numbers of participants and papers was to provide maximum opportunity for discussion both inside and outside the lecture room.

In an introductory lecture W.J. Luyten reviewed the discovering and observation (including classification) of white dwarfs, stressing the severe lack of reliable information on masses, and making a strong plea for the determination of more parallaxes. O.J. Eggen gave an account of UBVR observations of sub-luminous stars and discussed their location in colour magnitude and colour-colour diagrams. K.Aa. Strand described the U.S. Naval Observatory program for the determination of parallaxes of white dwarfs. Work on a second series of fifty stars has been completed, while that for a further fifty stars will be completed in one year. The work at Radcliffe Observatory on the determination of the parallaxes of two white dwarfs, LB 3303 and LB 3459, was described by A.D. Thackeray. H.L. Giglas gave an account of the identification of white dwarfs in the Lowell Observatory program using the method of measuring the proper motions directly on a projection screen. An astrometric study of van Maanen's star was described by P. van de Kamp, while W. Gliese discussed the parallaxes of white dwarfs in the catalogue of nearby stars. A description of the Princeton work on the photoelectric monitoring of southern white dwarfs was given by J.E. Hesser and J.P. Ostriker presented the results of the autocorrelation analysis of observations on the period of change of DQ Herculis, giving $P = 71.065454$ sec with $\dot{P} = -0.704 \times 10^{-12}$ leading to a 'lifetime' $\tau = |P/\dot{P}| = 3.2 \times 10^6$ yr. An interesting arrangement in the H-R diagram of the horizontal branch and subdwarf B stars and the subdwarf O stars and its possible relevance to the late stages of stellar evolution was discussed by J.L. Greenstein. A search for red degenerates or red sub-luminous stars produce no new examples of these objects. A novel method for carrying out surveys for new white dwarfs using an objective prism was presented by C.B. Stephenson. The indications are that it works well for white dwarfs with strong hydrogen lines. J.B. Oke and H.L. Shipman, in a paper presented by J.L. Greenstein, described a multi-channel scanner for the scanning of white dwarf spectra. The technique is applicable down to magnitude 20 and facilitates the determination of energy curves on an absolute scale for fitting to model atmospheres. Perhaps the most controversial paper presented at the symposium was that of J. Landstreet who discussed the observation of circular and linear polarization in the white dwarf Grw +70° 8247. The argument centred on whether or not such observations, interpreted on the basis of Komp's theory, provide evidence for the presence of magnetic fields in white dwarfs, and with field strengths appropriate to their degree of condensation.

models

In a general statement on the theory of white dwarfs, S. Chandrasekhar traced the historical development of the subject from the early work of Fowler which immediately followed the discovering of Fermi-Dirac statistics to the more recent work of Salpeter and Hamada. Particular emphasis was placed on considerations of the stability of stars under conditions of degeneracy, and as modified by effects such as rotation, and the relation of such objects to the evolution of stars in general. R. Durisen and J.P. Ostriker (in a paper read by Ostriker) discussed the evolution of massive white dwarfs. It was shown that white dwarfs with masses above the Chandrasekhar limit can exist provided the angular momentum is not zero. The role of viscosity and inverse beta decay in the evolution and cooling of these bodies was also treated.



Registration at Assembly Centre

And some.....



Between meetings

...Observations.....



Scientific discussion

.....of delegates

C.R. O'Dell discussed the location and evolution of the nuclei of planetary nebulae in the H-R diagram, showing that they can account for twenty per cent of the rate of production of white dwarfs. A theoretical approach to the origin of white dwarfs was described by B. Paczynski. By evolving stellar models from which the envelopes have been discarded on grounds of instability, it is found that for initial masses below about 3 solar masses the final product resembles a white dwarf. V. Weidemann, in a summarizing paper on white dwarf atmospheres, discussed the use of two-colour diagrams in the determination of gravities, radii and masses. A critical review by H.M. van Horn of the cooling of white dwarfs paid particular attention to the validity of simplifying approximations that have been used and emphasized the important role of convection. I. Bues described her work on the construction of model atmospheres of helium-rich white dwarfs, P. Strittmatter and D. Wickramasinghe (in a paper read by Wickramasinghe) discussed convection in white dwarf atmospheres, and K-H Bohm dealt with the problems of convection zones and chromospheres in helium white dwarfs. The results of studies of the vibrational stability of white dwarfs were given by G. Vanclair, and A. Baglin discussed her work on gravitational separation and overstability in white dwarfs. In the concluding paper of the symposium, F. Zwicky gave an entertaining projection into the future, in which he attempted to relate various fundamental units of length with physical objects of varying degrees of compactness.

T.R. Carson.

HOW SHOULD MEETINGS BE RUN?

Dear IAU Members,

This is the first IAU meeting I have attended. In general it has been stimulating and worthwhile so far, but I have found one aspect rather disappointing. It is perhaps too soon to judge fairly, but writing this now will give people time to reply.

I had thought that the Commissions would be mainly devoted to discussing problems shared by many in the discipline and would be concerned with planning ahead and with disseminating information in areas where international cooperation would advance the research being done. Some invited papers to report relevant developments and to stimulate discussion along these lines are of course very appropriate.

But it seems (from my limited observations) that the Commission meetings, in many cases, have degenerated into 'paper' sessions that include many talks, often hastily prepared or reporting preliminary or specialized results, which are not well adapted to furthering general discussion. In fact often so many papers are scheduled that the time for general discussion is severely limited. I wonder if the Commission meetings gradually over the years have drifted into this pattern through the self-indulgence of the members. After all, it is very pleasant to present one's latest results to one's colleagues, even though they will soon be published or are too speculative or preliminary to warrant publication. Considering that Commissions meet so seldom and that there are many general problems meriting discussion, it seems a pity to waste time with unsuitable papers which can be presented at national or local meetings and at IAU Colloquia and Symposia.

It seems to me that the Commissions should be 'working groups'. If they are too large to accomplish this effectively, perhaps at some sessions they could subdivide into 'instant committees' which could do some of the things that people at present hope (in vain) to carry out by mail between General Assemblies. I realise that this is a more difficult task and requires more preparation than 'paper sessions' do, but I think that to avoid such activities is to neglect one of the most important functions of the IAU.

I emphasize that this letter is not a blanket condemnation. Some parts of Commission meetings have been very worthwhile indeed.

I hope that if someone disagrees with my views he or she will reply; and explain the rationale for the present set-up.

N. Houk, U.S.A
(a 'young astronomer')

Scientific Demonstration

The Directors of C.Z. Scientific Instruments Ltd., are pleased to invite participants to see a special demonstration of the "Ascocord II" Coordinate Measuring Machine.

This demonstration is being held in the London showrooms of Carl Zeiss Jena. Coaches are being arranged for Tuesday and Wednesday next, leaving the University at 9.30 a.m. and departing from London approximately 15.00.

If you wish to attend either demonstration contact the Zeiss representative at the Hotel Metropole, (Brighton 775432) on Monday, August 24th between 10.00 and 16.00 or Mr. Chivers, who will be available during coffee and tea breaks on Monday.

Lunar Maps now available

Copies of the Lunar Map, lists of names and locations, and biographies are available at the Porter's desk in the Registration room in Falmer House. The numbers are limited, so please take only one map. There will be a few minor changes in the maps, locations of several craters, and a few errors exist in the tables.

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General
Assembly of the International
Astronomical Union

Brighton, Sussex

25th August 1970

SIMULATING STELLAR SYSTEMS BY COMPUTER

by Myron Lecar

who reports IAU Colloquium No.10
"Gravitational N-body Problem"
held in Cambridge, August 12-15 1970

In our third meeting (we met in Paris and Thessaloniki in conjunction with the previous two IAU's), interest was focused on computer simulation of stellar systems. Stellar systems divide naturally into two groups depending on whether (binary) encounters or collective instabilities dominate their dynamical evolution. Associations, galactic and globular clusters fall in the first group while galaxies are in the second.

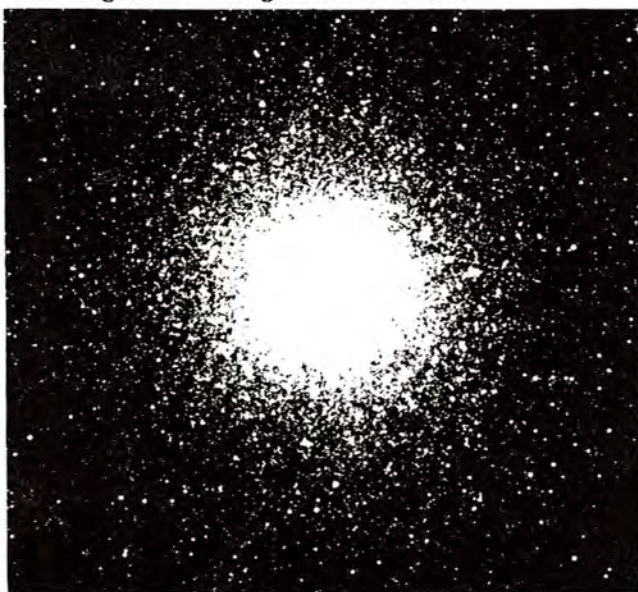
The earliest and still the most popular method of simulating clusters is by a direct integration of the Newtonian equations of motion of N mass points. In the competition for large N , Aarseth, our host in Cambridge, still leads the field with $N=500$. As with smaller N , he still finds that a central binary forms which soon soaks up all the binding energy of the system. In his latest case, before 10 per cent of the stars had escaped, the central binary had already more than 50 per cent of the total binding energy of the system. The entry of Szebehely and Bettis, and Schuster into this competition, will soon, I hope, push N up to 1,000. The direct integration is relatively assumption free but very expensive; the computing time increases as the square or cube of N per relaxation time. And for N less than 100, the results show an extremely wide dispersion. Two new methods for simulating much larger N have been developed by Henon (a Monte-Carlo treatment) and by Larson (a hydrodynamic approach). Their models do not include binaries, and the hot debate is whether their omission is unimportant or fatal.



'And what did you think of that?' Delegates engage in their own summing up at the end of what was obviously a provocative meeting....

integration

The direct integration accurately simulates galactic clusters and Wielen challenged us to reproduce the observed short dissolution times; 90 per cent break up in less than 400 million years. Taking the challenge, Wielen and also Hayli varied the tidal radius and Bouvier and Janin added encounters with clouds. With all that, the computer clusters still last longer than the galactic clusters.



Globular Star Cluster in Canes Venatica

An impressive simulation of spiral galaxies (with 50-250,000 "stars") was produced by Quirk, Miller and Prendergast and by Hohl. They both see spiral density waves. But both models are yet unable to produce the patterns predicted by Lin and Shu or by Kalnajs. The fault is now assigned to the computer models which show a puzzling tendency to heat up. Rybicki suggested that binary encounters (which for disk systems are independent of N) and Dawson suggested discrete jumps in the forces, as possible heating mechanisms in the computer models. On the analytical side, Lin, Kalnajs and

Contopoulos reported (somewhat differing versions) of the interaction of the spiral waves at the inner Lindblad resonance. As non-linear effects are important here, it may be that the galaxies themselves (real or computer) may have to lead us out of this resonance. The one-dimensional sheet model (corresponding to Z -motion in the Galaxy) is still a favourite of the theorists and numerical experimentalists. Feix proved stability for equilibrium distributions which decrease monotonically with energy (as is the case in plasmas) and Goldstein reported stability for one case where the distribution function increased monotonically with energy (to some cutoff); the latter case has not been treated for plasmas. Janin and also Lecar again demonstrated that the classical "degeneracy" predicted by Lynden-Bell holds. For the die-hards, there is now no doubt about it. The relaxed distribution functions have the low energy plateau that unmistakably signals Fermi-Dirac statistics. Further, Cuperman, Harten and Lecar also verified the "equipartition" prediction of Lynden-Bell; regions of high phase densities relax to low random velocities. But quantitatively, Lynden-Bell did not fare so well. In the experiments of Lecar and Cohen, quantitative agreement between the predicted and observed distributions was not reached no matter how "violent" the relaxation. As in earlier experiments, a significant fraction of the mass gets flung into the halo where it thereafter loafs along, refusing to "relax".

An unusual highlight of the meeting was an invited session on computer simulation in plasma physics, organised by Dawson, with Kulsrud and Feix participating. Of course, they've had the simpler homogeneous system to practise on, but nevertheless they have developed an impressive catalogue of collective instabilities, which we're just starting to fill in. Kulsrud suggested, and Gilbert and Kalnajs demonstrated that collective effects can significantly alter the relaxation times. This area needs a lot more attention.

Today's Cultural Events

- 20.00 Play: "A Touch of the Poet", Gardner Centre, University.
- 20.30 Film: "Steamboat Bill Jr.", Brighton Film Theatre, North Street.
- 20.30 Concert: Lancaster Ensemble String Quartet, Meeting Room VIII, University.
- 20.30 Song Recital: Ian and Jennifer Partridge, Meeting House, University.
- 20.30 Folk Recital: Joy Hyman and Jennifer Rice, Pavilion Theatre, Brighton.
- 21.00 Apollo 11 and 12 films, Meeting Room II, University.

Please arrive punctually at the event of your choice. We have been asked to say that the usual starting time of the play in the Gardner Centre has been changed from 19.30 to 20.00 specially for us and that the play must now start very promptly. The film, Steamboat Bill Jr., is a regular showing and it will certainly start at the advertised time. Participants going to events at the University may find it most convenient to eat at the Refectory.

NOTICES

Commission 8 Additional meeting: Tuesday, 25th August at 11.30 in Room XI.

Commission 34: Tuesday, 25th August from 14.00 to 17.30 in Room I.

Discussion on Energy Balance and Large Scale Dynamics of the Interstellar Medium. Speakers: Glyn Haslam: 'Spurs: Radio and Optical Evidence' Elly Berkhuijsen: 'Galactic continuum spurs and neutral H.'

Percy Seymour: 'Magnetic field near continuum spurs' Bill Zuzak: 'Models of Loop Structures' Tea Break

Don Wentzel: 'Acceleration and Heating of Interstellar Gas by Cosmic Rays'

Harm Habing: 'Thermal Balance in H I Regions'

Bill Roberts: 'Shock Waves and Spiral Structure'

Dick Henriksen: 'Pulsars in a Spiral Arm?'

Commission 35 An additional scientific meeting, on instabilities, will be held at 09.30 on Tuesday, 25th August (today) in Room X.

Commission 36 The subjects of the two additional scientific sessions already announced for Wednesday, August 26th in Meeting Room II will be:

09.15 Solar abundances

11.15 Non LTE problems

Television and the IAU Assembly

During much of last week, BBC Television units were to be seen at the University. The result of their work will be seen at 23.05 on Tuesday, August 25th, when there will be a programme from the Assembly on BBC1. The members of the Union who will be taking part are Dr. V.L. Ginzburg, Dr. Bart J. Bok, Dr. Anthony Hewish, and Patrick Moore. The programme is in the *Sky at Night* series, which has been broadcast monthly on BBC television since April 1957.

EDINBURGH COLLOQUIUM: 'AUTOMATION NO SUBSTITUTE FOR THINKING'

A Colloquium on Automation in Optical Astrophysics was held at Edinburgh under the auspices of the Royal Observatory and the University Astronomy Department from the 12th - 14th August and the Colloquium began with a timely reminder from Professor J. Rosch that automation should not become a substitute for thinking.

Most systems of computer control, proposed or in operation, used one computer to control both telescope and instruments and to provide real time data analysis, but the KPNO proposal requires separate computers for control and data handling, as the second computer system can be easily changed or expanded without affecting the telescope control. D.L. Crawford estimated the cost at \$120,000 per telescope system, excluding the telescope drive. At the Hale Observatories, the application of numerical control to telescopes and associated instruments increased the number of stars observed per night by about a factor of two.

There was surprise at the small size of computer systems required for telescope and instrument control and real time data analysis. The new 60 inch telescope at the Hale Observatories, and the 2.2 meter telescopes for the Max-Planck-Institut, will each use 8K of 16 bit words. The original Jodrell Bank system used 8K of 24 bit words for telescope control, instrument control and real time data handling. The new system used 12K of 24 bit words and a 50K drum store for catalogues and data storage.

autoguiders

Photoelectric autoguiders are rapidly becoming standard equipment. A.A. Hoag described the use of image dissector tubes for spectrum scanning and autoguiding. At the KPNO their use in the autoguiding enables the telescope focus, sky transparency and sky brightness also to be measured. At the Royal Observatory, Edinburgh, where photoelectric autoguiders have been in use on all telescopes for several years, that in use with the Schmidt telescope gives such small images that the limiting magnitude attained on direct photographs has been substantially extended.

An appeal to the IAU to standardize mechanical and electronic interfaces was made by I.G. van Breda. He suggested adopting KPNO mechanical arrangements and the Camac system of standard electronic interfaces as adopted by the Atomic Energy community.

computer control

Computer control of instruments at the telescope foci has been employed mostly for photoelectric photometers and spectrum scanners. The speed of operation is increased and the integration times are optimised to give a desired photometric accuracy, and the observer can see his results being built up and can intervene if something of particular or unexpected astronomical importance arises. An ingenious system of photoelectric astronomy, in which the light received at the telescope focus is modulated by an off axis multi-slit rotating disc, and measured photoelectrically, is being developed at the Leander McCormick Observatory.

Several semi-automatic microdensitometers and iris photometers were described, most of which are output on computer tape, while some are directly computer controlled or have some form of more limited programming. The wide range of Joyce Loebel microdensitometers includes new designs giving measuring speeds of up to 5,000 data points per second. Accounts were given of the development of computer controlled micro-photometers at the Lick Observatory and at the Astrophysical Laboratory at Frascati. The development of a very precise programmable microdensitometer for the Utrecht Observatory by Paul Coradi (Scotland) Ltd., was described.

A. Behr described the development of a computer controlled iris photometer for ESO. in which preset co-ordinates are read in and correct ones output after computer controlled centering. A similar system was seen in operation at the Royal Observatory, Edinburgh.

The U.S. Naval Observatory's semi-automatic



Tracing the history of Sussex University is less of a problem than solving mysteries of creation. Pictured above is Stanmer House, once the home of the Earls of Chichester, which stands in Stanmer Park adjoining the University campus. In 1961, when the University opened, it was the Administrative offices.

machine for measuring the positions of photographic star images was described by K.Aa. Strand. This machine has been in use since 1966 and it has been five times faster and 30% more accurate than manually operated machines. The simultaneous measurement of position and magnitude at very high speeds is being investigated at the Cambridge Observatories by E.J. Kibblewhite. The machine under development uses interferometers to measure position, and a laser scanning system to find and photometer photographic star images. Computer analysis of image structure is employed. An account was also given of the GALAXY machine which has already been described in the Assembly Times (adapted from a report supplied by V.C. Reddish).

COMMISSION REPORTS:

**UBV photometry;
Solar Neutrino theory; Ultra-violet
and X-ray astronomy....**

1. JOINT DISCUSSION

A Joint Discussion was held by Commissions 10, 12, 14, 36 and 44, on Friday, on 'Atomic Data of Importance for ultra-violet and X-ray astronomy.' In recent years many new solar and stellar spectra in the ultra-violet and X-ray region have been obtained from rockets and satellites. These new observations require atomic data such as line classification, oscillator strengths and excitation cross-sections. The Joint Discussion was held to bring together the theoretical and experimental atomic physicists and those working on analyses of the observations.

The Discussion began with reviews of the observational data, by Professor D.C. Morton and Professor L. Goldberg, who drew attention to several problems where new atomic data are required. A description of a new general computer programme developed by Professor Seaton's group to provide excitation cross-sections, was given by Dr. W. Eissner.

Other recent advances in the fields of experimentally and theoretically determined transition probabilities, line identifications, line broadening, absorption coefficients and dielectronic recombination were also described. The most important points arising from the papers and discussion were summarized by Dr. A.G. Hearn.

2. COMMISSION 35

At a Commission 35 meeting on Saturday, G. Shaviv reviewed the present position of solar neutrino theory and experiment. The best present value of the observed flux is $(0.2 \pm 0.1) \times 10^{-35}$ per cm^2 per sec. The latest theoretical result assuming an unmixed sun is 0.7×10^{-35} , although this can be reduced 0.35×10^{-35} if one uncertain correction is unnecessary. Early calculations of the effects of mixing of the solar interior suggested that the theoretical flux could be reduced by a factor of seven but it now appears that, if theory and

observation of HR diagrams of globular clusters are to agree, the degree of mixing must be restricted and the reduction in flux cannot exceed 40 per cent. There is still sufficient uncertainty for it to be possible that theory and observation are compatible without any radical revision in the theory of stellar structure.

3. COMMISSION 25

UBV redefined. Commission 25 has adopted a new set of standard stars for UBV photometry. The new standards are HR stars in the equatorial zone (declination -10° to $+10^\circ$) with the advantage of accessibility from both hemispheres. The primary standards are now stars brighter than $V=5.0$ in this zone, with a supplementary list of many fainter stars for the determination of colour equation. Lists of the standard magnitudes and colours will be published by Dr. A.W.J. Cousins, probably in the Royal Observatory Bulletins. His lists will include measurements of essentially all stars brighter than $V=5.0$ south of declination $+10^\circ$. The accuracy with which the new system has been established is thought at least to equal the internal consistency of the previous standards.

ANNOUNCEMENTS

Buffet Supper and Dance:

Tickets are still available. Please purchase them before 13.00 today. No refunds after this time.

Visiting the NPL

As announced in the preliminary programme, the Director of the National Physical Laboratory, Teddington, invites participants to visit the Laboratory on the afternoon of Thursday, 27th August. Leaflets giving details of the visit, which is limited to 30 participants, may be obtained from the ticket desks on the second level of the Assembly Centre.

Participants who will be attending IAU Colloquium No. 8 will, however, have a further opportunity to visit the Laboratory on Friday, 4th September.

LOST PROPERTY

Black folding umbrella - Strohmeier, 2252
Blue and white mechanical pencil - Harrison, 8757 with blue eraser; (probably in Refectory)
Tarten (red) folding umbrella - Silvestro, 3457
Black telescopic umbrella - owner's no. 9434
Gentleman's brown leather purse containing 10s. - Dobrzycki, 4309
Participant's portfolio - Vesecky, 8628
Lady's brown umbrella and pair of brown framed, clear spectacles (on coach to Michelham Priory) - Flinsch, 8380

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General Assembly of the International Astronomical Union

URGENT!

Hostel residents are asked to pay any outstanding charges (including charges for additional nights) by noon today, Wednesday, 26th August, at the Registration Desk in Falmer House.

Participants are asked to collect all mail and messages from their mail boxes before they leave. As far as possible, all mail will be forwarded, but messages (not sent through the post) from other participants will not, in general, be so forwarded.

Tickets are STILL available for today's BUFFET SUPPER and DANCE.

Apollo Films

These will be shown in Meeting Room II TODAY at 14.00 and 16.00. No tickets are required but capacity is limited.

Brighton, Sussex

26th August 1970

Monday Evening's Special Degree Ceremony in the Dome

SUSSEX UNIVERSITY HONOURS ASTRONOMERS

Presenting the President of the IAU, Professor Dr. O. Heckmann, for the degree of Doctor of Science on Monday evening, Professor W.H. McCrea said that he had made distinguished contributions to relativity and cosmology and that his work on astronomy was of fundamental importance to studies of stellar evolution. As director of the European Southern Observatory, he saw a dream of a lifetime beginning to come true on a mountain top in Chile. Professor McCrea continued, "...Our university would have been honoured in honouring Otto Heckmann for himself. But today we salute him also as the chief representative of a great international scientific organisation - the greatest as everybody here believes - on a great occasion for our university and our country."

Presenting Academician V.L. Ginzburg, Professor R.J. Tayler referred to his outstanding work in many branches of physics and astronomy and to the great enthusiasm he always displays in his work. He continued, "The University of Sussex is proud to honour Academician Ginzburg because of these many individual contributions he has made to our science and because of the stimulus and encouragement he has given to others. In addition, however, he also stands here tonight as a representative of all those persons trained as physicists rather than astronomers who have in recent years realised that many of the most fascinating and difficult problems in physics lie in astronomy...."

women's role

Presenting Professor Margaret Burbidge, Professor J.C. West commented on the prominent part being played by women in this General Assembly, it having been opened by Mrs. Thatcher to the accompaniment of organ music by Lady Jeans. He said that Professor Burbidge was not only a distinguished astronomer but also a successful wife and mother. She has done outstanding work in many branches of observational astronomy, including abundances in stellar atmospheres, galactic rotation and the study of quasars and she also discharges the important task of preventing the speculations of Geoffrey Burbidge, Fowler and Hoyle from departing too far from the observational evidence.

Presenting the Astronomer Royal, Sir Richard Woolley, Professor D. Daiches referred to his early work at the Mount Wilson Observatory and to his long series of investigations on the motion of nearby stars in the Galaxy. Professor Woolley has had a long and successful career as an administrator of observatories at Mt. Stromlo and Herstmonceux but he has never ceased to be an active astronomer. The University of Sussex has been particularly fortunate that he has played an important role in the development of astronomy in the University.

reply

Replying on behalf of the honorary graduates, Margaret Burbidge thanked the University for the honour of the award of honorary degrees on the particularly appropriate occasion of a General Assembly of the IAU. She stressed the universal character of astronomy - bridging the gap between different countries and between young and old alike. The interest of young people in the subject was especially encouraging and there was a heavy demand from both arts and science students for courses in astronomy. She concluded by



The four astronomers with the man who conferred their degrees. From left to right: Professor Dr. O. Heckmann, Professor A. Briggs, Vice-Chancellor of the University, Sir Richard Woolley, Professor Margaret Burbidge and Academician V.L. Ginzburg

expressing the hope that the view of the earth as a very small platform in space - as revealed by the recent space probes - would bring home to mankind the importance of a careful consideration of ecology, in order that the continuation of life here on earth should be safeguarded.

All of the photographs ordered by delegates are now available for collection from the local information desk in the Assembly Centre.

Have you visited the Book Exhibition or the Non-Commercial Exhibition yet? Today is your last opportunity.

Tomorrow's Assembly Times will be distributed both in the Assembly Centre and at the Dome.

IAU Notices

Commission 12 will be meeting in Room VI (as well as in Room V) at 16.00 on Wednesday, 26th August.

Commission 19 will be meeting on Wednesday, 26th August at 11.15 in Room V.

Commission 31 will be meeting in Room III at 9.15 on Wednesday 26th August.

To members of Commission 37:

After a long delay the second edition of CATALOGUE OF STAR CLUSTERS AND ASSOCIATIONS has at last arrived and can be inspected in the Book Exhibition. It can be ordered through your book shop or directly from the Publishing House of the Hungarian Academy of Sciences: AKADEMIAI KIADO, Budapest V Alkotmany U 21, Hungary.

Joint Discussion F. Today at 14.00 in Meeting Room I. Speakers at the discussion will be M.J. Rees, L. Woltjer, M. Shapiro, A. Cameron and T. Gold.

J.H.Oort gives his views on ASSEMBLIES: PAST AND FUTURE

Due to a combination of special circumstances, I have had the good fortune to have been present at all the ordinary General Assemblies of the Union, from the first one in 1922 in Rome, when I happened to be passing the Easter vacation, during which the meeting was held, with a student friend who lived in Rome for a year. I then saw, from a distance, some of the great astronomers of that time, among whom were Schlesinger and Dyson. This influenced my further astronomical education, as I went to work with Schlesinger at the Yale Observatory soon after. Then followed the assemblies in Cambridge and Leiden. I must confess that my most vivid memories of those cosy early meetings, in particular Rome and Cambridge, are connected with the wonderful settings in which they were held rather than with astronomical information or conversations. This became very different in later meetings, when I became, involuntarily, involved in the affairs of the Union and its Commissions. This

new era became stimulating in a rather different way; it brought me in contact with very many astronomers, whom I would otherwise not have met, and was the starting point for international ties of friendship, which have become an invaluable part of my life as an astronomer. During the last few General Assemblies, I have sometimes been wondering whether, for those who come newly into the Union, the establishing of really strong ties of this sort is not seriously hampered by the too large number of possibilities, too many interesting meetings, often on overlapping subjects, and too many interesting people to meet. This has, of course, already for a considerable time been a source of concern for all of us who have had some responsibility for the affairs of the Union. Probably the only solution is to concentrate still more in symposia and colloquia on special topics and to reduce drastically the length of the General Assemblies.

WHY ASTRONOMERS ARE INTERESTED IN OCCULTATIONS

by L.V. Morrison
who sets the scene
for today's
Joint Discussion

Today Joint Discussion E is concerned with Stellar Occultations. Below one of the speakers in the discussion explains why astronomers are interested in occultations.

The Moon in its orbit around the Earth passes in front of stars lying in a 13° band about the ecliptic. The five bright stars, Aldebaran, Antares, Pollux, Regulus and Spica, the Pleiades, and the quasar 3C 273 are a few of the well-known stellar objects which lie in this occultation zone. From observations of occultations of these stars and the many thousands of others in the zone, we deduce changes in the rate of rotation of the Earth, systematic corrections to the lunar ephemeris and catalogue star positions, the size of stars, and the separation of very close binary systems.

Rate of rotation of the Earth. The discrepancy between the Moon's observed mean motion deduced from the timing of occultations covering a period of several centuries, and the gravitational theory of its motion, led to the conclusion that the Earth was decelerating. Although atomic clocks now give us a much more precise scale by which to monitor the Earth's deceleration, occultations are still essential for determining whether the difference between the atomic and ephemeris time scales is constant.

Lunar Ephemeris. E.W. Brown's celebrated work on the derivation of an analytical theory for the very perturbed motion of the Moon, still forms the basis of present day ephemerides. Computers now make possible the numerical integration of the equations of motion which results in an ephemeris of higher precision over short periods of time. But until the action of tidal friction can be adequately represented by differential equations, the analytical theory with its empirically determined constants based on long series of observations, must form the basis for long term extrapolation of the lunar orbit.

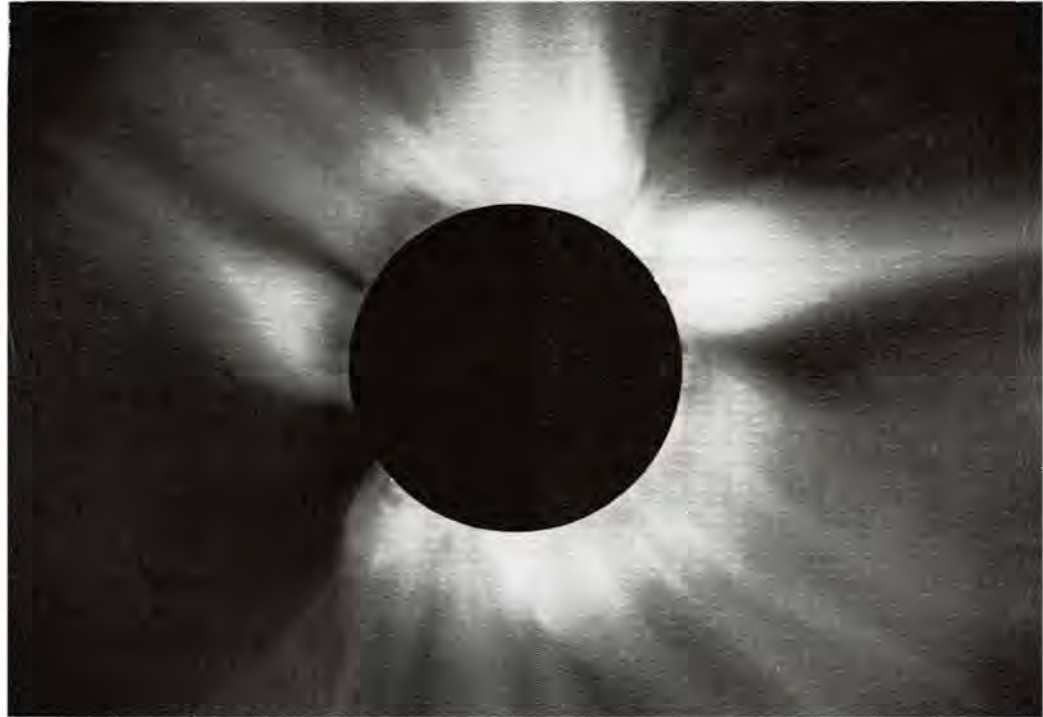
corrections

The analysis of residuals from occultations, now greatly improved by the application of corrections for irregularities of the limb profile charted by C.B. Watts, enables us to find corrections to the constants of the lunar orbit.

Catalogue star positions. There is much interest at present in determining the non-precessional motion of the origin of the right ascension system and in determining whether the observed motion of the obliquity of the ecliptic departs significantly from the gravitational theory of its motion. These, together with other systematic errors in the star coordinates, can be determined from analysis of the timing of occultations, provided that their effects are separable from errors arising from the shape and motion of the Moon.

angular diameters

Angular diameters of stars. With the development of stable, sensitive and high response electronic equipment in recent years great interest has been aroused in determining the angular diameters of stars by analysing the Fresnel diffraction patterns resulting from their occultations at the dark edge of the Moon. The angular diameter and flux received at the Earth give the emergent flux at the surface of the star which can then be compared with the values from theoretical models of stellar atmospheres. At present only 18 reliable direct measures (including the Sun) of stellar diameters have been made, 15 of these by Hanbury Brown using the intensity interferometer. This list is at present being extended by occultation measurements which are able to cover a wider magnitude and spectral type. Much interest now centres on how reliable these will be because of the inherent problem of removing anomalous values resulting from features on the limb of the Moon which have dimensions of the order of the first Fresnel zone of the diffraction pattern. Repeated observations should resolve this difficulty.



Solar Eclipse March 1970 (HAO photo)

Double stars. The traces from photoelectric equipment can reveal separations of about 0.01 at right angles to the limb of the Moon when the components are of comparable magnitude. Two passages of the Moon across the source at different angles of incidence permit the solution for separation and position angle to be made. Several

double stars have already been found and spectroscopic binaries separated by this method. Conclusion: The astronomical phenomena of lunar occultations, observed since ancient times, provide an increasing range of interest and application in astronomy today.

COMMISSION REPORTS:

Abundance ratios; infra-red objects; stellar atmospheres; RR Lyrae stars

1. ETA CARINAE

B. E. J. Pagel has reported estimates of abundance ratios derived from emission line intensities in the spectrum of η Car. His results indicate that the abundances of nitrogen and sulphur in this object are higher than previously supposed and quite close to solar abundances. Oxygen was underabundant. L.H. Aller remarked that the abundances derived were probably dependent on the form of any filamentary structure in the nebula.

2. NML CYGNI

At Wednesday afternoon's joint meeting of Commissions 27 and 29, G.H. Herbig reported spectroscopic observations of the infra-red objects NML Cyg and IRC+10216 which reveal the nature of these objects. The spectrograms were obtained with an image intensifier operating at wavelengths around 8000 \AA at the Coude focus of the 120-inch telescope; a second three-stage intensifier was used for visual guiding on the faint, extended objects. The spectrum of NML Cyg is that of a normal M6 III star, not a star of luminosity class Ia as previously supposed. The distance of the object may be estimated as 200 pc and it is not a member of the VI Cyg association. Heavy extinction must be present, but it is apparent that the absorbing medium is entirely circumstellar. Similarly, IRC+10216 contains a normal carbon star. The velocity is low and the object has a distance of about 300 pc; suggestions that it is extragalactic may be discounted. It seems that there is a shell of particulate matter which re-thermalises most of the stellar radiation. The particulate matter is presumably produced by the star and ejected from its atmosphere at a velocity low enough for it to remain captive.

3. NON-LTE EFFECTS

Dr. R.N. Thomas, opening the main scientific sessions of commission 36 (Stellar Atmospheres) drew attention to no less than fifteen physical principles necessary for the study of stellar atmospheres during a most animated introductory half hour. One principle every two minutes is pretty good going, and despite several calls to slow down from the Chairman, Dr. A. Underhill, nothing could quench his enthusiastic style! Following him, Dr. L.H. Auer outlined some

mathematical techniques, and gave convincing evidence from observations of the line profiles, that the O stars are certainly a case where the LTE approximation cannot be justified. The time available was simply insufficient for the spiritual discussions provoked by these and other speakers. A further "overflow" meeting of this commission has been arranged for the morning of Wednesday, 26th August. The devotion of the main part of the scientific sessions of Commission 36 to this subject demonstrates that the physics of stellar atmospheres is gradually acquiring a new look as brave men like today's speakers are tackling the tremendous complexities involved.

4. GALACTIC DISTANCE SCALE

At Friday's meeting on RR Lyrae stars, Clube suggested a small systematic correction to the secular parallax of faint reference stars to resolve a discrepancy in statistical parallaxes of RR Lyrae stars. The revised absolute magnitude of $+1.30$ leads to a distance to the galactic centre of 6.3 kpc. Others confirmed the discrepancy, but doubts were cast on the interpretation, principally by Oort. At the same session, the Astronomer Royal reviewed the problem of absolute magnitude determination, stressing the potential importance of the Baade-Wesselink method. Christy gave the theoretician's approach; his suggestion that absolute magnitude varied with metal content was supported by calculations by Iben. Van Herk discussed classification of faint RR Lyraes, and Klemola reported on the Lick astrometric program.

ANNOUNCEMENTS

University of London Observatory.

We should be pleased to refresh old friends and new who are passing through North London on Friday, 28th August. We are on A1/A41 just north of the start of the M1 motorway.

LOST PROPERTY

A pair of dark Polaroid sunglasses (inscribed with owner's name) - Purgathofer, 2002
blue umbrella (probably in Falmer House on Saturday) - Bell, 3143
blue basket (lost on coach to Charlston Manor) - Missana
Participant's portfolio (with important material in it) - Namba, 6303

1970



THE ASSEMBLY TIMES

The daily bulletin of the XIV General Assembly of the International Astronomical Union

Goodbye From the Editors

After what has by general report been a happy and successful General Assembly, the editors wish all of their readers three years of good progress in their work between now and the next General Assembly. They apologise to all those participants whose contributions to the Assembly Times they have failed to print or have cut out of all recognition and they would like to take this opportunity of denying all rumours that they will shortly be deserting astronomy for journalism.

F.E. Clifford,
R.C. Smith,
R.J. Tayler.

Brighton, Sussex

27th August 1970

YOUNG ASTRONOMERS AND THE IAU...

The IAU is subject to the same demographic explosions which characterize scientific institutions and universities all through the world. This sudden change in the membership of the IAU and in its age composition raises many questions which have to be solved urgently. The Executive Committee of the IAU was quite conscious of the potential existence of these problems, when deciding upon the organisation of a brain-storming session among young astronomers during the General Assembly at Brighton. Due to the absence of reaction to his letter to young astronomers the General Secretary decided to cancel the brain-storming session.

The failure of this attempt to organize in 1970 a broad discussion among young astronomers about the aims of the IAU, its structure and its organisation is by itself a lesson which should not be forgotten. In trying to understand the situation, the authors of the present paper apologize for writing in the defence of young astronomers. (Y.A.)

A quick inquiry gives the reason for which Y.A. have not reacted to Dr. Perek's letter. The Y.A. do not receive the IAU bulletin (as they are not IAU members) do not read it, and were completely unaware of the existence of Dr. Perek's letter and the suggestion of organising a brain-storming session. Obviously, neither the individual members or the National Committees ever realised that it was their urgent duty to bring to the attention of those younger people the proposal of Dr. Perek. The failure of the brain-storming session shows how difficult it is to establish the link between the centralised structure of the IAU and the Y.A.

international

The IAU is an international organisation which is set up in order to promote the progress of Astronomy all over the world and help that progress in all possible respects. Exchanging ideas, meeting people, discussing, establishing the present



Difficulties with an inter-galactic call?



Another day begins: early arrivals at the Assembly Centre

situation of knowledge, and of its means (instruments and institutions), opening roads for new directions of research are undoubtedly the goals of the IAU. The question is to find the best ways of achieving that result. It is clear that it is incredibly more difficult with three thousand astronomers in the world than with one hundred and fifty. It depends on each nation to find the way of establishing the best relations between the Y.A. and the international organisation. However, it seems difficult to imagine that those national organisations will at all be able to match the needs of the Y.A., if these Y.A. are not represented in some way at the national level. National Committees have a variety of structures and organisations, but again, it seems difficult to imagine how the expression of the needs of the Y.A. could be carried to the national level without some kind of democratic representation. In that respect, the structure of the French National Committee has been recently changed, with a double representation of the institutions and of the specialities, giving for the first time, even to non-IAU members, the possibility of being elected to the National Committee. The new organisation is too recent to know if it works according to the wishes which have motivated it. Immediately related to the question of the relations of Y.A. with the National organisation, is the problem of their invitation to the General Assembly. The National Committees propose to the IAU a list of people to be invited. It is quite clear that the scientific level and the scientific quality are the only criteria which can define the boundary between those who are invited and those who are not. However, it seems difficult to imagine that a list of invited participants could be drawn without some

participation of representatives of the Y.A. members. A similar problem has to be found with the organisation of symposia and colloquia. It is certainly true that symposia and colloquia are scientifically fruitful only if the number of participants is limited. In principle, only people active in the field should take part in such meetings and this is generally the main worry of organising committees. However, it should be stressed that the most active people in a given field are most frequently the younger ones. Their participation is not always granted. The presence of at least one Y.A. in an organising committee could be in some cases of very great importance.

votes

We have now to consider the way in which Y.A. can influence the policy of the IAU. During a General Assembly, depending upon the questions under discussion, each IAU member votes, or only national representatives vote. It is difficult to imagine that such votes are really meaningful if they have not been preceded in each country by a broad discussion in which the Y.A. (including those who are not yet IAU members) have taken part. The older IAU members cannot express the needs of the Y.A. But those who are conscious of the existence of the problems can at least give a hand. The problems of the young astronomers have to be raised by the young astronomers themselves.

M. Hack,
B.G. Marsden and
E. Schatzman.

TEL AVIV UNIVERSITY OBSERVATORY

Starting operations with a 40'' wide field telescope

The Department of Physics and Astronomy at the Tel Aviv University, in collaboration with the Smithsonian Astrophysical Observatory expect to start operations at a new observatory at Mitzpe Ramon, Israel in the first quarter of 1971. The primary instrument will be a 40'' wide field telescope with Richey-Chretien optics designed by Mt. Wilson/Palomar observatories and constructed

by Boller & Chivens. A substantial block of time has been allocated for visiting observers. Applications for observing time should be directed to: Dr. Uri Feldman, Department of Physics and Astronomy, Tel Aviv University, Ramat Aviv, Israel, or, in the case of U.S. observers, to: Dr. Myron Lecar, Smithsonian Astrophysical Observatory, 60 Garden Street, Cambridge, Mass. 02138.

HOW TO COPE WITH THOSE ASTRONOMICAL JOURNALS

At present the number of astronomical journals is increasing and the existing ones are becoming weightier. The number of astronomical papers published per year has probably increased by over 50% in the last decade. It might therefore be supposed that the task of the astronomer trying to keep abreast of his field has rapidly hardened. I would like to suggest that this is untrue; the information system in astronomy is certainly in a state of flux, but I do not believe that the likelihood of retrieving a particular item has appreciably decreased.

There are many reasons why astronomers should have relatively little difficulty in handling the literature. One is that several new journals have specialised contents to that an astronomer need only scan them if they cover his field of interest. Specialised journals have their own disadvantages but the most important reaction to this trend, the formation of the general European journal, *Astronomy and Astrophysics*, has also eased the information retrieval problem, by reducing the number of current journals. Another useful fact is that observatory publications are of decreasing importance; they are notoriously the most difficult part of the astronomical literature to track down. The most significant new factor is that efficient abstracting systems are becoming available, in



Relaxing in the Assembly Centre.

particular *Astronomy and Astrophysics Abstracts*; surprisingly a third of U.K. astronomers appear not to use abstract journals.

Although the volume of astronomical literature has not yet become unmanageable, it is still true that the rate of flow of information has markedly increased in recent years. An obvious sign of this is the increasing importance of letter journals. Letters differ from ordinary scientific papers not simply by being shorter and published more rapidly. They also use the existing literature differently, being much more likely to cite very recent papers. For this reason, their information retrieval requirements are rather different from the traditional requirements, there being far more emphasis on the need for speed. There are current developments in this direction but there is certainly room for more. Despite the highly international flavour of astronomy, there are still distinguishable national differences in the use of the astronomical literature. The most obvious is that, although the *Astrophysical Journal* is the most frequently read journal in the U.K., France and West Germany, in each case the second most heavily cited journal is the national one. Things may well change, however, now that a European astronomical journal has been established and there is the interesting possibility that the *Astrophysical Journal* may be overhauled in the popularity race.

Again, all countries which are major producers of astronomical research publish more theoretical papers than observational papers, but the amount of the difference does vary from country to country. For example, the proportion of observational papers



Lunch in the open air: delegates sample the menu and English Summer at the Marquee.

is appreciably higher in the U.S.A. than in most European countries. There are doubtless several factors involved here, but, in so far as the difference reflects the greater emphasis on observational work which has prevailed in the U.S.A. for much of this century, we might expect that this is another regional distinction which will gradually be eroded. The difference is, incidentally, of interest from the view point of information retrieval, since theoretical astronomers have a clear tendency to acquire more of their information from books than do observational astronomers.

To sum up, astronomers are as yet in little danger of drowning under the flood of scientific literature; there are sufficient information aids available, or becoming available, for them to keep abreast of their subject. It is important, however, that the astronomical community as a whole, and young astronomers in particular, should be aware of the existence of these aids and should, moreover, make habitual use of them. The price of efficient information retrieval is eternal vigilance.

A. J. Meadows (abridged)

A QUESTION OF COMMUNICATION

It is, perhaps, a bit surprising that while we astronomers devote much time to problems of nomenclature and notations (which are certainly important), we do not seem to pay proper attention to our essential tool: the language.

The present situation is far from satisfactory. For instance, because English is now practically the only language used, some speakers tend to overlook the fact that a part of their audience may not be thoroughly familiar with that language, and they do not make the necessary effort to speak slowly, distinctly and loudly. This is especially true during the discussions, and we have heard several young astronomers complain, sometimes bitterly, that in spite of their efforts they were completely unable to follow what was going on.

We feel that the language problem is a serious one, which will become more acute as more and more countries adhere to the IAU, and that it should be discussed in depth in the near future. This discussion could possibly take place in the IAU Information Bulletin and lead to a special meeting on the subject at the next General Assembly.

A. Heck,
M. Henon.

BILLIARDS

The traditional billiards match between the representatives of U.S.A. and U.K. took place at 18.00 on Tuesday. Members of the Union will recall that, started by Schlesinger and Stratton, this match has been a feature of all General Assemblies at least since that in Cambridge in 1925. Unfortunately it was not possible to give any publicity to the match and the only spectators were the wives of the two contestants - J.S. Hall for U.S.A. and D.H. Sadler for U.K. The, to him, large table with pockets proved rather too big a handicap for the U.S.A. representative; but he managed to win, with a superb pot "on the black", the consolation snooker game.

Space Research at Culham

The Science Research Council's Astrophysics Research Unit at Culham, under the direction of Dr. R. Wilson, is currently engaged in a programme of observations, using stabilized rockets to study the far ultra-violet and X-ray spectrum of the sun and stars.

Recent solar echelle spectra, covering 1216 Å to 2200 Å with a resolution of 0.03 Å, show details of the photospheric absorption spectrum and the profiles of chromospheric emission lines. Measurements of line intensities on the solar disk and at the limb, in the region 500 Å to 2500 Å, have led to a determination of the temperature structure in the chromosphere-corona transition region, confirming the steep gradients obtained from other analyses. In the soft X-ray region new forbidden lines have been identified, resulting in the development of a method for determining the electron density in active regions, where the temperatures are between 2×10^6 °K and 8×10^6 °K. A programme of stellar observations is under development. This is based upon a Cassegrain telescope, illuminating a high-resolution echelle spectrometer, fitted with an image intensifier tube. Supporting the space work is a comprehensive laboratory programme, covering line identification, absolute intensity calibration, and the measurement of collisional excitation rate coefficients. The light



A Brazilian delegate (right) samples some free Colombian coffee!

sources used include laser-generated plasmas, and a magnetically confined theta-pinch plasma, capable of producing temperatures up to 3×10^6 °K.

Excitation rates in lithium and beryllium-like ions have been measured, for use in determining solar electron temperatures. Satellite lines have been classified as inner-shell transitions formed by dielectronic recombination. These lines have now been reported in flare spectra obtained by other groups.

Many of the projects are carried out in collaboration with other groups from Universities. An example is the recent successful rocket experiment, which recorded the ultra-violet spectrum of the sun during the March 1970 total eclipse, carried out jointly with Imperial College, London, Harvard College Observatory and York University, Toronto.