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SOME HIGHLIGHTS OF JOINT DISCUSSION IV

THE EXPLORATION OF THE SOLAR SYSTEM

The Lord of the rings himself — the giant planet Saturn — came in for close scrutiny during last Friday morning's session of the Joint Discussion held between Commissions 16 and 44. And the concensus reached by the researchers is that Saturn is far from being a pale shadow of his big brother Jupiter.

Most workers reported on results obtained during the Voyager 1 and 2 flybys. Reta Beebe explained how she and her co-workers had identified three dominant kinds of structures in Saturn's atmosphere — small eddies which pump energy into zonal wind-flows; long-lived spots, averaging 5000 km in diameter which feed off the shear between opposing wind flows; and elongated waves. She also mentioned that Saturn has a unique, bright ultraviolet spot which appears to induce convection in features around it.

Saturn's dynamic weather is matched by its complex and very active magnetosphere, according to Fred Scarf. There are still a lot of problems in explaining the planet's radio-emission - not the least because Saturn was actually inside Jupiter's magnetotail for 4 days of the Voyager 2 flyby. In particular, although Saturn has a radio-emitting sector like Jupiter's, it does not beam radio waves by the same «light house beam» mechanism. Whatever gives rise to the radio waves also controls the mysterious radial spokes in Saturn's B ring which generally lie above the radio - emitting sector.

The spokes are made up of extremely small particles (comparable to the wavelength of light), but as Jeff Cuzzi explained in Review of Saturn's Rings, there is a large range in particle size through-out the system.

The narrow F-ring seen as linked and braided by Voyager 1, looked smooth in Voyager 2 photographs, implying that its irregularities are not continuous or that it may even change its structure with time. And there may be more to the F-ring than meets the eye. Data from the old Pioneer 11 craft showed some evidence that the ring extends to a width of more than 1000 km with a suggestion that the extended region may be made up of «unseen moonlets».

Saturn's extensive collection of major moons has a considerable effect on the ring system by giving rise to gaps. And high-resolution Voyager 2 photographs revealed a dozen examples of spiral density waves in the resonances as well as a couple of cases of corrugated, spiral bending waves, produced by the changing position of Mimas in its inclined orbit.

Saturn has at least twenty moons, reported Dave Morrison, and there's a possibility that there may be two or three more which were glimpsed by the Voyager probes. Four of the «new» satellites are to be officially given names at this General Assembly: Janus and Epimethus (the two «co-orbital» satellites) Telesto and Calypso (the two satellites in the same orbit as Tethys). And although the moons all have similar composition, consistent with a contant of 60% ice, they are a very mixed bunch in terms of their «geology». Of course, Titan - with its smoggy nitrogen atmosphere and a surface which may be covered with methane pools - is the weirdest of all. «It's a world where government control has been totally abandoned and chemistry has taken its toll», quipped Toby Owen in his account of the origin of this peculiar moon's atmosphere.

Although none of Saturn's other moons have any trace of atmosphere, some of them make up for it in exhibiting obvious signs of internal activity - some of it fairly recent Contrary to expectations it is not the largest satellites which are the most geologically active but the smaller ones. Enceladus, only 500 km in diameter has such a smooth icy surface that its craters must have been melted by thermal activity beneath, it has certainly been active within the past 10^9 years - and probably much more recently. And mysterious Iapetus, with its dark leading side and bright trailing side, continues to baffle researchers. So precisely does the distribution of dark material correspond to the satellite's leading hemisphere in its orbit that it looks almost certain to have been «dumped from space». Yet elsewhere on Iapetus, a number of dark-floored craters away from the leading hemisphere seem to indicate that the material has welled up from inside. As Dave Morrison concluded, the Saturn moons are a motley bunch - they make up a real miniature solar system, in terms of both their dynamics and in their individual quirks.

Venus observed

Despite an air-conditioning mechanism designed specifically to drown the speaker's voices, seats which squeaked shrilly at the slightest quiver and a lantern which would not focus, the afternoon audience in room AB on Friday saw Venus being remorselessly unveiled. So much has happened since the last IAU congress though each problem solved seems to raise a host of others.

Less than two decades ago we knew nothing about the surface. Today, thanks to the space probes, we have detailed maps. H. Masursky, the first speaker, gave an overall account of the rolling plains, the shield volcanoes and the highland areas of Ishtar and Aphrodite. The images obtained from the Soviet Venera 14, he said, showed some flattish plate-like rocks which could well be basaltic; the Aphrodite highland about the size of Africa was believed to be ancient - and if it included impact craters it must be very ancient indeed. But Venus and the Earth, near twins in size and mass, differed in many ways. Terrestrial type plate tectonics could not apply to Venus. But volcanoes undoubtedly existed, some with summit calderas, and they could be associated with gravity anomalies not unlike those of our own volcanoes.

R. Prinn then dealt with the chemistry and composition of the Venusian atmosphere. Of course carbon dioxide is dominant to the extent of some 96%, chlorine is 1000 times

Continued on page 2

Bang in the Middle!

Wednesday saw A Building's auditorium packed with astronomers eager to hear about the intricacies of active galactic nuclei, in a Joint Discussion organised by Commissions 28, 40 and 48. It is fair to say that the active galaxies — whose centres show signs of powerful, violent outbursts — scored a narrow victory in preserving their secrets, but not without a battle conducted on all wavelength fronts, and with all the power of theoretical astrophysics which could be brought to bear.

E.Y. Khachikian and Andrew Wilson were among several speakers who stressed the similarity is appearance of all active galactic nuclei, despite the different kinds of galaxy they live in Khachikian demonstrated this with results from the 6m telescope in the USSR: his sample of Markarian and Seyfert galaxies all had double or triple nuclei, suggestive of jet-like structures beamed out of the central core. Wilson reported his Very Large Array radio studies of the «intermediate» (kiloparsec) scales in Radio galaxies, and in particular the interaction of the ejected beams-whether particle jets or «lumps» of plasma — with the clouds of gas rotating around the centres of the galaxies. For their part, it appears that the rotating clouds can bend the jet, but the jet can get its own back by giving a cloud a kick if it happens to hit one!

«Classical» active galaxies kept coming home to roost throughout the meeting. M 87 and its jet came in for a lot of attention: «I"s everything you'd like to have when you study a galaxy!» enthused Massimo Tarenghi, reporting on optical studies of the bright «blobs» in its jet. Time only will tell what the blobs are; perhaps they are even mini-galactic nuclei in their own right? Tarenghi went on to describe the jet of another «old faithful», the quasar 3C 273, whose tip is distinctly red — probably from loss of energy of the light-emitting electrons.

3C 273 is one of several active whose central regions appear to be expanding at several times the speed of light. But Malcolm Longair, reporting on a «large number of sources» (actually, 4 or 5; but as he pointed out, «We're talking astronomy!») revealed how optical and infrared observations could give a better handle on the nature of the source. As most workers agree, it's all a question of geometry; if you're looking right up the end of the ejected jet, the light emitted virtually «catches up with itself» and gives rise to «superluminal» effects. It can also explain the very short-period variations observed in sources like OJ 287, whose nucleus brightens and fades at near-infrared wavelengths in only 1.28 minutes. L.B. Baath mentioned later —somewhat off the record— that he has mapped the source AO 0235 + 164 with the US and European VLBI networks and found a superluminal expansion velocity equivalent to 45 times the speed of light. A Westerbork astronomer yelled from the back that they had evidence that the superluminal phase was only temporary: in half a dozen sources they'd studies, there was evidence that the beam had «swung round» from its usual position to give the present superluminal effect. And Ken Kellerman invoked «geometry» to explain why the power emitted by galaxies, Radio galaxies and quasars covers such a wide range, when the phenomenon appears to be the same in each case. A «head-on» source will appear brighter than normal, as well as showing superluminal expansion and rapid flux variations.

These rapid intensity variations may mean that the nuclei of active galaxies are very small — but as Andy Fabian pointed out in his excellent overview of X-ray emission from galactic centres, this isn't necessarily the case if a lot of radiation comes from patterns you'd expect from a central, energetic source — which of course, begs the question as to what the source actually **is**.

Possibly the well-known Seyfert galaxy NGC 4151 will provide some answers, suggested Malcolm Longair. Reporting on Mike Penston's work with the International Ultraviolet Observatory satellite, Longair described the cyclical way is which the region around the central source responded to changes in the source's intensity. The results indicate the presence of a compact mass of some 10^8 solar masses-similar to that derived dynamically for the central CORE of M 87. Speaking for most of the theoreticians, Cavaliere put his money on a medium-to-large-sized black hole as the ultimate culprit in active galaxies, whose gravitational energy drives a whirling accretion disc responsible for producing the fireworks. There needs to be **something** pretty potent there, for recent results show that some galactic nuclei are prolific sources of positrons, which spontaneously annihilate with electrons in outlying clouds to give strong X-ray emission. Even our galaxy is not exempted here: one third of its X-ray emission comes from a single line at S11 MeV, and studies of the erratic variability of this line should shed new light on the nature of the object at our galactic centre.

«Franco Pacini asked me to sum up, but I'm really going to talk about redshifts, which he knew I'd do whatever he said», explained Geoff Burbidge in his summary. «Everyone plumps for a black hole at the centre, but how do you test it? Perhaps everyone believes it's true because they reiterate it so much!». And he warned of the risks involved in extrapolating conventional physics close to the event horizon of a black hole. Perhaps, he suggested, many of the energy problems of quasars —in particular— might go if you attribute their immense redshifts to something other than the expansion of the Universe, and thereby bring them closer. But despite some tantalising slides of quasar-quasar and quasar-galaxy associations, no-one seemed very convinced. We need some good, unbiased statistics, said the delegates —almost in one voice— as they rushed for their buses

FAREWELL FROM L.O.C.

At the conclusion of the XVIIIth General Assembly the Local Organizing Committee expresses its thanks to all participants and guests, hoping that their stay in Patras has been fruitful and pleasant. At the same time it wishes to all a happy and safe journey to their home countries and succesful continuation of their astronomical work. ΚΑΛΗ ΑΝΤΑΜΩΣΗ (until we meet again)!

Editorial

THE JOY AND THE SORROW

We have been together now for ten issues of ASTROCOSMOS and this is the last Something like 70 000 words with photographs, diagrams, puzzles, cartoons and adverts have appeared in these pages For our errors of omission and commission we apologise sincerely We hope we have not perpetrated any error like the one in a certain English newspaper which referred to «Major Goreworthy that well-known battle-scared veteran» and rushed out an apology the following day saying «This of course should have read 'Major Goreworthy,, that well-known bottle-scarred veteran»

We are in fact profoundly grateful for the unstinting support given us by all who have contributed to ASTROCOSMOS — our reporters Heather Nigel and Karen, our busy office people Aspasi Tonia, Olga and Vassilakis our transporter of staff Kosta available round the clock our general troubleshooter Peter and our longsuffering but always helpful printers Mr and Mrs Constantinopoulos Our thanks also go to the Local Organizing Committee and in particular Vassili Markellos for much aid, advice and support And of course our contributors who in a busy life provided articles at short notice We thank you most sincerely

And now the carnival is almost over Already some of us have left for our own countries and soon the 18th General Assembly of the International Astronomical Union will be ended

What have we as a community of astronomers as the Astrocosmos— learned? Certainly we have exchanged information about the cosmos and about our latest research methods certainly from our deliberations in session and out we have gained a clearer understanding and a wider synoptic view of the science we all pursue, undoubtedly we leave with a renewed enthusiasm for our exploration of that universe which progressively reveals itself to us in all it's mystery and beauty And on the human side we have strengthened the ties of international friendships and understanding as well as forming personal relationships that will influence us and enrich our future lives For that alone the 18th General Assembly has been a joyful event

It has been a joyful event overshadowed by the deep sorrow we have felt at the loss of our President, M K Vainu Bappu The tributes paid to this fine man in a touching ceremony have demonstrated again the truth spoken so long ago by John Donne when he talked of how each one of us is part of the continent of mankind «No man is an island Ask not for whom the bell tolls it tolls for thee»

There is a poem by T S Eliot called **Little Giddings.** In it he describes how the last place to be explored and appreciated in the world is the home from which we set out. Only after all else has been visited and experienced can one evaluate the familiar, taken-for-granted everyday events

Today man is exploring the worlds of the Solar System and beyond. In the cathedral of the universe his own galaxy is but a speck of dust, his Solar System is as a penny to the continent-sized galaxy, his Earth is the one green and blue, life-bearing planet in a Solar System of slag-worlds and poison-planets Like the astronauts returning from the Moon, astronomers see their home for the first time If we have learned anything at all, it is that the Earth is the mother of all life that we know of The sadness is that as the twentieth century enters its last years Earth, and its biosphere and that clever human race that has so brilliantly demonstrated its scientific and technological prowess in exploring the universe, are threatened as never before by the greed and stupidity and fear and intolerance of that same race

Sadly we must acknowledge with a sense of humility and fear that in the field of human relations our race has not even begun to ask the right questions, let alone find the right answers to free us from our sorry world state with its problems of famine and disease, of violence and oppression

Nevertheless, while admitting these facts, we can also take some small measure of hope for the uncertain future from the fact that there has been demonstrated once again at the 18th General Assembly of the IAU that spirit of international cooperation and concern without which there can be no future for our planet and our race And as astronomers we can endeavour to foster ever more clearly in our fellow humans realisation that they live on a finite, fragile unique home that once destroyed, is gone for ever

Let a Greek have the last word In talking of man's estate Pindar wrote more than two millennia ago

«What is a man? What is he not?
He is but a shadow in a dream.
But when the gods smile upon him,
There is a brightness upon Earth,
And life is sweet as honey»

If our race solves its problems then there will be a brightness upon Earth; life will be sweet as honey If not, then the Voyager records of the sights and sounds of man's planetary activities will journey on through interstellar space as his last brief moment of glory before hubris overtook him

ABOVE THE CLOUDS: BEYOND THE STARS

THE UNITED KINGDOM INFRARED TELESCOPE

Bill Zealey, U.K. Infrared Telescope of the Royal Observatory, Edinburgh

The 13,800 foot summit of Mauna Kea, on the Big Island of Hawaii is undeniably one of the best observational sites in the world. Its volcanic peak is the site of the Mauna Kea Observatories. Four major telescopes are now operating.

1. The University of Hawaii 2.2 metre Telescope.
2. The NASA 3 metre Infrared Telescope.
3. The Canada-France-Hawaii 3.6 metre Telescope.
4. The United Kingdom 3.8 metre Infrared Telescope.

The U.K. Infrared Telescope (UKIRT) is arguably the most powerful, ground-based, infrared telescope in the world. It is operated by the Royal Observatory Edinburgh on behalf of the U.K. Science and Engineering Research Council. An operating agreement exists whereby Netherlands astronomers and astronomers from the University of Hawaii have access to telescope time.

UKIRT is a thin mirror telescope It is light, compact and was comparatively cheap to build It's thin, upon a sophisticated support system to provide rigidity. So successful has this system been, that the optical performance of the telescope is comparable with more conventional 4 metre telescopes. It can thus, truly be considered the first large, thin mirror telescope.

UKIRT's aim is to make infrared astronomy available to the astronomical community as a whole: not just to infrared instrument specialists. To this end «Common User» instruments have been provided. Sited, as it is, above almost 40% of the Earth's atmosphere, UKIRT is particularly suited for work at wavelengths between 3 and 34 microns, and in the submillimetre and millimetre wavebands. Our immediate priorities have, therefore, been to develop instruments which fully exploit the high attitude site.

Operational instruments now include Indium Antimonide photometers, equipped with circular variable fitters for photometry and spectometry in the 1 to 5 micron region, bolometers working in the 4 to 35 micron region and cooled grating spectrometers for higher resolution spectrometry. Of particular interest is a dual channel photometer which operates simultareously in the J and K or H and K wavebands.

Future developments revolve around cooled grating spectrometers and the use of multielement array for mapping and spectrometry. Netherlands astronomers will provide a common user millimetre/submillimetre heterodyne receiver for night time and day time operation. To ease the astronomers task at 14,000 feet, as many telescope and instrument control functions as possible have been automated. This has been, logically extended to the implementation of remote operation of UKIRT. Initially a data transfer and communications link has been provided between the summit and Hilo. However by the end of 1982 a trial system will link Hawaii and Edinburgh. This will eventually provide the remote observer, in the UK with limited control of the telescope and data acquisition.

Perhaps the most exciting, recent, development has been the decision to site the U.K 15 metre millimetre-wave telescope on Mauna Kea. This telescope, coupled with UKIRT will provide an extremely powerful facility for UK and Netherland astronomers into the 1990s

CHINA JOINS THE FAMILY

A notable highlight of the 18th General Assembly of the IAU is the full adherence to the IAU of China as was anticipated at the General Assembly of 1979 at Montreal.

At the founding of the People's Republic in 1949, astronomy in China, like many other branches of science in the country, emerged to its rejuvenation. Today there are five major observatories, i.e. the Purple Mountain Observatory at Nanjing, Shanghai Observatory, Beijing Observatory, Yunnan Observatory at Kunming, and Shaanxi Observatory near Xian; four departments or sections of astronomy at major Chinese Universities —the Nanjing, Beijing Normal Universities and the Chinese University of Science and Technology; one factory devoted solely to astronomical instruments— the Nanjing Astronomical Instrument Factory; three artificial satellite observing stations (at Changchun, Urumqi and Guangzhou); and a planetarium at Beijing, with specialized personnel totalling about 2000, active on various fields of modern astronomy. Among those fields are solar physics, solar system studies, astrophysics, galaxies and cosmology, radio astronomy celestial mechanics and astrodynamics, star catalogues and astronomical constants, time and frequency service and astrogeodynamics. In addition, with its long tradition of astronomical observations and study, it is appropriate that the history of Chinese astronomy is an active field of research in China.

The booklet «Astronomy in China Today» published by the Chinese Astronomical Society, describes in detail the work carried out in each of the above fields. It is evident that in the years to come China will contribute ever more effectively and significantly to our subject. At the present moment something like 250 papers per year are being published by Chinese researchers, many of them in the journal **Chinese Astronomy and Astrophysics.** As time passes, this rate of production will undoubtedly rise steeply but, hopefully, not exponentially.

SOME HIGHLIGHTS OF JOINT DISCUSSION IV

THE EXPLORATION OF THE SOLAR SYSTEM

Continued from page 1

more abundant than in the Earth's air: HCl is of great importance - and there is the H_2SO_4 which goes so far to make Venus an unInviting world Dr Prinn outlined several possible atmospheric cycles the exact processes are still under discussion (though tremendous progress has been made), but it does seem likely vulcanism may be current

T Donohue followed with a fascinating analysis of the Cytherean H_2O problem It is a dry world with no more than 200 ppm in its lower atmosphere, why was this so? It was hardly likely that virtually no H_2O existed in the original planetesimals, so Venus must have lost its water in some way or other. The vital clue could lie in the relative abundance of deuterium as against hydrogen - greater than for Earth by a factor of 100. The measurement had been made fortuitously when the Pioneer mass spectrometer became clogged with H_2SO_4 droplets during its descent; but it does indicate that Venus may once have had an ocean, sufficient to cover the surface to a depth of 9 m. The youthful Sun was less luminous than that of today: as the temperature rose the water evaporated - and the escape mechanism is discriminatory which would explain the greater relative abundance of deuterium remaining.

Plate tectonics could have started during the oceanic period. Perhaps Ishtar had been formed then; would we eventually find fluvial channels there? It is by no means out of the question.

L. Brace described the solar wind in relation to Venus; D. Campbell gave an account of the radar work at Arecibo which had revealed circular features some with central elevations. This was followed by further contributions about the nature of the surface. Clearly our knowledge of Venus is not yet complete - but we have found out more than would have seemed even remotely possible a few years ago.

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St ANDREWS

St Andrew is the patron saint of Patras, the place where he was martyred. St Andrew and his diagonal cross, or saltire, appear on the placards placed on the building where IAU meetings take plaoe and on the first page of ASTROCOSMOS. St Andrew is also the patron saint of Scotland. How did this happen?

It is reputed that about the 9th century A.D. a Greek monk from Patras known as St. Regulus or Rule landed on the east coast of Scotland at a place called Kilrymonth or Headland of the Pigs. He carried with him a relic of St Andrew, a portion of a finger-bone. A monastery was founded at this place and later a great cathedral was built. St Andrews became the ecclesiastical capital of Scotland and the seat of an Arehbishop. The cathedral and monastery buildings were destroyed during the reformation and only ruins remain.

Meanwhile the great universities of Europe were founded, Paris, Bologna, Oxford, Cambridge. During the middle ages Scotland was an independent nation and often at war with England. Scottish students found it difficult to travel to Paris to study and so in 1410 a university was founded at St Andrews. Every year around Eastertime the students hold a pageant and process through the streets of St Andrews representing important people in the history of Scotland, St Andrews and the University. The procession is led by St Andrew walking barefoot camying his cross.

James Gregory, inventor of the Gregorian telescope, was professor of Mathematics for a short period in the 17th century and some relies of his observatory remain. Napier, the inventor of logarithms was a student at St Andrews. The modern observatory and astronomy department were only founded some 45 years ago. There are many participants in the Patras General Assembly who were students at St Andrews or have other connections with the University.

TODAY'S EVENTS:

LES EVENEMENTS DU JOUR:

In the Concourse Auditorium:
10.00 Second Session of the General Assembly.

In the Averof Grand Hotel:
15.00-18.00 Executive Committee 50th meeting.

At EOT Swimming Resort, Aya, Patras:
WINE FESTIVAL: 20.00-24.00.

GASTRONOMY CORNER

Melitzanes papoutsakia

1 1/2 kilo aubergines
3/4 kilo chopped beef
2 onions
2 tablespoons butter
Salt, pepper, cinnamon
160 grams grated chesse (kefalotyri or parmesan)

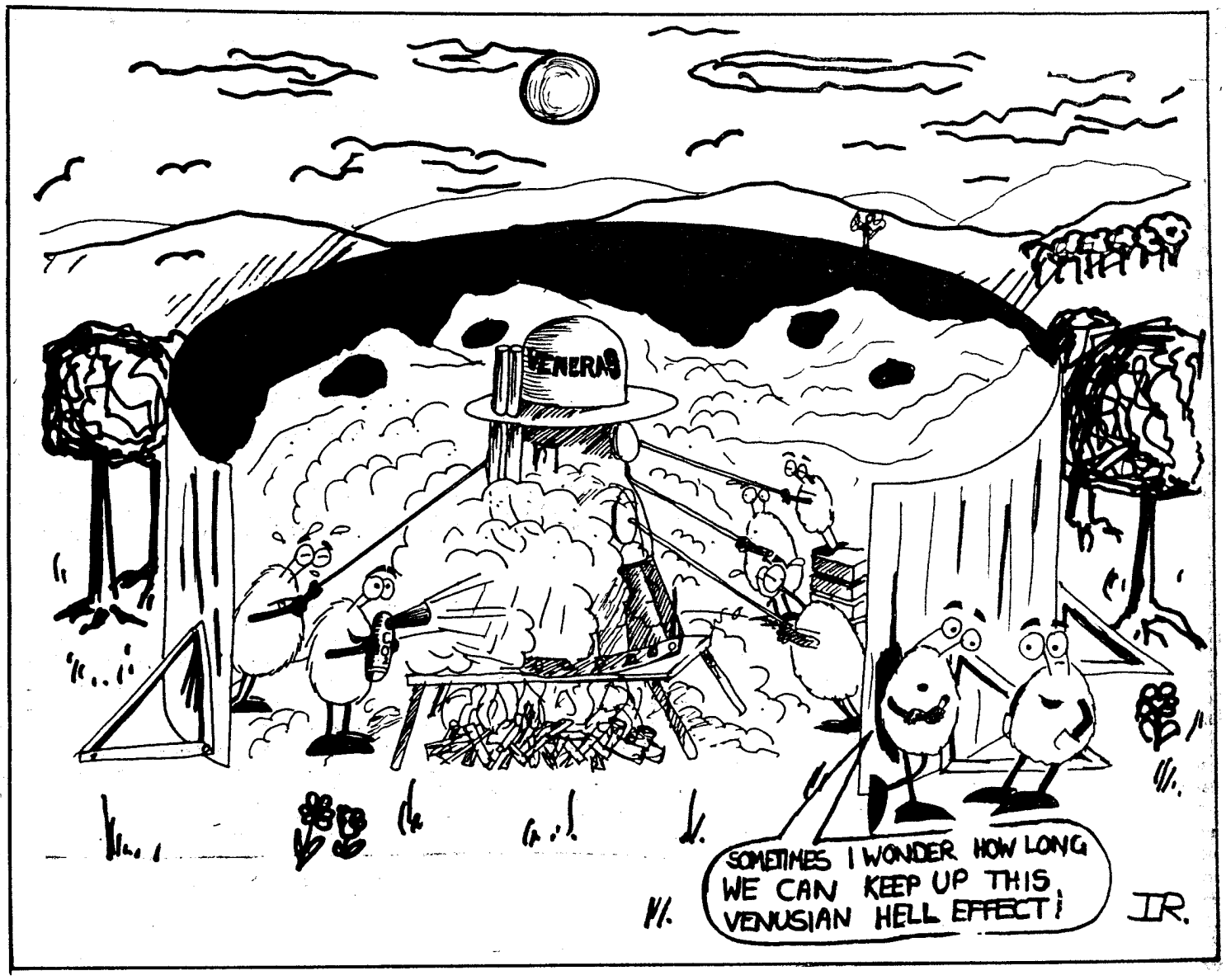
Cut the aubergines in half lengthwise. Take away the pulp with a spoon to make a hollow in each half, sprinkle with salt. Fill with the minced meat sauted with butter, the chopped onions, pepper and cinnamon. Arrange them in a baking dish, cover each one with béchamel sauce and sprinkle them with cheese. Bake them in moderate oven adding tomato juice.

Melitzanosalata

2 large (round variety) aubergines
2 cloves of garlic, chopped parsley, wine, vinegar, olive oil.

Bake aubergines in oven. When baked, peel them, put into a mortar and pound well with garlic, salt, vinegar and olive oil. Serve with chopped parsley and sliced tomato if desired.

Wanda Goudas



Delphi: Impressions and reflections

For the busy traveller hastening through modern times, Delphi, including its incomparable museum, represents more than a double sanctuary (Athena's and Apollo's); its godlike scenery offers a spiritual vision of the «centre of the world»

The site nestles at the foot of the Phaedriades, those grey rocks with ochre scars which overlook the wild and green valley of Pleistos. On the other side of the hill, the valley opens up onto the silvery green sacred plain covered with huge venerable olive trees, then onto the smiling coast of the deep blue sea.

To visit Apollo Pythian's Hieron, you follow the Sacred Way, a steep path covered with polished blocks — how many million pilgrims must have walked up there and smoothed it.

It is from above the theatre, in contemplating the ruins of the sanctuary that one grasps the harmony of the whole site: the Treasure of the Athenians, the rocky throne where Pythia gave her Oracles, the wall with its penta- and polygonal blocks supporting Apollo's temple, the temple itself, which contained the Omphalos — the centre of the world — and finally the theatre built with grey stone from Mount Parnassus. 5.000 people attended the Delphic celebrations of Apollo's victory over the Python snake. Today, we look from the pine and olive grove above the theatre and our glance embraces the scenery inspired by the gods and muses of Mount Parnassus. Cicadas twitter, the scents of Greek plants and herbs float in the air — sage, mint, origan, citronella, resin... —, rocks, dark cypresses and marble columns rise toward the sky like a song of triumph over the powers of darkness..

Below Apollo's sanctuary, the eyes dwell upon the mysterious white marble Tholos of Athena's sanctuary, that gracious light-house marking the lower end of this divine area.

The only earthly parts of Delphi which show the vanity of man are the votive monuments. «The monuments which surround the god on all sides, the offerings and levies which are the products of massacres, wars and bounty, how can we accept this revolting sight without indignation?», said Plutarch.

The god of the Sun and the goddess of Beauty and Arts have inspired man in Delphi and this spirituality which haunts the place still touches man today.

As to the Castalia Fountain, it casts a magic spell; under the deep green foliage of huge plane trees, runs a happy, cool and clear brook. The fountain flows out of an ochre carved rock next to a very narrow gorge, at the base of the Phaedriades; this silent grove was dedicated to the goddess Gê, the Earth, who gave her Oracles there, centuries before Apollo came.

After having passed a huge recently excavated basin of the Hellenistic period, the tired pilgrim has only a few steps to walk above the road, then he can quench his thirst and rest under the shade in peaceful solitude.

And, who knows, in the rose-tipped hues of early dawn, the sylphs and muses may dance there to the music of Pan's flute...

XVIII GENERAL ASSEMBLY RESOLUTIONS

The International Astronomical Union
recognizing that since the Seventeenth General Assembly Commissions 4, 7, 8, 19 and 31 have adopted the 1980 IAU Theory of Nutation in place of the 1979 IAU Theory of Nutation now
endorses the adoption of the 1980 IAU Theory of Nutation

Commissions 4 and 31
noting that the present method of keeping UTC within Os9 of UT1 by means of leap seconds both provides the second of S1 and meets the needs for safe celestial navigation,
recommend that the Air and Nautical Almanacs continue to be published with UT1 as the argument

Commissions 4, 19, 31
noting that the International Meridian Conference held in Washington in October 1884 adopted a resolution that from the meridian of the Observatory of Greenwich «longitude shall be counted in two directions up to 180 degrees, east longitude being plus and west longitude minus,» and **noting** that there is an increasing interaction between astronomy and geodesy in which field and sign convention «east longitude is positive» as in common use,
recommends that as soon as practicable all national ephemerides and other astronomical publications adopt the convention that terrestrial longitude be measured positively to the east

Commissions 4, 19 and 31
considering Commission resolution (4) of the Seventeenth General Assembly and that it is planned to introduce the IAU (1976) System of Astronomical Constants, the 1980 IAU Theory of Nutation, and the equinox of the FK5 on 1984 January 1
recommend that (a) the relationship between mean sidereal time and UT1 bae modified so that there is no change in either value or rate of UT1, as determined from stellar observations, due to a correction to the zero point of right ascensions of the FK4 and to a correction for the motion of the zero point both to be introduced in FK5, (b) the new expression for Greenwich mean sidereal time of Oh UTI be GMST of Oh UTI = 6h 41m 50s 54841 + 8640184s 812866 Tu + 0s.093104 Tu^2 - 6s 2 x 10^{-6} Tu^3 where Tu is the number of Julian centuries of 36525 days of universal time elapsed since 2000 January 1 12h UTI (JD451545.0)

Commission 8
considering that the determination of the equinox and equator will remain to be an important task of positional astronomy
recommends that
a) the Sun and major and minor planets are included in observational programs with transit circles
b) the Sun, and major planets are included in programs with astrolabes and
c) minor planets are included in programs of photographic astrometry,
such that from differential and/or absolute observations the positions can be rigorously referred to the fundamental reference system and serve for further improvements of the zero points of this system

Commission 12
recognising the extreme importance of the observation of solar seismology
strongly **supports** international co-operation in establishing a world-wide network of observing stations

Commission 50
considering with deep concern the proposals for a Satellite Power System which would place very large structures into Earth orbit with the potential of destroying the conditions for a major part of astronomical research in many regions of the electromagnetic spectrum,
recommends national representatives to bring this concern to the notice of space agencies in their countries, and to ensure that the IAU is kept fully informed of proposed developments in space techniques which would involve dangers to astronomy

Commissions 19 and 31
considering the need to clarify the role of the zonal tides in the processing and publication of the universal time,
recommend 1 that, when the effect of the short period zonal tides, i e periods less than 35 days, is computed for the above purposes, the attached tabulation based on Yoder, Williams, and Parkes study (J. Geophys Res **86**, 881 (1981) be used,
2 that the letter R be added to the notation of the relevant quantities to indicate that the correction for the short period zonal terms has been made (for instance UT1R)

Commission 40
recalling the considerations (a) to (d) of IAU Resolution No 3 of 1979 concerning harmful interference to radio astronomy observations
and **considering** the pioneering use by radio astronomers of the radio spectrum at frequencies above 275 GHz,
recommends 1. The provision by national administrations of frequency bands for radio astronomy continuum and polarization measurements at nearly octave intervals throughout the radio spectrum.
2. The provision of bands at the frequencies of the astrophysically most important spectral lines tabulated in the 1982 report of IAU Commission 40.
3. The protection of these frequency bands from harmful interference from in-band, band-edge and sub-harmonic emmissions, especially from space-borne transmitters.

Commission No. 4
considering that it is planned to introduce the IAU (1976) System of Astronomical Constants, the 1980 IAU Theory of Nutation, and the equinox of the FK5 on 1984 January 1
recommends that in the calculation of lunar and solar eclipses, there be a single value for k, the ratio of the radius of the lunar profile to the Earth's radius, and that it correspond to the mean radius of Watts' datum as determined by obsrvation of occultations and to the adopted radius of the Earth; the value is k = 0.2725076.

The International Astronomical Union
recognizing that continuing long-term synoptic observations of solar activity are vitally necessary, and that some long-term programmes have been lost or are threatened in the present worldwide economic situation,
recommends that all countries endeavour to plan well balanced programmes of synoptic solar observations for the sake of future generations.

Commission No. 8
in view of the importance of accurate positions and proper motions of High Luminosity Stars for galactic research
reaffirms its previous recommendation that such stars be included in transit circle programmes

Commissions Nos. 19 and 31
The International Astronomical Union taking note of the success of the MERIT short campaign and **recognising** that the results to be obtained during the MERIT main campaign will be of short and long-term benefit for the studies of the planet Earth
endorses the following two resolutions adopted by the International Association of Geodesy (IAG) at its General Meeting of Tokyo (May 1982),

AIG RESOLUTION 1
The International Association of Geodesy
noting that the results to obtained during the MERIT main campaign will be of long-term benefit to geodesy and its applications
strongly-endorses the proposals of the COTES and MERIT Working Groups that during the campaign
(a) very long baseline radio interferometric and satellite and lunear laser ranging systems be used for co-located observations of high precision at the recommended sites, and
(b) observations be made intensively for a limited period to detect any short-period variations in the derived earth-rotation parameters
and urges that the appropriate resources and facilities be made available for these activities by the countries involved.

AIG RESOLUTION 2
The International Association of Geodesy
considers that it is important that the new terrestrial reference frame to be derived from high-precision observations during the MERIT Main Campaign should be extended and related to existing services as accurately and quickly as possible
and urges that co-ordinated precise positioning observations be made during the campaign by satellite radio-tracking systems at the Very Long Baseline Interferometric, Lunar and Satellite Laser Ranging sites as well as at a larger number of well distributed sites around the world».
recommends (a) that the co-ordinates of the stations of the International Service of Latitude be determined in the Reference System (NWL 10F) adopted for the analysis of observations, by the Doppler method of artificial satellite of TRANSIT or NOVA type.
(b) that special support be given to BIH acting as the co-ordinating center for the MERIT international campaign.

Commission 8
recommends to observe by transit-circle the subset of stars requested by the HIPPARCOS Input Catalogue Consortium. The positions should be available before 1985.5. A moderate accuracy of ± 1.0 arcsec at that epoch is required; however ± 0.3 arcsec (in the FK4 system) is desirable.

Commission 8
noting that the HIPPARCOS stars will be selected for their astrophysical and/or astrometric interest and that such stars would traditionally be included in meridian observing programmes,
and **noting** that very accurate meridian positions of suitable subsets of the HIPPARCOS stars would give checks of the space observations and calibration of the ground-based instruments, it is
recommended that such subsets, e.g. faint fundamental stars and International Reference Stars be observed.

The International Astronomical Union
recognizing the recent increased interest in cataclysmic variables, and the need for long-term light-curves to make possible the correlation of theoretical and observational research,
noting that data collected by AAVSO observers and other groups throughout the world are available on magnetic tape
recommends the publication of this valuable reference material

Commission No 5
The International Astronomical Union
reconfirming Resolution No 3 adopted by the XVI General Assembly
considers that Astronomy and Astrophysics Abstracts (AAA) fulfil excellently the specialised needs for an abstracting service in Astronomy and Astrophysics,
and **recommends** strongly that AAA continue to be produced by the Astronomisches Rechen Institut, Heidelberg, Fed. Rep. Germany, under the auspices of the IAU.

The International Astronomical Union
recognizing the importance of interdisciplinary scientific use of large steerable antennas for astrophysical, astrometric and geodetic research in Very Long Baseline Interferometry (VLBI),
endorses the formation of a working group under Commission 40 to collect and disseminate information concerning plans of VLBI experiments in astronomy and geodesy, and to encourage co-operation between observatories internationally.

Commission 49
noting decision 5/82 adopted at the XXIVth COSPAR meeting in May 1982,
recommends the introduction of the International Heliospheric Study during January 1988 - December 1990 as an IAU activity conducted under the auspices of COSPAR in conjunction with other appropriate ICSU bodies.

Commission 22
noting the importance of the recent contributions from the Canadian and European Fireball Networks
recommends that continued support be provided of these observational programs in order that a more extensive body of reliable data may be gathered for critical analysis.
notes the recovery of meteorites from these two major camera networks is likely to remain limited to rare events; progress in the interpretation of fireball data is now leading to significant studies of both the astronomical properties of meteorites and the physics of their atmospheric interaction.

Commission 22
recognising their key position in the Network and their essential role in the location and recovery of meteorites which fall on Austrian Soil,
recommends that the University Observatory of Vienna give its fullest support to the continuation of operation of the two Austrian stations of the European Fireball Network.

Appendix IV
Item 13(d) of the AGENDA
1. The Executive Committee,
having examined the proposal of the President of Commission 22 to establish a Meteor Data Center of the Commission at the Observatory of Lund in Sweden,
propose the allocation of SwFr 1 800 per annum as a financial contribution to the costs of such a center, so established, for the period 1983-85.
2. The Executive Committee,
noting the expressed wish of the official representative of the Swedish National Committee of Astronomy at the XVIIth General Assembly of 1979 at Montreal that fellowships for students from developing countries be encouraged,
and recognizing the valuable discussions carried out in the interim by the Working Group of Commissions 46 and 38 on the Education of Astronomers from Developing Countries,
proposes that a sum of SwFr 35000 be allowed during the period 1983-85 to support the carrying out of a Contract Scheme for Visiting Lecturers with a sponsoring institution in a country newly entering into astronomical work, to be selected before June 1983, as the result of active enquiry within IAU member countries and other selected countries.

Appendix I
Item 4(c) of the AGENDA
Motion of the Executive Committee:
The General Assembly of the Union
noting that progress has been achieved in restoring full adherence to the IAU of China, as was anticipated at the XVIIth General Assembly of 1979 at Montreal, and that agreement was obtained by 1 May 1980 on the mode of listing, in the official list of member countries, two adhering bodies for China as a temporary measure,
ratifies the arrangements made by the Executive Committee for the adherence of China to the Union during the period elapsed since the XVIIth General Assembly.

Appendix VI
Item 18(b) of the AGENDA
The Executive Committee proposes to the General Assembly that a new Commission of the Union be established in respect of the search for life in the Universe, the name of the Commission to be Commission 51

Appendix VII
Item 18(c) of the AGENDA
The following changes of name have been proposed for existing Commissions of the Union:
Commission 26 (Double Stars) to be renamed «Double and Multiple Stars»
Commission 34 (Interstellar Matter and Planetary Nebulae) to be renamed «Interstellar Matter»

Appendix VIII
Item 5 of the AGENDA
The Special Nominating Committee, convened during 1980 and 1981 by the President of the Union, has selected the following IAU Members to be proposed to the XVIIIth General Assembly at Patras as members of the IAU Executive Committee from 26 August 1982:
As President - Professor R. Hanbury Brown (Australia).
As Vice-Presidents continuing from the former period Dr. M.W. Feast (South Africa), Dr. L. Kresak (Czechoslovakia), Professor R. Wilson (UK).
As Vice-Presidents to be newly proposed: Professor R.P. Kraft (USA), Dr. M. Peimbert (Mexico), Dr Ya. S. Yatskiv (USSR).
As General Secretary - Dr. R.M. West (Denmark)
As Assistant General Secretary - Dr. J.P. Swings (Belgium).
As Advisers to the Executive Committee - Professor P.A. Wayman (Ireland).

Appendix II
Item 11 of the AGENDA
1. Resolution proposed on behalf of Commission 5.

Commission 5
considering the present unsatisfactory situation of the transfer of astronomical data between astronomical institutions
recommends that all astronomical computer facilities recognise and support the Flexible Image Transport System (FITS) for the interchange of binary data on magnetic tape, as described in Astronomy and Astrophysics Supplement, vol. 44, pp 363 and 371.
2. Resolution proposed on behalf of Commission 15:

The International Astronomical Union
recognising that it is particularly desirable that pre-selected Comet Halley Days for co-ordinated observation over a limited time be supported
recommends that observatory directors and observing program committees give high priority to Comet Halley observation during the interval 1985-1987.
3. Resolution proposed on behalf of Commission 15.

The International Astronomical Union
noting that in order to organise and marshall ground-based observations of Comet Halley throughout its 1986 perihelion passage and to co-ordinate them with space missions, an international program, the International Halley Watch, has been established
and wishing to avoid duplication of effort at the international level and to encourage participation in this program
endorses the International Halley Watch as the international co-ordinating agency for Comet Halley observations.
4. Resolution proposed on behalf of Commission 46
Whereas astronomy is an integral part of the physical sciences, both in education and in research,
and **whereas** some countries now without astronomy may desire to introduce astronomy in their educational or scientific institutions,
be it resolved that the International Astronomical Union supports the introduction of astronomy in such countries and encourages activities by its Commissions toward that purpose.

Appendix II
Item 13(c) of the AGENDA
Proposal of the Executive Committee:
Budget for adoption 1983-1985
Unit of Contribution: 1760

RECEIPTS (Swiss Francs)	Swiss Francs
1. Contribution from Adhering Bodies (225 units per year)	1.188.000
2. Revenue from IAU Publications	51.000
3. Interest on Accounts	125.000
4. UNESCO and ICSU Contributions	68.000
Total Receipts	1.432.000
Excess of Payments over Receipts	1.700
	1.433.700
PAYMENTS (Swiss Francs)	
1. Administrative Office	
1.1. Paris Secretariat (incl. furniture, equipment etc)	500.000
1.2. Secretarial help to GS & AGS	10.000
2. Subscription to ICSU	29.700
3. Commission Expenses	15.000
4. Projects of Commissions	
4.1. Exchange of Astronomers (Commission 38)	58.000
4.2. Teaching of Astronomy (Commission 46)	40.000
4.3 IAU Telegram Bureau (Commission 6)	10.000
4.4 Minor Planet Centre (Commission 20)	10.000
4.5 Variable Star Catalogue (Commission 27)	10.000
5. General Assembly	200.000
6. Publications (IAU Information Bulletin)	60.000

Continued on page 6

RESOLUTIONS DE LA XVIIIème ASSEMBLEE GENERALE

L'Union Astronomique Internationale
considérant que depuis la XVIIe Assemblée Générale, les Commissions 4, 7, 8, 19 et 31 ont adopté la Théorie de la Nutation UAI 1980 en remplacement de la Théorie de la Nutation UAI 1979,
souscrit désormais à l'adoption de la Théorie de la Nutation UAI 1980.

Les Commission 4 et 31

notant que la méthode actuelle consistant à conserver l'écart entre le UTC et le UTI, dans les limites de 0.9s, au moyen de secondes intercalaires, fournit à la fois la seconde de SI et satisfait aux besoins de la sécurité de la navigation par les méthodes astronomiques,
recommandent que les annuaires aéronautiques et nautiques continuent d'être publiés avec le UTI comme argument.

Les Commissions 4, 19 et 31

notant que la Conférence du Méridien International tenue à Washington en Octobre 1884 a adopté une résolution selon laquelle à partir du méridien de l'Observatoire de Greenwich «La longitude sera completée dans deux directions jusqu'à 180°, la longitude Est étant positive et la longitude Ouest étant negative»,
et **notant** qu'il existe une interaction croissante entre l'astronomie et la géodesie dans lequel la convention de signe «longitude positive vers l'Est» est d'un usage courant,
recommandent que tous les éphémerides nationaux et les autres publications astronomiques adoptent dès que possible la convention selon laquelle la longitude terrestre soit mesurée positivement vers l'Est.

Les Commissions 4, 19 et 31

considérant la Résolution 3 de la Commission 4 prise lors de la XVIIe Assemblée Générale et
considérant qu'il est prévu d'introduire le Système des Constantes Astronomiques de l'IAU 1976, la Théorie de la Nutation UAI 1980 et l'équinoxe du FK5 au 1er Janvier 1984,
recommandent a) de modifier la relation existant entre le temps sidéral moyen et le UTI de façon à ne changer ni la valeur ni le taux de UTI, déterminés à partir d'observations stellaires et introduits, par suite d'une correction à l'origine des ascensions droites du FK4 et du mouvement de cette origine, toutes deux étant apportées au FK5,
b) que la nouvelle relation du temps sidéral moyen de Greenwich à Oh UTI soit de GMST à 0hUT1 = 6h41mn 50s.54841 + 8640184s.812866 T_U + 0s093104 T_U^2 - 6s.2 x $10^{-6} T_U^3$
où T_U est le nombre de siècles juliens de 36525 jours de temps universel écoulés depuis le 1er janvier 2000, 21 h UTI (JD451545, 0).

La Commission 8

considérant que la détermination de l'équinoxe et de l'équateur resteront une tâche importante pour l'astronomie de position,
recommande que a) le Soleil, les grosses et les petites planètes soient inclues dans les programmes d'observation au moyen d'instruments de passage,
le Soleil et les grosses planètes soient inclues dans les programmes d'astrolabe et
les petites planètes soient inclues dans les programmes d'astrométrie photographiques en sorte qu'à partir d'observations différentielles et/ou absolues, les positions puissent être soigneusement rattachées au système de référence fondamental et servir à améliorer les origines de ce système.

La Commission 12

reconnaissant l'extrême importance de l'observation de sismologie solaire,
encourage vivement la coopération internationale par la mise en place d'un réseau mondial de stations d'observation.

La Commission 50

considérant avec profonde inquiétude les propositions relatives à un système d'approvisionnement en énergie par satellite qui mettrait en importantes installations sur orbite terrestre ayant le pouvoir de détériorer une grande partie des conditions de recherche astronomique dans beaucoup de régions du spectre électromagnétique,
recommande aux représentants nationaux d'attirer l'attention des agences spatiales de leurs pays sur ce problème, et d'assurer que l'UAI soit pleinement informée des projects proposés de tous les techniques spatiales pouvant entraîner des dangers pour l'astronomie.

Les Commissions 19 et 31

considérant le besoin de représenter clairement l'effet des marées zonales dans le calcul et la définition du temps universel,
recommandent que lorsque l'effet des marées zonales à court terme (période inférieure à 35 jours) est calculé dans les buts précités, on utilise l'expression ci-jointe, tirée des travaux de Brouwer, Williams et Parke (J. Geophys. Res. 86, 10 1981), et que le suffixe R soit ajouté à la notation des quantités concernées pour signifier que la correction des effects à court terme a été effectuée (exemple: UTIR).

La Commission 40

Rappellant les considérations (a) à (d) de la Résolution UAI 1979 No 3 relative aux interférences nuisibles aux observations radioastronomiques,
considérant l'exploitation d'avant-garde que font les radioastronomes du spectre radioélectrique à des fréquences supérieures à 275 GHz,
recommande
1. l'attribution par les administrations nationales de bandes de fréquence destinées aux mesures radioastronomiques du spectre continu et de la polarisation à des intervalles de presque un octave dans tout le spectre radioélectrique.
2. l'attribution de bandes à des fréquences correspondant aux raies spectrales les plus importantes du point de vue astrophysique énumérées dans le rapport 1982 de la Commission 40 de l'UAI.
3. la protection de ces bandes de fréquence contre toute interférence nuisible d'émissions dans la bande même, sur le bord de la bande et dans les bandes sous-harmoniques; tout particulièrement de la part d'émissions émanant d'émetteurs spatiaux.

La Commission 4

considérant qu'il est prévu d'introduire le Système des Constantes Astronomiques UAI 1976, la Théorie de la Nutation UAI 1980 et l'équinoxe du FK5 au 1er Janvier 1984,
recommande qu'il y ait, dans le calcul des éclipses lunaires et solaires, une seule valeur pour K, rapport du rayon du profil lunaire au rayon de la Terre, et que ce rapport corresponde au rayon moyen de la donnée de Watts déterminée par observation d'occultations et au rayon qui a été adopté pour la Terre; cette valeur est K = 0,2725076.

L'Union Astronomique Internationale
reconnaissant que les observations synoptiques continues et de longue durée de l'activité solaire sont d'une nécessité vitale et que certains programmes à long terme ont été perdus ou sont menacés par suite de la situation économique mondiale actuelle,
recommande que tous les pays s'efforcent d'organiser des programmes rationnels d'observation synoptique solaire pour les générations futures.

La Commission 8

étant donné l'importance des positions et mouvements propres précis d'étoiles très lumineuses pour la recherche galactique,
reconfirme sa recommandation antérieure selon laquelle ces étoiles soient inclues dans des programmes d'instruments de passage.

L'Union Astronomique Internationale
Prenant note du succès de la campagne courte du programme MERIT et
reconnaissant que les résultats à obtenir au cours de la campagne principale de MERIT apporteront des contributions à long et à court terme pour les études de la planète Terre,
souscrit aux deux résolutions suivantes adoptées par l'Association Internationale de Géodésie (AIG) lors de sa réunion générale de Tokyo (Mai 1982):

AIG - RESOLUTION 1

«The International Association of Geodesy»
noting that the results to be obtained during the MERIT Main Campaign will be of long-term to geodesy and its applications,
strongly endorses the proposals of the COTES and MERIT Working Groups that during the Campaign
(a) very long baseline radio interferometric and satellite and lunar laser ranging systems be used for co-located observations of high precision at the recommended sites and
(b) observations be made intensively for a limited period to detect any short-period variations in the derived earth-rotation parameters, **and urges** that the appropriate resources and facilities be made available for these activities by the countries involved.

AIG - RESOLUTION 2

The International Association of Geodesy
considers that it is important that the new terrestrial reference frame to be derived from high-precision observations during the MERIT Main Campaign should be extended and related to existing services as accurately and quickly as possible
and urges that coordinated precise positioning observations be made during the Campaign by satellite radio-tracking systems at the Very Long Baseline Interferometric, Lunar and Satellite Laser Ranging sites as well as at a larger number of well ditributed sites around the world».

et L'UNION ASTRONOMIQUE INTERNATIONALE

recommande (a) que les coordonnées, des stations du Service International des Latitudes soient déterminées dans le système de référence (NWL10F) adopté pour l'analyse des observations par la méthode Doppler des satellites artificiels du type Transit ou Nova.
(b) qu'une aide spéciale soit octroyée au Bureau International de l'Heure (BIH) agissant en qualité de centre coordinateur pour la campagne internationale MERIT.

La Commission 8

recommande d'observer par instruments de passage le sous-ensemble d'étoiles demandé par le HIPPARCOS Input Catalogue Consortium. Les positions devraient être disponibles avant 1985.5. Une précision moyenne de ± 1,0 arcsec à cette époque est requise; toutefois ± 0,3 arcsec (dans le système FK4) est souhaitable.

La Commission 8

notant que les étoiles HIPPARCOS seront sélectionnées pour l'intérêt qu'elles présentent du point de vue astrophysique et /ou astrométrique et que ces étoiles devraient être inclues comme d'habitude dans les programmes d'observation méridienne,
et notant que les positions méridiennes très précises des sous-ensembles appropriés d'étoiles HIPPARCOS permettraient d'effectuer des sondages sur les observations effectuées dans l'espace et sur la calibration d'instruments au sol, il est
recommandé d'observer de tels sous-ensembles, c'est-à-dire les étoiles fondamentales faibles et les Etoiles de Reference Internationale.

L'Union Astronomique Internationale
reconnaissant l'intérêt croissant que présent les variables cataclysmiques et la nécessité de disposer de courbes de lumière à long terme afin de permettre la corrélation entre la recherche théorique et observationnelle,
notant que les données rassemblées par les observateurs AAVSO et d'autres groupes de par le monde sont disponibles sur bandes magnétiques,
recommande la publication de ces données de réference de grande valeur.

La Commission 5

L'Union Astronomique Internationale
reconfirmant la Résolution No 3 adoptée par la XVIe Assemblée Générale,
considère que les Astronomy and Astrophysics Abstracts (AAA) satisfont pleinement aux besoins des spécialistes désirant publier des notes abrégées dans la revue Astronomy and Astrophysics,
et recommande vivement que l'Astronomisches Rechen-Institut de Heidelberg, Rep. Féd. d'Allemagne, continue de publier les AAA sous les auspices de l'UAI.

L'Union Astronomique Internationale
reconnaissant l'importance que présente l'usage scientifique interdisciplinaire de grandes antennes orientables pour la recherche astrophysique, astrométrique et géodésique dans l'Interférometrie à très Longue Base (VLBI),
souscrit à la création d'un groupe de travail dépendant de la Commission 40 en vue de rassembler et disséminer l'information concernant les projects d'expériences VLBI en astronomie et en géodésie, et d'encourager la coopération internationale entre les observatoires.

La Commission 49

notant la décision 5/82 adoptée à la XXIVe réunion du COSPAR tenue en Mai 1982,
recommande d'incorporer l'Etude Héliosphérique Internationale de Janvier 1988 à Décembre 1990 parmi les activités de l'UAI, sous les auspices du COSPAR, conjointement aux autres organismes appropriés de l'ICSU.

La Commission 22

notant l'importance des récentes réalisations des Réseaux de Bolides Canadiens et Européens,
recommande de poursuivre sans discontinuer l'aide apportée à ces programmes d'observation afin qu'un plus vaste ensemble de données fiables puisse être rassemblé en vue d'une analyse critique,
note que la récupération des météorites au moyen des deux principaux réseaux d'équipements photographiques (de camera's?) restera vraisemblablement limitée à quelques cas rares; les progrès réalisés dans l'interprétation des données relatives aux bolides permet actuellement d'entreprendre des études sérieuses à la fois sur les propriétés astronomiques des météorites et sur la physique de leur interaction dans l'atmosphère.

La Commission 22

reconnaissant leur position clé dans le Réseau et leur rôle fondamental dans la localisation et la récupération des météorites qui tombent sur le sol autrichien,
recommande que l'Observatoire de l'Université de Vienne accorde tout son soutien à la poursuite des activités des deux stations autrichiennes appartenant au Reseau Européen de Bolides.

Appendice IV
Point 13(d) de l'Ordre du Jour

1. Le Comité Exécutif
ayant examiné la proposition du Président de la Commission 22 d'établir un Centre de Données sur les Météores à l'Observatoire de Lund en Suède,
propose d'allouer une somme de 1800 Francs Suisses par an comme participation financière aux frais de ce centre, pour la période 1983-85.
2. Le Comité Exécutif
notant le voeu exprimé par le représentant officiel du Comité National Suédois d'Astronomie à la XVIIème Assemblée Générale de 1979 à Montréal que soient encouragées les bourses pour les étudiants des pays en voie de développement,
et reconnaissant les discussions valables engagées depuis par le Groupe de Travail des Commissions 46 et 38 sur la Formation des Astronomes des pays en voie de développement,
propose qu'une somme de 35.000 Francs Suisses soit allouée pendant la période 1983-85 pour permettre d'établir un Modéle de Contrat pour Conférenciers Visiteurs avec un institut de tutelle dans un pays nouvellement acquis à la recherche astronomique, dont le choix sera arrêté avant Juin 1983, et qui dépendra d'une enquête approfondie dans les pays membres de l'UAI et dans d'autres pays sélectionnés.

Appendice I
Point 4(c) de l'Ordre du Jour
Motion du Comité Exécutif

L'Assemblée Générale de l'Union
constatant le progrès accompli pour le rétablissement de la pleine adhésion de la Chine à l'UAI, tel qu'il avait été anticipé à la XVIIème Assemblée Générale de 1979 à Montréal, et l'accord obtenu au 1er Mai 1980 pour la dénomination, dans la liste des pays membres, de deux organisations adhérentes pour la Chine à titre provisoire,
ratifie les accords passés par le Comité Exécutif pour l'adhésion de la Chine à l'Union pendant la période écoulée depuis la XVIIème Assemblée Générale.

Appendice VI
Point 18(b) de l'Ordre du Jour

Le Comité Exécutif propose à l'Assemblée Générale qu'une nouvelle Commission de l'Union soit créée, relative à la recherche de la vie dans l'Univers, le nom de la Commission et l'appartenance à cette Commission devant être Commission 51 Recherches de la cré dans l'Univers.

Appendice VII
Point 18(c) de l'Ordre du Jour

Ont été proposés les changements suivants pour les Commissions existantes de l'Union:
La Commission 26 (Etoiles Doubles) deviendra «Etoiles Doubles et Multiples».
La Commission 34 (Matière Interstellaire et Nébuleuses Planétaires) deviendra «Matière Interstellaire».

Appendice VIII
Point 5 de l'Ordre du Jour

Le Comité Spécial des Nominations, réuni en 1980 et 1981 par le Président de l'Union, a sélectionné les membres de l'UAI suivants pour être proposés à la XVIIème Assemblée Générale de l'UAI à Patras comme membres du Comité Exécutif de l'UAI à dater du 26 Août 1982:
Comme Président: Professeur R. Hanbury-Brown (Australie).
Comme Vice-Présidents continuant de la période précédente: Dr M.W. Feast (Afrique du Sud), Dr. L. Kresak (Tchécoslovaquie), Professeur R. Wilson (Royaume-Uni).
Comme Vice-Présidents nouvellement proposés: Professeur R.P Kraft (USA), Dr. M. Peimbert (Mexique), Dr. Ya. S. Yatskiv (URSS)
Comme Secrétaire Général: Dr. R.M. West (Danemark).
Comme Secrétaire Général Adjoint: Dr. J.P. Swings (Belgique)
Comme Conseillers au Comité Exécutif: Professeur P.A. Wayman (Irlande).

Appendice II
Point 11 de l'Ordre du Jour

1. Resolution proposée au nom de la Commission 5:

La Commission 5
considérant la situation actuelle peu satisfaisante de l'echange de données entre instituts d'astronomie
recommande que tous les ordinateurs utilisés en astronomie reconnaissent et adoptent le Système de Transport d'Image Souple pour l'échange de données binaires sur bande magnétique, tel qu'il est décrit dans le Supplémentad'Astronomy and Astrophysics, vol. 44, pp. 363 et 371.
2. Résolution proposée au nom de la Commission 15:

L'Union Astronomique Internationale
estimant qu'il est particulièrement souhaitable que l'on consacre des Journées Comète de Halley' choisies à l'avance à des observations coordonnées pendant une durée limitée
recommande que les directeurs d'observatoires et les comités de programme attributent une force pricrité aux observations de la Comète de Halley dans l'intervalle 1985-1987.
3. Résolution proposée au nom de la Commission 15:

L'Union Astronomique Internationale
constatant qu'un programme international de surveillance de la Comète de Halley dit «International Halley Watch» a été mis en place afin de préparer et d'orchestrer les observations depuis la Terre de la Comète de Halley tout au long de son passage au périhélie en 1986 et de les coordonner avec les missions spatiales
et désirant éviter la duplication des efforts au niveau international et encourager la participation à cette campagne
reconnaît l'International Halley Watch comme l'organisation internationale coordonnant les observations de la Comète de Halley.
4. Résolution proposée au nom de la Commission 46:
Alors que l'astronomie fait partie intégrante des sciences physiques tant dans l'enseignement que dans la recherche,
et alors que certains pays dépourvus d'astronomie peuvent souhaiter introduire l'astronomie dans leurs institutions scientifiques ou d'enseignement,
il est résolu que l'Union Astronomique Internationale soutienne l'introduction de l'Astronomie dans ces pays et encourage les activités dans ce but par le biais de ces Commissions.

Guests enjoy the closing dinner of the XVIIIth General Assembly at the Averof Grand Hotel

THE IDENTITY CRISIS OUTLOOK FOR THE FUTURE

Report from Commission 5 (Documentation of Astronomical Data):

We wish to bring to the attention of all astronomers the following documents which have been compiled and will be published as soon as possible (before next IAU General Assembly) «Astronomers Handbook» prepared by S. Mitton.
«Guide to Presentation of Astronomical Data» CODATA public 46 prepared by G.A. Wilkins.
«IAU Vocabulary» (astronomical key words) prepared by P. Lantos.
«The first Dictionary of the Nomenclature of Celestial Objects» prepared by A. Fernandez, M C Lortet, F Spite
«Compilation of Current Designation Practices in Astronomy» prepared by J. Mead.

Commission 5 has established a Working Group on «Designations» chaired by Haschek whose major task is to bring into a uniform system the various current designation practices of the other commissions. Such designations are often in conflict with one another. Recommendations will be formulated and circulated among the commissions well in advance of the next General Assembly so that the resolutions may be acted upon at that time.

Difficulties and Recommendations

In compiling the «Dictionary of Nomenclature of Celestial Objects», Fernandez, Lortet and Spite encountered a number of difficulties such as many authors using abbreviations or acronyms without any explanation. Often positional information was lacking for what was deemed by the authors as a «well known» object such as the KL nebula or BN source in the Orion region. It must be stressed that at least the following information be given in order for a minimum of perspicuity and consistency be achieved:

1. Acronyms, abbreviations of sources and catalog names must be defined by their complete bibliographic reference, except for a few widely known catalogues, a list of which should be published by Commission 5.

2. The objects studied should always be identified by two designations, one of which may be coordinates. The equinox always be specified for equatorial coordinates.

3. Before coining a new acronym or abbreviation, check for any possible ambiguity with previous designations by consulting the Dictionary (once it is published). The 3 letter abbreviations for constellation names should also be excluded and used only to refer to constellation names. Note that if a constellation is part of a designation, the entire 3 letter abbreviation should be used and not just the first letter, e.g. ORI MCLD (or ORI MC) but not OMC for a molecular cloud in the constellation of Orion.

It is important that editors of astronomical journals and their referees should enforce these minimum standards concerning nomenclature.

GIORGIO ABETTI

Giorgio Abetti, the father of modern astrophysics in Italy, died on August 24 in Florence

He was going to be 100 years old next october and the Italian Astronomical Society was going to celebrate his anniversary with a special meeting attended by representatives of various national astronomical societies.

A student of G E Hale, he was well known for his contributions to solar research and for his fostering international cooperation. He has been one of the founders of the International Astronomical Union at the Rome Meeting in 1922 and Director of the Arcetri Astrophysical Observatory for almost 30 years

All those who have known him and especially the Italian astronomers mourn the loss of a great scientist and a man with an extraordinarily warm personality.

(F. Pacini)

THE HENRI CHRETIEN AWARD

A generous donor, who wishes to remain anonymous, has given funds to the American Astronomical Society for the purpose of Awards in Honor of Professor Henri Chrétien. A committee of five persons from three countries has worked with the Executive Offices of the American Astronomical Society in selecting Chrétien Award winners. For 1982 they are Catherine Boisson, France, and Paul Ho, U.S.A.

For future consideration, the rules adopted by the current committee are as follows:
1 Application must be received in the Executive Office of the American Astronomical Society by the first of April.
2 A scientific project description, with emphasis on individual observational or experimental work, is to be included and must not exceed three pages.
3. Identification of applicant not to exceed one page
4. The application must include two letters of nomination from well-established astronomers
5 A very brief statement of support required and a mention of other resources should be included.

Chrétien Awards may number one or more in any given year.

Mrs Wanda Goudas, Chairperson of the social events subcommittee of L.O.C. Many participants have expressed their sincere appreciation for the social events in this General Assembly.

THIRD INVITED DISCOURSE ON CONTEMPORARY COSMOLOGY

Monday night's discourse on «Contemporary Cosmology», given by Professor Ya. B. Zeldovitch in the Ancient Odeon, was a memorable and joyful occasion. In introducing the much-loved and highly-respected theoretician, Professor D.S. Heeschen reported that he had had a hard time finding out about all Zel'dovitch's academic honours because Zel'dovitch himself wouldn't tell him. But in the course of his researches, Heeschen had discovered that Zel'dovitch's 3 children and their spouses were all physicists; they had so far produced two physics students as grandchildren; and now one of the grandchildren was about to marry, and so we can look forward to a fourth generation of physicists!

In his discourse Professor Zel'dovich remarked that Cosmology got a reputation of being a respectable science only in the last few decades. It now has a solid backbone of well established facts and a long range perspective of developing further most audacious hypotheses. He divided the sources of cosmology's successes into 1)progress of observations-optical, radio and X-ray; 2) Progress in theoretical physics - electromagnetic theory, theory of gravitation, quantum theory including atomic physics, nuclear and particle physics and last but not least 3) moral courage.

One really needs courage, he said, to apply the laws found in our laboratories to the infinite universe.

After the prediction and actual discovery of cosmic background radiation, the theory of a hot Big Bang seems to be established beyond any reasonable doubt. New problems are arising connected with the actual inhomogenity of the Universe and its structure.

Quite new branches of mathematics are used to describe the nonlinear part of the story: catastrophe theory, percolation theory, pattern formation, so called synergetics.

Perhaps, the speaker said, we are near to explain the very specific structure of the universe with voids, sheets, strings and clusters of galaxies. One asks why is the Universe as it is? Why is «matter» present and antimatter (antiprotons, positrons etc.) practically absent?

Why were the initial conditions as they were — quasiuniform but with small perturbations?

To answer these questions, one needs to go to time intervals and characteristic energies very far from those studied in laboratories.

It is said that the early Universe is a paradise for physicists in its abundance of all particle species. But is it a paradise lost? The task of finding the footprints of high energies which were present in the past is most exciting.

Remember, Zel'dovich said, that the law of gravity was discovered not by an apple, but comparing the motion of the apple and that of the moon. The velocity of light was found by observations of Jupiter's satellites. If proton decay is found in the next years — we will be proud because cosmology has given the first hints to predict the proton instability. So it is also with several other physical hypotheses.

«The near future must bring most interesting results. I hope we shall hear about them on the XIX, XX etc. Assemblies of the IAU».

«I will give here my sincere thanks to those who proposed me the difficult invited report and to those who attended it».

ANNOUNCEMENT

It has been brought to the attention of ASTROCOSMOS that some of our participants have been concerned and annoyed at certain activities of other participants regarding a human rights question relating to an astronomer not attending the General Assembly.

We wish to express our regret that such activities should occur in the area of the Assembly and to declare that these have been isolated personal activities of the persons involved, for which the Local Organizing Committee has had no control or responsibility.

Meteor Data Centre in Lund

by B.A. Lindblad

The IAU has made a grant to Commission 22 that will enable a meteor data centre to be established at the Lund Observatory in Sweden. The data centre will be under the responsibility of B.A. Lindblad. Purpose of the centre is to make available to interested scientists data on photographic and radio meteor orbits. Both published and unpublished data will be included. In the future copies of the data will also be available from the Ondrejov Observatory (Z. Ceplecha).

Letter to the Editor

As a tribute to Professor Bappu, I suggest that in future the first Invited Discourse at an IAU General Assembly be known as the Bappu Memorial Discourse.

Patrick Moore

XVIII GENERAL ASSEMBLY RESOLUTIONS

Continued from page 4

7. Distribution of IAU Publications to Developing Countries and Executive Committee Members	20.000
8. Executive Committee Meetings	70.000
9. Officers' Meetings	20.000
10. Symposia and Colloquia	225.000
11. Inter-Union Commissions	40.000
12. Projects of the Executive Committee	14.000
13. Representation	30.000
14 Bank Charges	1000
15. Young Astronomers' Schools	36.000
16. Regional Meetings	30.000
17. Expenses of the Special Nominating Committee	5000
Total Payments	1.433.700

Message from your ASTROCOSMOS printers, Mr and Mrs Constantinopoulos: Don't think it hasn't been fun: it hasn't!

FROM THE BIRTH OF THE UNIVERSE TO THE DEATH OF THE SUN

From F. and M. SPITE, R. and G. CAYREL and B. CAMPBELL

Lithium is a very strange metal: its nucleus is made of 7 baryons. It is very fragile and cannot be formed in the normal supernovae, in contrast to the other metals. It is a very shy element, showing only two spectral lines, located in the red part of the visible range. Its observation needs spectra with a very high signal-to-noise ratio.

This is why the recent operation of the coudé focus of the new Canada-France-Hawaii Telescope, with a Retican receiver, brought exciting informations. Lithium was discovered in halo dwarfs: these are very old (but essentially unevolved) very metal-poor stars, formed at the beginning of the life of the Galaxy. This was mentioned in the Joint Discussion II and discussed in a meeting about the EARLY UNIVERSE. This discovery confirms the hypothesis of the Big Bang and brings some constraints on the corresponding theory; there is a fair agreement with the constraints derived from Deuterium and ^{3}He abundances.

In the Sun, which is about 5×10^9 years old, practically no Lithium is observed, because the deep convective movements of its envelope drive the Lithium into deep layers which are hot enough for leading to an immediate destruction of Lithium by proton fusion.

In the young Hyades stars, recent observations by R. and G. Cayrel show that Li-destruction takes place in solar-type stars in a narrow range of effective temperature: the phenomenon is nearly in a guillotine form. Further study of this phenomenon needs observation of stars with very weak (evanescent) Lithium lines. This is hard work, but it will bring essential information on the internal structure of the stars, and especially of our Sun (surprisingly its structure is not indisputed). These results, and many others, collected at the CFH Telescope coudé focus, justify largely the efforts spent generously by the CFHT staff for bringing its coudé focus and coude spectrograph to a very high level of quality and efficiency.

Hubble, bubble...

The Hubble constant is 85 km/s Mpc. And the Universe is 15 billion years old. These figures appeared to be the concensus at Joint Discussion III on Monday. But they leave a major problem, for the two figures are mutually incompatible. If the Hubble constant is really 85, then the Universe must be younger than 12 billion years. Alternatively, a Universe expanding more slowly from a Big Bang 15 billion years ago must have a Hubble constant less than 70.

Delegates heard two direct methods for determining the Universe's age. David Schramm reviewed the latest results from nucleocosmochronology, stressing the importance of rhenium-187, which has a half-life considerably larger than the age of the Universe. As a result of new experimental results from Oak Ridge and Livermore, the errors in this method have been considerably reduced. Rhenium sets a very strong lower limit of 8 billion years on the Universe's age. The actual age depends slightly on details of galactic evolution, but lies in the range 11 to 17 billion years for standard models, with 15 billion years as a «best guess». The oldest known objects in the Galaxy are the globular clusters, and Bruce Carney argued that their colour-magnitude diagrams show they are somewhere between 15 and 19 billion years old. According to Schramm, the two methods, together with the abundances of elements created in the Big Bang, give a fairly tight range of 13.5 to 16 billion years, with a best value of 15 billion years.

The measurement of the Hubble constant is beset by problems in the distance scale to galaxies. Barry Madore showed an exciting new approach to the use of Cepheid variable stars, the classic method for nearby stars. By observing them in the near-infrared H band (1.6 microns), we can virtually eliminate the effects of metallicity in the stars and absorption along the line of sight. And because the characteristic brightness variation drops to only 0.1 to 0.2 magnitudes, we need just one H band measurement (not a complete light curve) to get a mean magnitude for use in the period-luminosity relation.

For galaxies beyond about 4 Mpc, the distance scales derived by various workers begin to differ markedly. Over the past two decades, this has led to two schools of thought: the Hubble constant is 50 Km/s/Mpc (Allan Sandage and Gustav Tammann) or it is 100 Km/s/Mpc (Gerard de Vaucouleurs). At the meeting, Tammann argued that the Malmquist effect makes de Vaucouleurs' value too large, and used Type I supernovae to derive a Hubble constant of 50 ± 7 Km/s/Mpc.

But the general feeling was for an intermediate value and that the best method at present is some version of the Fisher-Tully relation. This is a tight correleration between the width (in velocity) of the 21 cm emission from a galaxy and its total magnitude. Marc Aaronsen reported a Fisher-Tully analysis of 300 spiral galaxies all over the sky. This confirms previous indications that the Hubble constant appears different in different directions, and in a manner consistent with our Galaxy «falling» towards the giant Virgo Cluster at 330 km/s. This motion can explain most of the anisotropy of the microwave background radiation, which is slightly «hotter» in the direction of Virgo.

When this effect is removed, the Hubble constant derived from Virgo, ten more distant galaxies and 22 distant Sc spiral galaxies averages out to 85 Km/s/Mpc, a value which met general acceptance at the meeting. But Tammann and Schramm both emphasized that this value is inconsistent with the age of the Universe, if it follows the standard Friedmann expansion. It is possible to reconcile the two if Einstein's «cosmological constant» is not zero, for this introduces an early period when the Universe stopped expanding, giving stars and galaxies more time to evolve. But Ya. B. Zel'dovitch pointed out that these particular values of the age and the Hubble constant would mean this period occurred at a time corresponding to a redshift of 3. We would then expect to see a lot of quasars at this redshift — whereas in fact the opposite is true. So the condrundrum remains, with firmer but conflicting values for the Universe's age and the Hubble constant.

Perhaps the next General Assembly will see some way out of this rather fundamental deadlock!

Solution to Chess-Position 9

1. Kt— Kt6 ch, P x Kt 2. R—B8 ch, K—R2 3. K—B2, and Black is unable to stave off R—R1 mate.

Chess-Problem

The following problem has been proposed for the readers of ASTROCOSMOS by its composer W.D. HEINTZ, participant of the XVIIIth General Assembly:

White: K a6, Q a1, N b5, e6, B g5, P f7
Black: K c8, R b7, N f5, f8, B b8, P a7, b6, d7
white to play and mate in three moves.

Solution to Chess Problem:

(Main variation): 1. Q-h8, B d6, 2. Q h1, R C7, 3. Q a8 check-mate.
The Queen has travelled to all four corners of the board!

FOURTH INVITED DISCOURSE

For Professor C. de Jager's Discourse — the last of the General Assembly — the Greek sky put on its finest display of sunset colours, and a crescent moon shone high above the Ancient Odeon. Professor Edith A. Muller of the IAU's Executive Committee introduced de Jager, her dear friend and colleague. Summarising his highly esteemed work in solar physics, most of it conducted at Utrecht, Professor Muller remarked on de Jager's great ability as a synthesiser of ideas — and of his considerable experience as an administrator. On a more personal note, Professor Muller mentioned that one of de Jager's abiding passions was marathon running, and she would not have been in the least surprised if he and his wife had attempted to cycle by tandem all the way from Utrecht to Patras!

Professor de Jager also started on a personal note. He had just received a message that he had a new grandson — «And my wife even does not know yet», he told the delighted audience.

Beginning his discourse on the «Origin and Development of Solar Flares», Professor de Jager reviewed the history of their observation, starting with Carrington's rare discovery of a flare in visible light in 1859. With some spectacular film specially made for this General Assembly by Harold Zirin of the Big Bear Solar Observatory, de Jager demonstrated the development of typical solar flares at a speed 200 times faster than normal. In Ha light the flares — located in the Sun's lower corona above sunspot groups — could be seen snaking and billowing outwards along the direction of the magnetic field lines.

De Jager went on to describe models for the origin of solar flares. The generally accepted picture is that flares occur in the loops of strong magnetic field which reach upwards through the photosphere and into the corona. If magnetic field lines re-connect with one another, an enormous amount of energy can be explosively released as a flare. De Jager likened the situation to an electric circuit with resistance (provided by the photosphere), inductance (in the loop), and possibly capacitance. Although this was obviously a broad outline, the model could be firmed up with high-resolution obsrvations.

Much of de Jager's recent work had been with the Solar Maximum Mission satellite. He showed a film of the flare of 5 November 1980 in hard X-rays, pointing out that until these satellite observations, it had been uncertain exactly where in the flare the hard X-rays were generated. It had seemed most likely that the hardest X-rays came from the re-connection flash-point itself, directly above the neutral line between the sunspots; but the SMM data showed that the most energetic radiation was produced at the two «feet» of the flare where fast electrons hit the photosphere. And the location of the flash point above the neutral line has been confirmed by radio observations with the Very Large Array, which show a turnover in the direction of the magnetic field here.

In another short movie film made specially for this General Assembly by Dave Rust, de Jager presented both hard and soft X-ray images of flares from the SMM satellite simultaneously. While the hard X-rays last for a very short time and come from a relatively small region, the soft X-rays are produced in a larger area and sometimes larger for many hours after the event. And there is slight evidence that some of the energy of a typical flare is generated in a region as small as 50 Km in diameter.

But our understanding of flares is still in its infancy, cautioned de Jager. Although we may have the broad-brush picture, there are many details to fill in, and it is hoped that high-energy observations over the next two or three decades will provide some of the answers. And the Solar Maximum Mission Satellite will have a rôle to play — for the second time — when its blown fuses are replaced by a Space Shuttle Crew in 1984. This time however, it ought perhaps to be called the «Solar Minimum Mission»!

JOINT DISCUSSION I

THE VARIABLE SUN

The Sun is a variable star. Even as recently as the last IAU General Assembly three years ago, there was little evidence for any changes in the Sun's light output, but by now the observations are so definite that a whole Joint Discussion was devoted to the Sun's variable brightness.

In the late 1960s, astronomers measured the Sun's irradiance (the flux arriving at the Earth's average distance) with a variety of instruments flown to high altitudes to minimise the corrections for atmospheric absorption — on balloons, an X-15 rocket-plane and on two space probes. Once they had obtained a definite value in about 1971, they stopped: they had, after all, determined what is known as the «solar constant». But as G. Fröhlich pointed out, more recent results (from 1975 onwards) show that the Sun has brightened slightly, by 0.2 per cent, in the decade from the late 1960s to the late 1970s. These measurements are from balloons, rocket flights, the Nimbus 6 and 7 satellites and the Solar Maximum Mission (SMM) satellite. The radiometers on Nimbus 7 and SMM show that the Sun is currently fading again, at a rate of 0.02 per cent /year (Nimbus 7) or 0.06 per cent /year (SMM).

The SMM radiometer, built by JPL's Dick Willson, has convincingly shown that the Sun's light alters on much shorter periods too. It has «exceptionally good» sensitivity, to quote Hugh Hudson, of about 15 parts per million, and is extremely stable with no detectable drift between the three identical radiometer units after two years in orbit. Willson's radiometer produced extremely high-quality results for the first nine months — until the SMM's fuses blew — and is still returning useful data from the partially-crippled satellite.

The SMM radiometer reveals very small (but real) variations from day to day and week to week, and every so often a really pronounced drop in brightness of about 0.2 per cent, lasting for around a week. And, as Hudson demonstrated, the dips occur whenever the Sun has a large group of sunspots, with the degree of dimming directly correlated with the total projected area of sunspots on the hemisphere facing us.

Solar astronomers have always wondered whether the dark sunspots actually dim the Sun's total light output, or if the radiation escapes somewhere else to keep the Sun's luminosity constant — the question even occurred to Galileo, according to Jack Eddy. Now we know the answer: sunspots do dim the Sun. In fact, astronomers like Hudson and S. Sofia who are investigating the correlation are hampered now not by the quality of irradiance measurements, but by a lack of consistent measurements of sunspot areas. Different solar observatories can give areas for the same group which differ by 50 per cent!

The radiant energy blocked by the spot must be stored somehow, to emerge later when the spot has gone. Peter Fonkal pointed out that although the total energy blocked in each observed «dip» amounts to 10^{36} ergs, this can be readily stored in the gases below the spot «plug» as extra thermal and potential energy.

The Sun's changing brightness should affect the Earth's temperature too: a 1 per cent alteration in the «solar constant» should change the Earth's temperature by 1°C. Jack Eddy described the SMM precision measurement as a «truly historic step» in solar-terrestrial physics, and the most significant advance in weather and climate research in the past 20 years. he has used the correlation between sunspot area and solar brightness to calculate the «solar constant» for every day since 1874, when the Greenwich records of suspots began. This Atlas is available to climate modellers, and we can now look forward to work at the terrestrial end of the relationship. But Eddy pointed out that the major trend over the past 180 years has been an increase in temperature of almost one degree — and this cannot be due to the eleven-year-cycle of sunspots. But much longer term trends may exist, and certainly astronomers and climatologists will from now on be keeping a much closer watch on the brightness of our very own variable star.

Archaeoastronomy and the IAU

Douglas C. Heggie University of Edinburgh, U.K.

Whatever happened to archaeoastronomy at the IAU? Three years ago at Montreal recent developments in the field were eloquently reviewed by Jack Eddy, and in 1976 at Grenoble there was standing room only at an entire session of Commission 41 devoted to the topic Archaeoastronomy —the study of ancient astronomy, mostly prehistoric, through orientations of structures like Stonehenge – attracts the interest of far more astronomers than the small band of researchers involved Why, then, no archaeoastronomy at Patras?

The answer is that, far from having been neglected by the IAU in the past three years, the subject has been treated to an entire colloquium The meeting, co-sponsored by the IAU, was held at Oxford in September last year under the organising genius of the President of Commission 41, Michael Hoskin The proceedings edited in two volumes by Tony Aveni and Douglas Heggie, have now been published by Cambridge University Press just in time for the Patras conference They provide a fascinating picture of current attitudes in this highly contentious field

The attitude that will strike the most sympathetic note with astronomers is the statistical one —the insistence that astronomical orientations claimed for ancient structures should occur more often than would happen by chance alone Arguments of this kind have been in use in this subject for almost 50 years, but they are still often ignored, even in areas such as megalithic astronomy in north-west Europe, where the great bulk of the evidence consists of orientation studies and nothing else Even where the statistical approach is not ignored, it is rarely easy to ensure that the data on orientations are free of selection effects Just as in astronomy, the collection of field data in archaeology is expensive and timeconsuming, and, unlike astronomers, the people who research into megalithic astronomy generally have to do so in their spare time, and often at their own expense Therefore it is necessary to be selective about the orientations which are to be measured at each site, and somehow it is all too easy to do so in a way which weights the evidence in favour of the astronomical theories The normal course in a scientific investigation where the data are suspect is to collect fresh data, but this takes time and so it is not surprising that much debate in megalithic astronomy centres on the reliability of the data and how much may be safely inferred from them

So much for a strictly scientific attitude to megalithic astronomy But the subject is one that crosses the borders of several disciplines and each brings a fresh attitude Archaeologists, for example, while recognising vaguely the importance of statistical arguments, usually do not regard them as paramount. They have their own ways of testing theories for example by excavation Certainly if an archaeologist were to uncover an ancient brass telescope at a megalithic site instead of the usual pots and bones, then the statistical arguments would count for very little But the evidence which the spade has so far turned up is hardly more decisive than the statistical evidence

The archaeologist who has done more than any other to test the theories of megalithic astronomy is Euan MacKie, of Glasgow University For example, there is a site on the west coast of Scotland where the astronomical theory had, in effect, predicted where the prehistoric observers must have stood Digging at this spot, MacKie found a layer of stones, which has been claimed as striking confirmation of the astronomical interpretation But though the platform of stones is artificial, there is no evidence that it is ancient Also, evidence was presented at the Oxford conference showing that it would not, after all, have been possible to make satisfactory observations from the platform. So the excavated evidence at this site is certainly no less ambiguous than the statistical evidence as a whole But there is another site, still under investigation, which may very well prove to be the decisive kind of observing site which MacKie has been searching for.

Astronomer Mike Edmunds visits a disused observatory in south Wales.

A famous ceremonial observatory in England's Lake District - Castle Rigg stone circle.

The main thing yet to be established is its date; so far no date earlier than late preRoman has been reported

Megalithic astronomy still has a hard time being accepted by most archaeologists Progress would be faster if many of those theories which have no statistical support were to be abandoned Still, there is much evidence that is clearcut, and archaeologists are taking an increasing interest in it. One who has blended archaeology and astronomy with great success is Aubrey Burl. He puts the archaeology first, arguing that we should look for orientations only within groups of sites which are clearly linked on archaeological grounds. Almost all of these are ritual or ceremonial, and Burl concludes that the orientations were one ingredient in the system of beliefs held by the megalith builders. He also considers that the orientations are pretty rough, and that no care was taken to get them just right. But that's not to say that the sun and moon were not very compelling objects indeed. There is impressive evidence that the builders of a group of tombs in the north of Scotland systematically noted the 19 year cycle of lunar setting positions — a length of time comparable with the average working life of an astronomer in prehistoric times

What, then, was the role of astronomy in the ceremonial life of the prehistoric inhabitants of north-west Europe? Was it something as vague and incidental as the orientation of Christian churches? Or was it the burial that took second place to the astronomy, like the remains of James Lick in the telescope pier at his famous observatory? Science or symbolism? Perhaps we shall be in a better position to tell by the time the IAU next meets. Meanwhile the IAU can take much pride in its support for archaeoastronomy in the past three years, and the sessions of Commission 41 at Patras can for once be devoted to the history of astronomy, and not its prehistory

The European Southern Observatory Very Large Telescope (VLT) Project

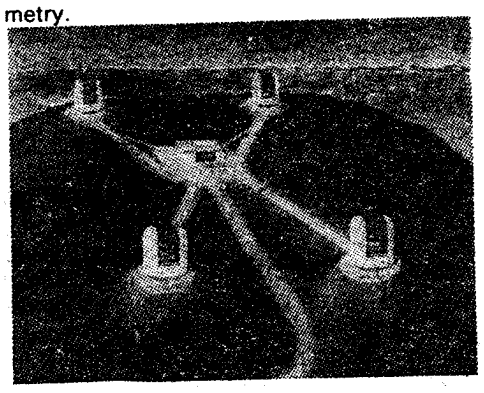
As we heard during a meeting of Commission 44 the launching of the Space Telescope (ST) will significantly change the pace of astronomical research. ST, however, will not be able to solve all the problems, and a number of important observations will not be made unless new larger instruments are constructed. Let us mention a few examples:

— High resolution spectroscopy at faint objects,

— Diffraction limited imaging in the infrared;

— Interferometric studies of milli-arcsecond structures in the optical and infrared.

The solution of many astrophysical problems does require such observation: in order to perform them one will have to construct a telescope system of large collecting area with a capability for interferometry. For the latter, several telescopes are necessary; to collect enough light the total mirror area should be that of a telescope of no less than 16-meter diameter, and to meet the requirements in the infrared, the individual telescope should be in the 8-10 meter range. To satisfy all these specifications ESO's VLT is conceived as an array of four telescopes each of 8-10 m diameter (monolithic mirrors, alt-az mounts, rotating building) Such an array will have maximum flexibility: the four telescopes can operate independently, they can simultaneously observe the same object, in different modes or with digital superposition of the data for maximum sensitivity, or with coherent optical beam combination for interferometry.



The present ESO Very Large Telescope project consisting of four 8-meter telescopes

It seems presently possible to construct an 8-meter telescope for a price which is not very different of that for a similar 4-meter telescope a decade ago; with the additional savings for the fabrication of four identical telescopes it would appear that the VLT may be constructed for a cost of the order of 10^8us dollars.

At ESO work is actively being pursued in some of the fundamental technical aspects: a 3.5 m. New Technology Telescope (NTT) is being built for completion in 1986 to test several of the concepts before embarking on the VLT (e.g. closed loop active optical control of the primary mirror, optimization of dome design to reduce seeing effects, new material (e.g. metal) for mirrors...). It is thus planned that the final design of the VLT will be frozen one year after the installation of the NTT is completed: first light is foreseen about ten years from now.

In this context I would like to announce that ESO will organize a meeting (proposal submitted for an IAU Colloquium) on VLT's their instrumentation and scientific programs from April 9 to 12, 1984, in Garching (W Germany) as a continuation in the series initiated in the 1970's.

J.P. Swings
Coordinator of ESO's VLT Study Group

LETTER TO THE EDITOR:

I have read with interest the open letter «Everything ever published on the Crab Nebula».

For stars such a bibliography exists already, covering the years from 1950 on. There are now more than ninety thousand stars with 350.000 references in it — we call it the «Bibliographical Star Index». It is published by the Strasbourg «Centre de Données Stellaires».

C. Jaschek

The Iraqi National Astronomical Observatory

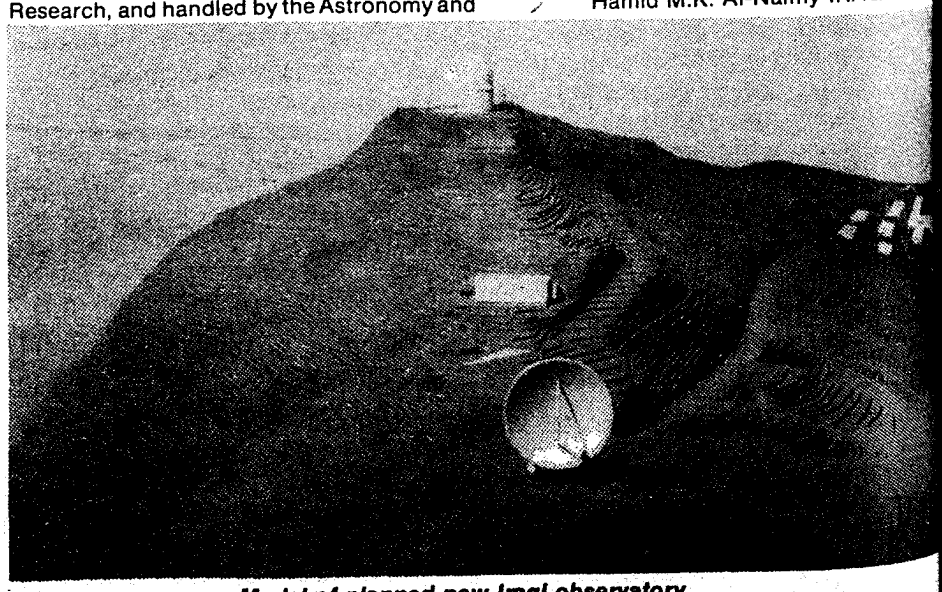
HAMID M.K. AL-NAIMY, IRAQ

Iraq s planned project for a major astronomical observatory is on schedule The observatory will contain A 30m radio telescope for millimeter wave length range, a 1.25 m optical telescope and a 3 5 m optical telescope, the project is supplemented by much auxiliary instrumentation (i.e. astronomical clock, spectrographs, photometers, cameras T V equipment and computers)

The observatory will be installed on a summit of a mountain called mount Korek in north Iraq of 2100 m altitude. The entire observatory will be erected by a German joint venture KRUPP, MAN and ZEISS KRUPP will supply the civil work, the domes and partly the radio telescope. MAN will supply the rest of the radio telescope and ZEISS is the supplier of the optical telescopes and their instrumentations The contract is under force since July 1981, and the execution is on schedule, (i e the primary mirror of the 3-5 m telescope is undergoing polishing, the smaller mirrors are partly ready, and the civil work on the site is going on very well) It is planned that the observatory will be completed by the end of 1985

The project was executed under the supervision of the Iraqi Council for Scientific Research, and handled by the Astronomy and Space Research Center, the headquarters of which is in the city of Baghdad, Jadriya P.O. Box 255.

Hamid M.K. Al-Naimy IRAQ



Model of planned new Iraqi observatory