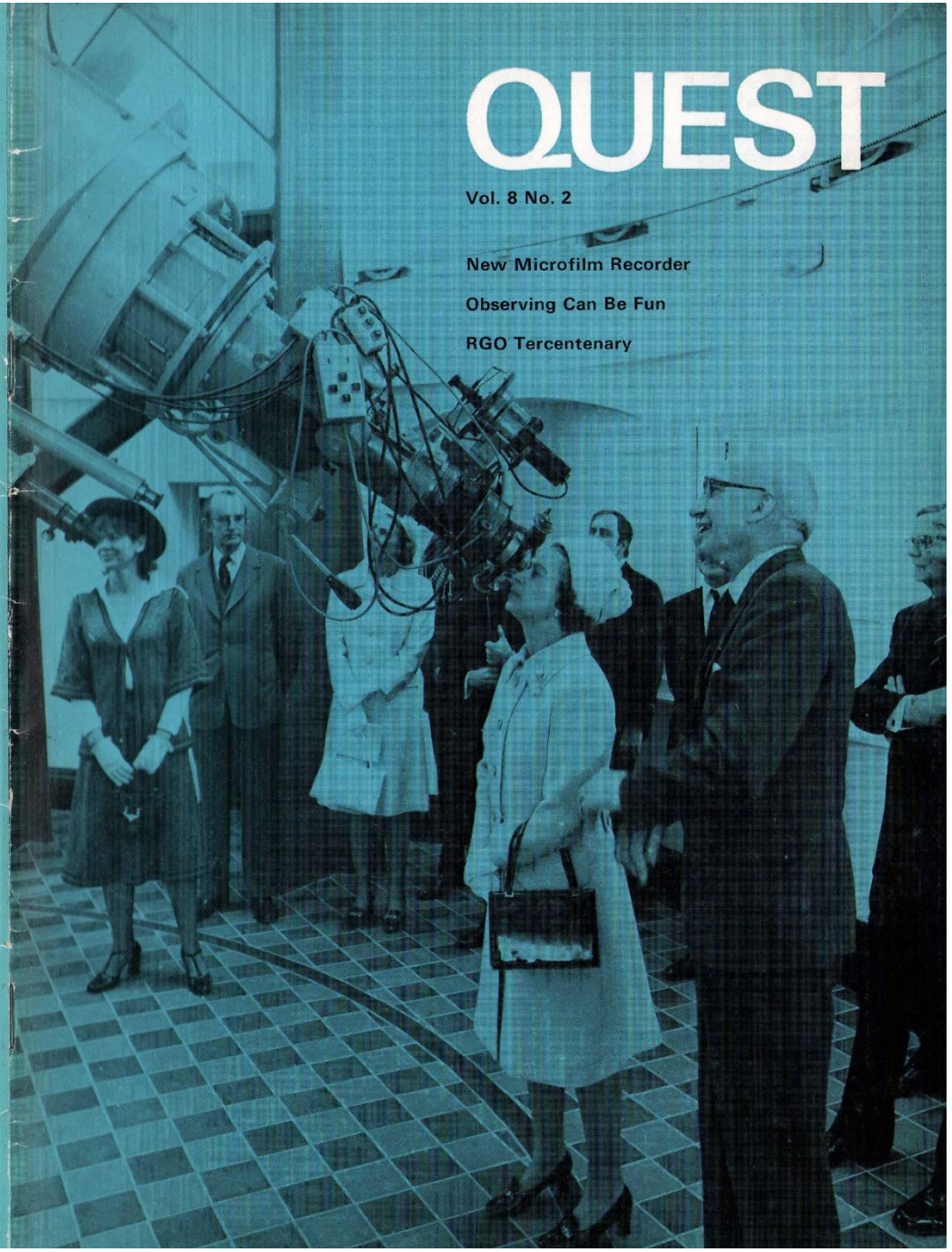

QUEST

Vol. 8 No. 2

New Microfilm Recorder

Observing Can Be Fun

RGO Tercentenary

QUEST

House Journal of the Science Research Council

Vol. 8 No. 2
1975

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Cover
Our cover picture shows the Queen looking through the 28-inch telescope under the guidance of Dr Hunter, Director, RGO, when she inaugurated the instrument in the restored onion dome at the Old Royal Observatory (National Maritime Museum) during a visit to Greenwich in May. Behind Dr Hunter: the Duke of Edinburgh and Admiral Sir Charles Madden, Chairman of the Museum Trustees. On the extreme left: Mrs Anthony Crosland, wife of the Secretary of State for the Environment, and Mr Basil Greenhill, Museum Director.

The visitors also saw 300 Years of Astronomy, the special Tercentenary Exhibition in the Queen's House at the Museum in which the Museum and RGO have collaborated. The exhibition which is on show until 31 December, is open daily from 10 am until 6 pm and on Sundays from 2.30 until 6 pm. There is no admission charge.

Contents

Council Commentary

March to May 1975

Forward Look 1976–81
The Council noted, at its March Meeting the Policy and Programme Reviews of the Astronomy, Space and Radio Board and the Engineering Board respectively. A draft version of the Forward Look was considered in March and finalised at the April Council Meeting. The 1976/81 Forward Look was then submitted to the Department of Education and Science in April. The Advisory Board for the Research Councils will be considering the Forward Looks of all the Research Councils and its advice to the Secretary of State on the allocation of the Science Budget, for at least the first year of the period, should be known by the end of the summer.

Provisional Outturn 1974/5
The provisional assessment of outturn for Financial Year 1974/5 was £83·8M compared with the Supplementary Estimate £83·7M. The main features being that expenditure on Engineering exceeded estimates by about £850K whilst there was an underspend on Astronomy, Space and Radio of about £900K.

Regrouping of Activities
Council in April, in the light of consultation with the Engineering and Science Board and the Atlas Committee, confirmed the regrouping decisions taken in principle at its February meeting. The changes have been described in General Notice 21/75.

Review of Methods of Supporting Research
Council has decided that in 1975 there should be an examination of its procedures for the support of research in universities and polytechnics and related arrangements for the support of university manpower. The December Council meeting will be a joint meeting with representatives from each Board to discuss these issues.

May Meeting
The May meeting, the hundredth of the Council, was held appropriately at the Royal Greenwich Observatory, Herstmonceux during its Tercentenary year. Council members much appreciated the efforts of Dr Hunter and his staff to make the visit interesting and informative. Furthermore the weather was perfect for the evening demonstration on the telescopes!

Senior Fellowship Scheme
Council has agreed to implement a new Senior Fellowship Scheme to enable up to twenty-five outstanding academics to devote themselves full-time to research and scholarship for a maximum of five years, free of their normal teaching and administrative duties. The Fellow will be able to apply for research grants and SRC will pay his salary and essential extra costs arising from his tenure. The parent institution will be able to make temporary appointments to replace the Fellow, but he will normally return to his academic post when the fellowship ends.

Science Sub-Committee of the Select Committee on Science and Technology
In April, the Council noted the joint Research Councils' memorandum to the Science Sub-Committee and the specific SRC section.

At the May meeting there was a report on the formal session with the Sub-Committee on 30 April when the Chairman and Secretary, accompanied by representatives of other Councils, gave evidence to the Sub-Committee. The questioning was concentrated on (1) the dual support system, (2) the financial difficulties of universities, (3) postgraduate studentships rates and the lack of British postgraduates, and (4) SRC policy for support of special areas. The SRC will be giving further evidence to the Sub-Committee in June.

Polymer Engineering
In 1969 polymer science and technology was selected as a priority area for concentrated SRC support in selected universities. While the programme was successful in polymer science it did not develop an adequate scale of activity in polymer engineering.

In March Council agreed that a polymer engineering directorate be established by SRC to initiate and oversee a closely coordinated programme of research and postgraduate training in selected universities and polytechnics with the active involvement of industry. The British Plastics Federation and the British Rubber Manufacturers' Research Association have agreed both to contribute to administrative costs of the programme and to collaborate with the Council in appointing the Director and managing the programme. The Directorate will probably be sited at the Daresbury Laboratory. The Director, who will have a small supporting staff, will work with a small management

committee. He will have the authority of an executive head of a research establishment and will be able to commission research in universities and polytechnics on a more generous basis than is normal through research grants. Council hopes that this will encourage academic staff to move into the selected centres in order to develop an effective programme, provisionally costed at about £2·5M over five years.

Atmospheric Studies: EISCAT

In May Council agreed in principle that the UK should participate in the proposed European Incoherent Scatter Facility (EISCAT) with France, Germany, Norway, Sweden and Finland and that the Appleton Laboratory should be responsible for the management aspects of the UK participation. The facility, using radar techniques and located in Scandinavia would give detailed information about the ionosphere in the auroral zone which could otherwise only be provided intermittently by rockets and satellites. A better understanding is expected of the energy inputs to the ionosphere and the influence on the world's weather. Council has agreed that the UK should provide a VHF transmitter to add to the planned UHF system; the VHF receiver and antenna will be provided by the Scandinavian countries. Council's approval for the VHF transmitter at a capital cost of £2·0M is subject to funds being available and to satisfactory arrangements being made between the prospective parties. The ASR Board will hold an open meeting to enable the scientific community to express their views on EISCAT.

Kiruna Rocket Range

Council agreed that SRC should extend the existing agreement whereby it contributed £250K per annum towards the cost of the Swedish launching range ESRANGE at Kiruna from 1977 to the end of 1980. The decision was conditional on the other countries involved giving parallel agreement. This condition has now been met. It is expected that the rocket campaign in 1979/80, allowed for in the ASR Forward Look, will make good use of ESRANGE.

Research Grants

Council has approved the following research grants:

(a) **Astronomy Space and Radio**

(i) A supplementary grant of £154K to Dr J T Houghton, Oxford University for the construction of the stratospheric and mesopheric sounder (SAMS) experiment which will be included in the payload of the NASA NIMBUS–G satellite now scheduled for launch in mid-1978.

(ii) A consolidated grant not exceeding £406K to Professor Boyd, Mullard Space Science Laboratory, University College, London, for the year ending 31 July 1976.

(b) **Engineering**

(i) £122·8K to Professor W A Gambling (Southampton University) for studies of optical fibre communications.

(ii) A supplementary award of £154·9K to Professor H H Rosenbrock UMIST for analysis, identification and control of composite systems.

(iii) £147·0K to Professor A G J MacFarlane (Cambridge University) for the study of the design and application of multi-control systems.

(c) **Nuclear Physics**

Grants of £141·4K and £210·4K to Glasgow and Oxford Universities respectively for the maintenance of accelerators for nuclear structure research for the year 1975/6.

(d) **Science**

(i) £125·8K to Dr R E Richards, Dr I D Campbell and Dr D I Koult, Oxford University, for the construction of a 400 MHz high resolution nuclear magnetic resonance spectrometer;

(ii) £120·0K in the first instance to Professor Sir George Porter, Royal Institution, for photochemistry research; and

(iii) a grant of up to £104·5K to Professor S D Smith and Dr C H Pidgeon, Heriot-Watt University, for research in physics and chemistry using a spin-flip Raman laser.

SRC's new microfilm recorder

F R A HOPGOOD

The Atlas Laboratory has taken delivery recently of an FR 80 microfilm recorder to replace its SD 4020 which has been SRC's main graphical output device for the last seven years.

The attraction of a microfilm recorder for graphical output as against a pen-plotter is mainly its speed and flexibility. As well as being able to produce graphs on sensitized paper (called "hardcopy" for some unknown reason), the SD 4020 can output to both 16 mm and 35 mm film. In a typical year, the SD 4020 produces about 1,700,000 pages or frames, of output. We estimate that it would take about two hundred pen-plotters to generate a similar amount of output!

Production of cine films

Users of Atlas' graphical facilities come from all parts of SRC. Probably the largest user of hardcopy is the Neutron Beam Research Unit at Chilton. Other large users include satellite data processing and the JASIN project organised by the Department of Oceanography at Southampton University. One of the more novel uses is, of course, the production of cine films. It is surprising how many of the large computer projects find this method of displaying results attractive. Films have been made on such diverse topics as galaxy evolution, effluent dispersal in the Solent and textile design.

The decision to replace the SD 4020 was made about three years ago. The machine is a mixture of valve and solid state circuitry. It has become increasingly difficult to maintain and we have had to cannibalise two tape decks in order to keep the third one in a working condition. Even with a full-time engineer, the machine now only averages about 70% up-time in the prime shift.

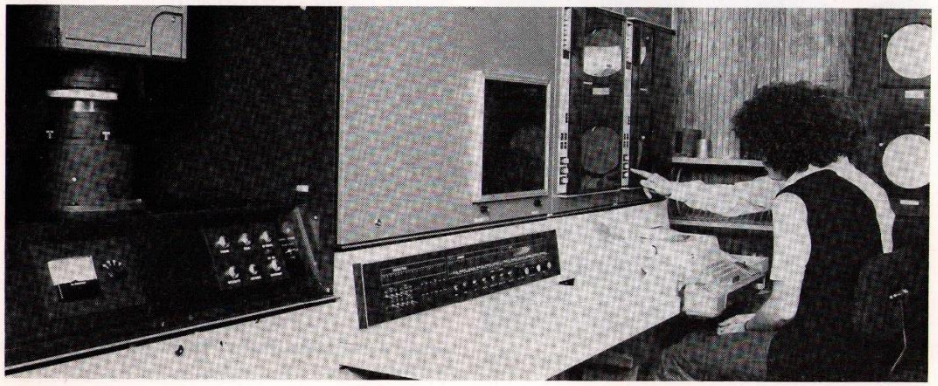
Most accurate

The FR 80 microfilm recorder, manufactured by Information International Incorporated (III) of Los Angeles, was a natural successor to the SD 4020. It is both the most versatile and most accurate of the recorders currently available. Like the SD 4020, it has hardcopy, 16 mm and 35 mm cameras. In addition, it has a microfiche camera capable of producing fiche at a reduction of forty-two or forty-eight times. This allows four hundred pages of output to be contained on a single fiche. With the world paper shortage, microfiche is becoming the standard interchange media for large volumes of text.

New features

Our particular FR 80 has a number of recently-introduced features which probably make it the most

A magnetic tape being loaded on the FR 80, the contents of which, when run, will be photographed by the microfiche camera seen in position on the left of the picture



sophisticated recorder in the world today. A colour filter system incorporated in the 16 mm and 35 mm cameras allows multi-colour output to be produced directly on the recorder. Over two hundred distinct colours can be generated which gives the user another dimension to his output. This large range of colours is possible because two hundred and fifty-six different intensity levels can be produced.

Even though the order for the FR 80 was not placed until last October, III managed to deliver the machine before Easter—but not without some trials and tribulations on the way. Its journey to the Laboratory was delayed initially when it was found the contractors' truck sent to take the machine from the factory to the airport was not large enough, with the result that it missed the first plane out of Los Angeles.

Installing the machine

Eventually, it arrived at the Atlas Computer Laboratory and there was a sigh of relief as it was successfully squeezed into the lift to take it to the first floor. The manufacturers' measurements had indicated that the machine was EXACTLY the same size as the lift so there was no room to spare—luckily, the only damage to paintwork was to the lift and not the FR 80!

Next came the film processor. This was obviously too large for the lift and the only way up was via three short flights of stairs, with a corner to negotiate at the end of each flight. However, several strong men made short work of this task and surprisingly quickly everything was in its place.

One minor hitch since installation has been that due to late delivery of a calorifier, one wing of the building is denied supplies of hot water whenever film processing is going on!

Some careful manoeuvring as the FR 80's film processor, weighing about 400 lbs, is taken up to the first floor

Celebrating acceptance of the FR 80 are (from left to right): Dave Daniel, Mike Daniels (of Information International Inc), Eric Thomas and Dr Howlett

Acceptance tests

Hardware acceptance tests began as soon as the machine was installed while at the same time programmers were rapidly putting the finishing touches to some eight months' work rewriting the graphical software for both the 1906A and 360/195 computers so that it would work with the FR 80.

Early in May, the full range of acceptance tests was completed—not without some celebration—and a user service introduced at the beginning of June.

Bob Hopgood is the Head of the Basic Software Group at Atlas.

Filamentary niobium-tin – a new high field superconducting magnet conductor

D C LARBALESTIER and C A SCOTT

The Rutherford Laboratory has been closely involved in the development of superconductors and the construction of superconducting magnets for some ten years.

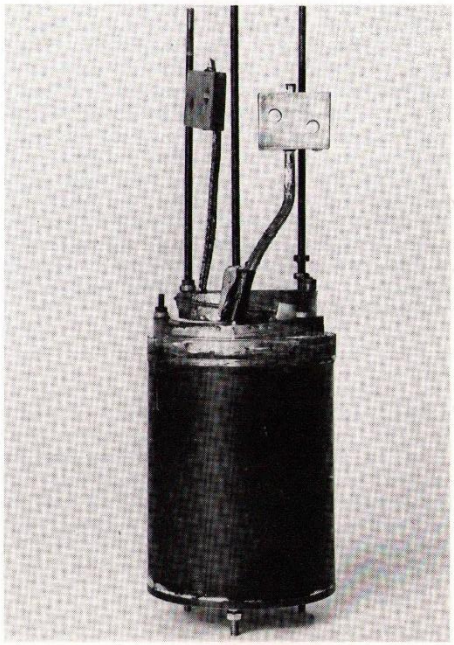
Over this period superconducting magnets have grown from small laboratory solenoids with bores of a few centimetres to beam transport magnets with lengths typically of one metre and, largest of all, to bubble chamber magnets with diameters exceeding 4 metres.

A crucial step in this progress was the development by the Laboratory, in collaboration with Imperial Metal Industries, of filamentary superconductors in which an array of fine filaments of superconducting Nb-Ti (niobium-titanium) alloy are embedded in a normal conducting matrix of copper or copper-nickel alloy. This fine subdivision of the super-conductor removes or greatly reduces the instabilities known as flux jumps which can initial premature transition ("Quench") from the super-conducting to the normal state and were responsible for the frequent observation in the early days of super-conducting magnet technology that the quench currents of coils were very much less than those of well cooled short samples of wire.

Although superconductivity is a property only found close to absolute zero (23°K maximum), the attractions of superconductors for magnet builders are very powerful. For example, to produce a field of 10 Tesla in a 5 mm bore solenoid using copper conductor would consume ~ 2MW—a superconducting version might consume 500W in refrigeration to keep the magnet cold. The Rutherford Laboratory in common with other experimental high energy physics establishments uses large numbers of magnets to bend and focus beams of charged particles. Magnets are also required in bubble chambers and in polarised targets. The higher field strength and negligible power consumption of superconducting magnets thus offer the possibility of lower capital and running costs for these applications compared to conventional magnets with copper windings.

The Nb-Ti alloy developed for filamentary superconductors during the nineteen sixties remains superconducting in fields up to about 10 Tesla at its normal temperature of operation 4·2°K. The superconducting current density which can be carried falls off rapidly with increasing field however, so that practical solenoid magnets of NbTi are limited to about 8·5 Tesla and beam transport magnets such as dipoles to about 6 Tesla at 4·2°K. A much better superconducting material which remains superconducting in fields greater than 20 Tesla is the compound Nb_3Sn (niobium-tin) which has been available as a magnet conductor since the early sixties. Its use has however been severely limited due to problems connected with its great brittleness. Since it breaks at strains of much

Figure 1. A photograph of our most recent magnet, a 10 Tesla 55 mm bore solenoid



less than 1% it was quite impossible to draw Nb_3Sn down in filamentary form as is done for the ductile Nb-Ti alloy and the material was only available as a very thin layer some 2–5 μm thick deposited on a strong backing layer. To carry reasonable currents the tape has thus to be 15–30 mm wide and this wide tape configuration is the direct cause of unreliable magnet performance due to flux jumps which occur when currents flow across the width of the tape.

Recently AERE Harwell have been working closely with Rutherford Laboratory on a novel metallurgical technique which enables Nb_3Sn to be produced in filamentary form. The trick is to leave the formation of Nb_3Sn to the last stage in the process. The composite is made with Nb rods in a Cu-Sn (copper-tin) alloy matrix, both materials being ductile and thus capable of being reduced to fine wire by conventional processes. At its final size the conductor is insulated with a glass fibre braid and wound on a stainless steel former and is then reacted in a vacuum furnace at temperatures between 600–750°C. During this reaction process, tin diffuses from the bronze to the niobium, forming a layer of Nb_3Sn at the interface. After formation, the conductor is rather susceptible to damage but the fact that the last 4 coils have performed to their expected short sample characteristics, shows that the "wind-and-react" procedure is a perfectly feasible method for avoiding damage.

The maximum fields attained in these test solenoids exceed 12 Tesla at 4·2K, comfortably exceeding that possible with Nb-Ti. A photograph of our most recent magnet, a 10 Tesla 55 mm bore solenoid is shown in Figure 1. Figure 2 shows a cross-section of the conductor used for the coil. It contains 5143 fine superconducting filaments of Nb_3Sn as well as 24 hexagonal regions of high purity copper surrounded by a diffusion barrier. The copper has two functions—first to conduct heat away from regions where flux jumps or other instabilities occur and second to provide a low resistance shunt for the coil when it quenches, thus minimising the internal voltages and temperature.

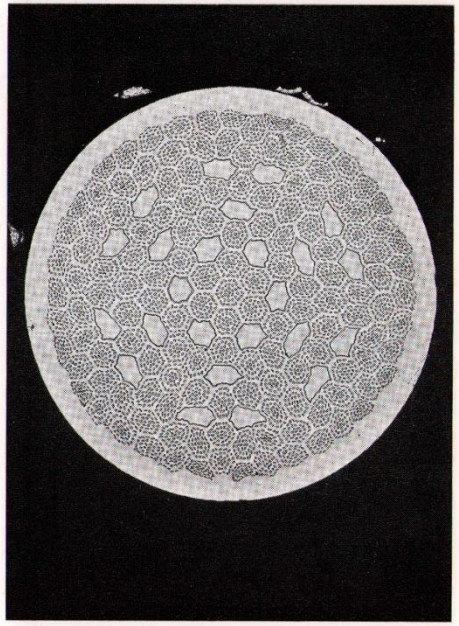


Figure 2 shows a cross-section of the conductor used for the coil

The successful application of filamentary Nb_3Sn to small solenoids now permits its application to larger magnets for beam handling, as well as to higher field solenoids. The new material should approximately double the fields already quoted for NbTi, thus allowing saddle shaped magnets of fields up to 10–12 Tesla and solenoids up to 15 Tesla at 4·2K.

Dr D C Larbalestier is a Research Associate and Dr C A Scott is a Senior Scientific Officer. Both are members of the Applied Physics Division of the Superconducting Magnet Research Group at Rutherford.

Observing can be fun

A POWELL

Friday 23 January—funds available and permission given for my observing run on the SAAO (South African Astronomical Observatory) 20 inch telescope. Yipee!—after waiting since January 1972 I am now in a position to successfully conclude (I hope) my observing programme on Strömgren photometry of F stars with known distances. Problem—next week I am going on my skiing holiday to Avoriaz in France and I have not prepared my observing programme. So I quickly ask "Admin" to arrange my flights. On return from my holiday I was refreshed and ready to make preparations. By the evening of 11 February I am all set to go. It's too late now to worry about any omissions. I managed to get my smallpox vaccination, work permit, international driving licence. travellers cheques, rands, plane tickets and passport all in order.

Back to School

At 10.30 am the next day the car comes to take my children Christopher and Sandy (See Quest vol 5 No. 3) and myself to Eastbourne station. No, the SRC are not letting my children come with me! Their mother is working hard at her teacher's training practice, so the children are going to find their way back to their boarding houses which are attached to the Thomas Peacocke School at Rye. They have £3.50 which should see them through lunch at Debenhams in Hastings followed by a film (The Man with the Golden Gun), then tea at the Golden Egg. [These companies are not sponsoring this article. In spite of all rumours Quest does not pay its authors—(Perhaps I will get Quest's Most Promising Writer of the Year Award).] Anyway back to the theme of this article. I see the children off on the 11.25. They both seem happy and this makes me contented. Parting on their return to boarding school is never a very happy moment. (The understatement of the year).

First stop: Ilha do Sai

The 13.03 train speeds me towards London. A sensual frisk by the Securicor security guard and I am boarding the 747 bound for Johannesburg. Fifteen minutes behind schedule, the plane takes off. At last I can relax—anything I have forgotten is now beyond recall—I will have to exist without it. I discover I am sitting next to a young married South African couple returning to their country after a three-month holiday on the Continent. This just happens to include two weeks skiing. At last my shade of green lessened when I heard they were on a tight budget. Only £12 a day to spend on food and extras! I told them how good the film being shown aboard was. (Actually I had never heard of it). This induced them to move to some empty seats in the cinema section. The plan had worked—I got two blankets from the steward and two Mandrax's later I was well away. So well away, they could not wake me at Ilha do Soi our first and only stop. The next eight hours were the worst especially when the crew decided that at 04.30 the tourist class passengers were ready for their breakfast. What had we done to deserve this? Kept them up all night with requests for tea or coffee! Mine arrived cold so I sent it back.Cold "bangers", scrambled egg and tomatoes were transformed into hot bacon, scrambled egg and fillet steak. Could the pilot be off his food? Airsick? Not worth worrying about such possibilities—enjoy the food now—tomorrow we might be in the sea.

Wally and I

Finally I arrive at Cape Town, only half an hour late. Surprise – surprise, they still had my case, it was in one piece (just) and most of the things were still in it. Beautiful sunshine – I could not care if there was nobody to meet me. Anyhow I phone Wally Grimwood (ex-RGO transferred to CSIR – who says "you cannot teach old dogs new tricks") and he replies that he will come "just now" (South African for 10 minutes) to collect me. My relationship with Wally is now taking on a new level. He is my opposite number in the Solar Department in Cape Town. The Solar Department relies heavily on the Cape Observatory to provide any missing Solar photoheliographic plates so that a continuous daily record of the sun's activity can be made at the RGO. Remarkably, the Sun can be recorded at Herstmonceux on plus minus (a South African expression meaning approximately) 280 days. Also Wally and I belong to the same Christian fellowship.

Wally and his wife Jenny live in one of the Observa-

The Observatory's staff

tory's houses. They have offered to let me stay with them rather than leaving me to the tender mercies of the South African hotels (actually they are very good). They show me to my room, soon I feel like one of the family – a lost son returned. In fact they have three sons who all work in Southern Africa. While Jenny prepared one of the superb meals which I was to enjoy during my stay (incidentally I have had to resign from "Weight Watchers" – I cannot afford the fines for losing ground in the "weigh-in stakes"), I went to see Mike Feast the deputy director at the SAAO. Panic – the original observing schedule has been brought forward a night which meant the non-arrival of my observing programme could be a disaster. For economy reasons this had been sent by airmail in an unsealed light-weight envelope just secured by a tie-tag. This had still not arrived by Friday morning and there were only two more postal deliveries before I left on Sunday. Fortunately it arrived by the next post. However, two items were missing from the envelope, one of them vital (some economy!) I telexed RGO to send out a copy of the vital documents, one has to be recovered from the ATLAS file store.

Setting out for Sutherland

Sunday: Wally and I set out for Sutherland some 270 miles NE of Cape Town. There is a fifty mile an hour blanket speed limit on the roads, so we will not arrive until 8 pm. We were accompanied by two of the administrative staff. One was new and was to be shown the observatory site at Sutherland. They were both very keen to discover how astronomers "do their thing", so that they could help the astronomers in their attempts to solve the mysteries of the universe. SRC has a lot to learn in this regard. They had given up their Sunday so that they could fit in with my plans to get to Sutherland a night early.

Cape Town was suffering from a heat wave and crawling along at fifty miles an hour on the fantastic South African roads, was just too much for me. Especially when one of the adminstrators told me that he used to swim in the river ahead. I demanded that we should stop – due mainly to my large size I have a very persuasive nature. Within minutes all four of us were stripped off to our underpants and were swimming in the beautiful clear water. After about an hour of pure ecstasy we dried off on the nearby rocks (when we arrived later at Sutherland Wally discovered that he had lost his underpants – I hope he can explain this to Jenny when he gets back).

Travelling on Sunday in South Africa is now limited because petrol stations are closed for the weekend. This combined with my progressive driving, (I was trained to Police standards for advanced driving) made it touch and go whether we could make it on a full tank. We arrived at Sutherland at 21.35. Mrs Roux the resident hostel manager was there to welcome us with soup, tea or coffee, rolled ham, meat on the stick, orange juice and sandwiches. Just a little something to make sure that we did not go to bed hungry! South African, Peter Warren and his English wife, Lesley, were the incumbents on the 20 inch telescope and they soon gave us a friendly welcome, typical of this country. We were then taken up to the telescope to be shown its intricacies. Every telescope seems to have its own peculiarities – this one is a delight to use. Before "women's lib" I would have called it a ladies' telescope. Incidentally Lesley had taken a week's leave so that she could act as an unpaid night assistant. Such devotion is not rare among long suffering wives of astronomers. Being more mercenary than Peter, I had pulled the Radcliffe Observatory apart three years ago in order that my wife could be paid while she assisted me to push back the frontiers of sceince.

And so to bed. I can now rest happy that my turn will come tomorrow to use the excellent facilities on this well chosen site. All that remains to be done is to recover the information lost in the post. I will rely on my astronomical colleagues at Herstmonceux and that well used and trusty friend the telex.

"Holding thumbs"

Now everything is set to go, only the weather can ruin the trip. However, they are "holding thumbs for me" (an Afrikaans equivalent of crossing ones fingers) for fine weather.

Dr Alan Powell is Head of the Solar Department at RGO.

Impressions of Russia

ANGELA KILLICK

Angela Killick, who works in the International Relations Section of the Council Secretariat, is a Westminster City Councillor in her spare time. Last summer she visited Russia with a group of Young Conservatives and in this article she gives her own personal impressions of Russia.

"Visit Russia," said the man on the corner, selling copies of Soviet Weekly, "you don't know what you're missing." Too true!

Last summer we visited four towns: Kiev and Kharkov in the Ukraine, Leningrad and Moscow in Russia. On the whole, Intourist took a lot of trouble over our visit. There was no harrassment. None of us was ever aware of being followed outside the hotels, though we were conscious of being watched in a hotel and we also found several bugging devices in hotel bedrooms but these were not necessarily active. To our knowledge, our suitcases were never opened and there was only the most cursory glance at some of our books. We were free to go where we liked, when we liked and how we liked within the towns we visited. (This freedom to explore accidentally resulted in two of us being carried into the engine shed in a blacked-out train in Kiev, to the subsequent consternation of the driver!) We were repeatedly told we could photograph anything, subject only to two caveats: that we should not photograph anything military (this was broadly interpreted and included road and railway bridges) and, more subtly, that we should not photograph individuals without their permission. This meant that when I wished to photograph a young women working like mad with a pneumatic drill, the Intourist guide watched her forbid me to do so. The USSR is, after all, a land where people are wary of foreigners, spies and photography.

Our passports were taken from us on arrival at each hotel and returned just before departure. We were told we need not take any identification papers with us in the streets as we would never be asked for them—and we never were.

An isolated group

We were, however, cocooned from human contact. Whenever a stranger came to the edge of our Intourist group he or she was rudely told to go away and if I were to single out one aspect of our visit which was unpleasant it was the feeling that one carried the plague: apart from isolated instances, people in the streets did not want to be seen talking to us. When I asked a young couple the way to the underground, they turned on their heels without answering. This nervousness was less marked in Leningrad and Moscow—towns which are more accustomed to Western tourists.

The building programme

The most impressive accomplishment of the Soviet system is its house-building programme. The USSR claims to have constructed 22 million flats between 1960–70 and to be building at an even faster rate now. The blocks are uniform and mostly ugly. It is still common in older blocks for five people to share two rooms and then to share a kitchen and bathroom with the occupants of another apartment. High rise flat phobias are either unknown or else the Russians do not admit to them. It may well be that they do not yet exist and may never develop because of the Russian character and the Soviet system. If your Government tells you that "you have never had it so good" and you have no access to the free press; if you and your wife both go out to work and the children go to a nursery or school, you join your floor committee, go to some of the many semi-political meetings which you are expected to attend, work on a couple of subbotniks (voluntary labour days) a year, and what little time is left you spend watching one of the four State Television Channels, why should you develop high rise phobias?

Some of the 22,000,000 flats built since 1969

Possibly as many as two-thirds of Soviet families own a home similar to this

Russian standard of living

This brings me to the standard of living. Leningrad, a prestigious city and justifiably known as Venice-of-the-North, enjoys standards which, in my opinion, are approximately the same as London in 1954. The choice of fruit and vegetables is limited to those grown locally (therefore, no oranges, grapefruits, bananas, coconuts, etc) but most other articles could be purchased even though there might not be very much choice. Deliveries are somewhat erratic, leading to massive queues, and (possibly to artificial shortages) the moment a new consignment comes in. Queues of 30–50 people are common and I saw one of over 100, though they did not appear to be sure what they were queueing for, apart from knowing there were some new shoes in . . . and there were many other nearby shoeshops with plenty of choice (though possibly not in all sizes).

Clothes are no longer labelled "Eastern Bloc" by their design or material but the prices are still quite high: £50 for the average woman's coat, £25 for the cheapest; fur coats around £300 (someone must buy them); 30p for the cheapest 'peasant type' stockings, £1 50 for nylons and £4 for tights. Functional shoes could be obtained for £3—most women's shoes ranged from £10 to £20 with some costing even more. Soap was poor but compared with ours in price. Colour television costs £340. Black and white half the price. Butter is £1 for 1 lb, and cheese and meat are little less than in Britain but the quality of the latter looks poor. An adequate meal can be obtained in a cafe for one rouble—50p on the rule of thumb exchange rate I have been using.

The minimum wage is £35 a month, the average wage £67 a month and it is rare to earn £100 but perks are another matter. Direct taxation starts at 6% and rises to 13%, on top of which there is a 6% tax applied to bachelors and childless couples. Utilities (rent, electricity, gas, water, central heating) come to an average of 5% of a man's wage, which means the less well off pay relatively more than those higher up the wage scale. Over 90% of Soviet taxation is indirect and—like profit—not acknowledged. Prices have remained fairly constant. The annual GNP growth rate is said to be 7–8%, and all workers have been promised an annual increase of 4%. No-one is unemployed, though sometimes fatuous jobs have to be found for people and sickness benefit is not universal. Communists we met were startled when I observed that if these figures were correct and sustained, their standard of living could improve dramatically and that in 22–30 years time they might catch us up materially. Road traffic, including the number of private cars, is increasing rapidly. There was a 12-lane road near our hotel in Moscow and the traffic never stopped day or night.

Before my visit I thought it was glib to say that Communism had become a religion. I was wrong. There is undoubtedly a Marxist-Leninist catechism, which is learned by rote and this is not necessarily thought out or criticised. I lost count of the number of statues and representations of Lenin, but on the morning we visited the Kharkov tractor factory, we saw between 50 and 80 pictures, medals, photographs, and statues of this man. We "christened" him ITMA. One of our party acquired four dozen different postcard representations of ITMA within two days. You couldn't do this in London if you combined the Royal Family and Winston Churchill! I don't know whether it could be done in Rome with "holy" postcards. At the same time I tried in vain to buy either an exterior or interior view of the glorious cathedrals of St Sofia in Kiev, or St Bazil in Moscow.

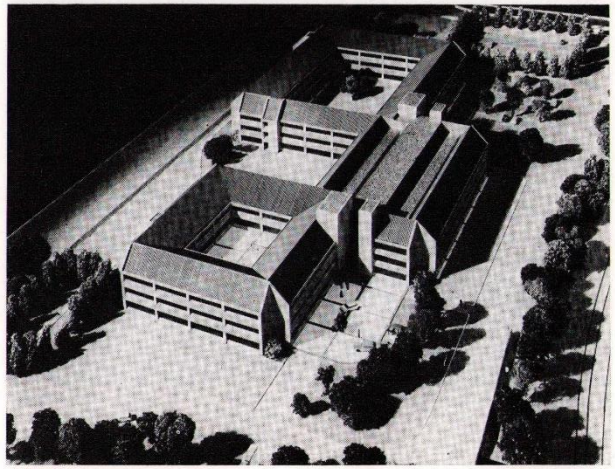
I would have liked to visit a Russian home. The Intourist guide said I should make friends with someone. It so happened that the next Young Communist I met, said that as far as he and his wife were concerned, they would very much like to invite me round "But, as you know, we have rules about these things". It is not illegal for a foreigner to go to a Russian home and this episode calls to mind the question asked by an Oxford don, when assessing the Soviet system: does the rule of law prevail?

Newsfront

Swindon

Our picture shows the architect's model of the proposed new headquarters which we shall share with the Natural Environment Research Council in Swindon. It now seems likely that the model shown will be the basis for the construction of the new building, to be erected on the railway site adjacent to the railway station and opened, if present plans materialize, in late 1977/78.

In September this year a further forty to fifty staff at the Council's London office are transferring to the Stage II Advance Office in the British Rail complex. After that there may be a further movement of staff in 1976 to occupy vacant space in the Stage II accommodation, provided a viable block of work can be isolated and adequately staffed.



Swindon Advance Office Stage II
The units of work being transferred in September and the senior staff involved are as follows:

Directorate B Engineering and Nuclear Physics
Under Secretary: Mr A J Egginton

E & O General
Principal: Mr B E Broughton

Finance II
Principal: Mr A Dobbins

Contracts (that part which remained in the Oxford Street Annexe at Stage I dispersal)
Principal: Mr R S Reed

Engineering (Aeronautical and Mechanical Engineering and Manufacturing Technology Secretariats)
Principal Scientific Officer: Dr N J Lawrence

Secretary's Department
Senior Principal Scientific Officer: Dr D L Johns

Regrouping of establishments

At its April meeting Council, after extensive consultation with all interested parties, including staff side, took a number of decisions about the regrouping of activities in establishments.

High energy physics
Support for high energy physics will be concentrated at the Rutherford Laboratory. Work at Daresbury Laboratory in preparation for CERN experiments which are already approved (such as the $e^-\gamma$ and muon programmes) will continue there, but work in support of all new proposals will be the responsibility of Rutherford.

A substantial part of the computing now carried out at the Atlas Computer Laboratory will be transferred to Daresbury where it will support a growing variety of work outside the field of high energy physics. The transfer will begin in 1976 and take several years to complete.

Interactive computer facility
The interactive computing facility recommended by the Engineering Board is to be set up, using as its base that part of the Atlas Computer Laboratory remaining at Chilton.

National computing campus
Discussions are under way between the SRC and the Department of Industry to consider the possibility of establishing a national computing campus to which the interactive facility would be the initial SRC contribution.

Transfer of staff
Specific plans for transferring staff will be worked out progressively with the staff and trade union sides and every effort will be made to ensure that movement of staff will be on a voluntary basis and full account will be taken of personal circumstances.

Ariel 5 results

The exciting results from the experiments carried out by Ariel 5, Britain's first x-ray astronomy satellite (see Quest vol 7 No 3 1974 for details) were widely reported in the national press and discussed at a well attended press conference at State House on April 15. Our picture shows from left to right five of the principal experimenters involved (Dr P W Sanford, University College, London; Professor A P Willmore, University of Birmingham; Dr Joycelyn Bell Burnell, University College, London; Professor K Pounds, Leicester University; and Professor R L F Boyd, University College. Among the new scientific data on the x-ray sources that have been viewed so far, the Leicester University, University College, London and Imperial College groups have reported on a new x-ray source in the constellation of Centaurus which is found to flash on and off with a period of nearly 6–8 minutes. This kind of behaviour is common, in x-ray stars but usually the period is that of the rotation of the star about its polar axis, when it is only a few seconds, or it is that of its orbital rotation about a companion star, when it is a few hours. A period of a few minutes implies either very slow rotation or fast orbiting: compare the orbit of the Earth about the Sun, with a period of a year. If orbiting, a period of the order of five minutes implies a very small orbit, smaller than the size of a normal star, so that a system consisting of, perhaps, a neutron star and a dwarf star must be involved.

A second new source reported by Ariel 5 investigators was found in February. It rapidly became the second brightest x-ray source in the sky for a time, after which it faded gradually. The source is in the direction of the centre of the galaxy and is probably actually in the galactic nucleus. It is possible that it coincides with a remarkable radio and infra-red source at the galactic centre, though other measurements at different wavelengths will be required to confirm this. The scientists believe this could be a new kind of object.

Finally, it is believed that x-ray emission lines have been detected from the Cassiopeia and Tycho supernova remnants. These are clouds of debris which result from the explosion which shatters many or all stars when their nuclear fuel is exhausted. If the observations are confirmed it will be possible to determine the amount of iron and silicon in the stellar debris. This will be important because it is believed that all the heavy elements in stars on planets such as Earth have been manufactured in nuclear reactions in supernova.

Photo: Keystone Press

European Space Agency

The setting up of the European Space Agency (ESA) was approved by the European Space Conference held in Brussels in April and ESA came into operation on May 31. ESA was formed from a merger of the European Space Research Organisation (ESRO) and the European Organisation for the Development of Space Vehicle Launchers (ELDO). The member states of ESA are: Belgium, Denmark, France, Federal Republic of Germany, Italy, Netherlands, Spain, Sweden, Switzerland and the United Kingdom. The Director General of ESA is Mr Roy Gibson, who was formerly Director General of ESRO. Mr Gibson joined ESRO in 1967 and prior to this spent eight years as an administrator with the UK Atomic Energy Authority.

CERN appointments

Dr John B Adams and Professor Leon van Hove have been appointed Directors-General of CERN for a period of five years from 1 January 1976.

Dr Adams will be responsible for administration, for the operation of equipment and services as well as the construction of buildings and major equipment. Professor van Hove will be responsible for the research programme.

Dr Adams first joined CERN in its earliest days and after being head of the division which built the 25 GeV proton synchrotron became Director-General in 1960 before returning to England. He rejoined CERN as Director of the 300 GeV accelerator project at the beginning of 1969 and became Director-General of Laboratory II in 1971.

Professor van Hove first joined CERN in 1961, as Head of the Theoretical Physics Division. Since then he has taken a leading role in the scientific life of the organization, twice serving as Director of the Theoretical Physics Department in 1966–68 and 1972–74. He was President of the Scientific Directorate of the Max-Planck Institute of Physics and Astrophysics in Munich from 1971–74.

'The work of the Research Councils'

The 'Work of the Research Councils' is to be the subject of a major one day symposium (Friday, August 29) to be held at this year's meeting of the British Association for the Advancement of Science at the University of Surrey, Guildford. Professor Edwards will present the opening address. He will review the work of the Councils, including support for 'big science'. Other topics of discussion will include 'Nutrition and food'; 'Oil from beneath Britain's seas and its consequences'; 'Changes in the natural and social environment' and 'Some benefits of fundamental science'. The symposium—the first of its kind—will be accompanied by an exhibition on the work of the Councils. Those wishing to attend the symposium or British Association meeting are invited to contact Mr Peter Smith, the British Association's Secretary at the University of Surrey, Guildford (Tel: Guildford 71281).

An aerial view showing the university campus and Guildford Cathedral in the centre of the picture. *Photo: Southern England Air-Photos*

Synchrotron Radiation Source

Approval has now been received from government for a Synchrotron Radiation Source to be built at the Daresbury Laboratory at an estimated capital cost of £3 million at mid 1974 prices. This includes the equipment for the first three beam lines. The Daresbury Source will be the first of its kind anywhere in the world to be purpose-built in order to provide synchrotron radiation which is applicable in the study of atoms, molecules and condensed matter covering a wide range of physics and extending to chemistry, metallurgy and materials science and molecular biology.

It is expected that this major scientific facility will be ready for the first experiments on completion of its construction in about four years' time, and the construction programme has been arranged so that work involving the Laboratory's 5 GeV accelerator known as NINA is not seriously affected.

The decision of SRC late in 1972 to terminate the high energy physics programme on the NINA accelerator within about five years had given extra urgency to the project. A panel set up at that time recommended the construction of an electron storage ring to replace NINA as a source of synchrotron radiation.

The project has arisen from the realisation of the scientific potentialities of such a source among users of the existing Synchrotron Radiation Facility on the NINA accelerator. Use of the Synchrotron Radiation Facility is near saturation, with nine sets of apparatus on two beam lines and over forty scientists using the Facility, including the Physics Departments of the Universities of Manchester, Reading, Cambridge, Oxford, Warwick, Leicester, Ulster and Bristol as well as the Metallurgy Department of the University of Strathclyde, the Chemistry Department of the University of Leicester, the National Physical Laboratory and the MRC Laboratory of Molecular Biology in Cambridge.

The availability of the new source of synchrotron radiation should result in a considerable increase in scientific interest in more universities and institutes as well as benefits of physics being brought into other subjects.

The RGO Tercentenary

Highlight of this year's celebrations of the tercentenary of the foundation of the RGO, will be the Royal Garden Party on July 18 for delegates to the Symposia as well as RGO staff, past and present. The guest of honour will be HRH Princess Anne who will unveil a bust of John Flamsteed.

Two days later at the invitation of the Dean and Chapter of Westminster Abbey, a service of commemoration for the tercentenary will be held in the Abbey on Sunday, July 20 at 3 pm. An address will be given by Professor Sir Bernard Lovell, Director of the Nuffield Radio Astronomy Laboratories, Jodrell Bank, and the emphasis of the service will be on the themes of Time, Navigation and Astronomy. Before the service, at approximately 2.30, Sir Richard Woolley will lay a wreath on the tomb of Charles II, who founded the Observatory.

From Saturday, August 2 until August 17 it will be Open Fortnight at the RGO, Herstmonceux Castle. This is a unique opportunity for members of the public to see certain domes and departments that are not normally open to them and there will be recorded commentaries on the work carried out on some of the telescopes.

August 10 is the anniversary of the laying of the foundation stone of the Observatory by John Flamsteed, the first Astronomer Royal, in 1675. (A commemorative service for Flamsteed, who was Rector of Burstow, Surrey will be conducted in Burstow Church by the Bishop of Kingston-on-Thames on July 13.)

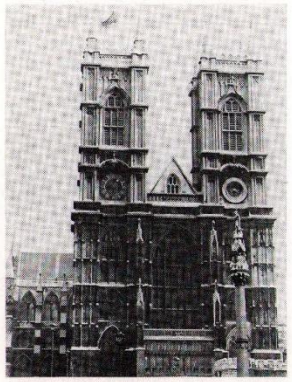


Photo: Keystone Press

Tercentenary transparencies
The Tercentenary Committee selected twelve subjects for transparencies to be on sale during the open fortnight in August and these are now available (from Miss C V Hewerdine) price 30 pence per set of three as follows:

1. Castle, an equatorial dome, a view of the Folly and lake.
2. Cooke Transit Circle, Photographic Zenith Tube, Time Department Control.
3. Isaac Newton Telescope, 36-inch Yapp telescope, 30-inch telescope.
4. Orion Nebula, M3 globular cluster, M51 spiral galaxy, the last two being taken on the Isaac Newton telescope.

"Greenwich Observatory"
The publication of the three volume history "Greenwich Observatory" by Taylor and Francis was marked by a reception in the rooms of the Royal Society on 18 April, attended by Dr A Hunter, the Director of the Royal Greenwich Observatory and Mr P S Laurie, the Observatory's archivist. All three authors pay tribute in their books to the amount of help they received from Mr Laurie.

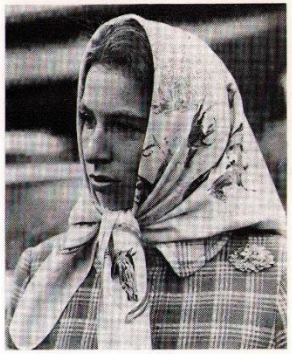


Photo: Keystone Press

Tercentenary medals
The Royal Mint has struck three 2½ inch commemorative medals in gold, silver and gilt-bronze. The medals were designed by William Andrewes, who teaches horology at Eton and maintains some of the Old Royal Observatory clocks.

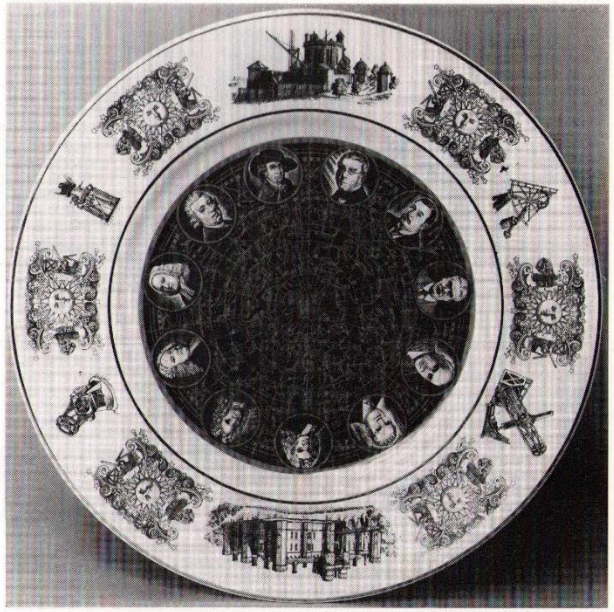
The reverse designs depict three themes: astronomy, time and navigation. The obverse design on each medal is of Flamsteed House at Greenwich.

The price of the gold medals is £750 each, the silver £25 each and the bronze £7 each and they are available from the Royal Mint, Numismatic Bureau, P O Box 1000, Edinburgh EH1 1AG.

Tercentenary visits
A press visit to RGO was held on 19 June when science correspondents, technical journalists and local press were invited to tour the domes, exhibitions and displays prior to the visits by special parties the following week. These parties included the Royal Society, Royal Astronomical Society, National Physical Laboratory, Royal Institute of Navigation, British Horological Institute, Clockmakers' Company, British Astronomical Association, Institute of Physics (Optics Section) and Science Research Council staff.

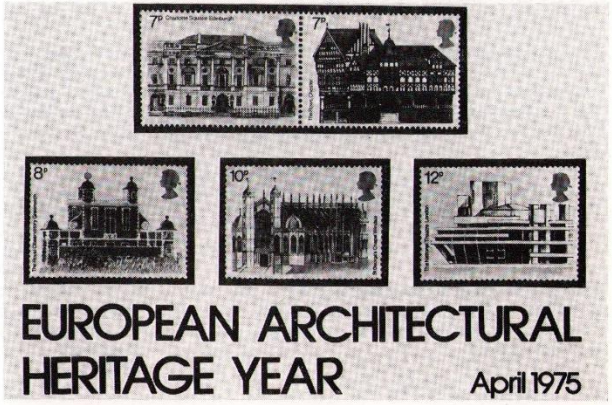
Commemorative issues

Royal Observatory Plate
Josiah Wedgwood and Sons Ltd have produced a Royal Observatory Plate in fine bone china, to a commission by Harrods, who have exclusive selling rights. The design is in black and gold and the plate has a diameter of 10¾ inches. In the centre of the plate is a 17th century star map of the Northern Hemisphere, superimposed on which are portraits of the first eleven (the Greenwich) Astronomers Royal. The border illustrates the Old Royal Observatory at Greenwich, Herstmonceux Castle, and four important astronomical instruments—separated by a repeating 17th century star motif. On the reverse of the plate is a commemorative backstamp which incorporates the names, lifespans and periods in office of the past Astronomers Royal. The edition is limited to 1,000 and each plate is accompanied by a numbered certificate and illustrated folder which relates the history of the Observatory. The price is £25.



Commemorative Covers
The commemorative stamp of Flamsteed House, one in a series issued by the Post Office for European Architectural Heritage Year, appeared on the commemorative covers issued on Sunday, 22 June to mark the 300th anniversary of the foundation of the Royal Observatory. A facsimile of the Foundation Warrant was enclosed and the Post Office placed a special post box at RGO for collection and handstamping with a specially designed die stamp.

Flamsteed House, Greenwich was put up by Sir Christopher Wren on the orders of Charles II in 1675–76. Designed as a house for the first Astronomer Royal, the Rev John Flamsteed, it was not so much an observatory but more—as Wren put it—"for the Observer's habitation and a little for Pompe." Flamsteed presumably enjoyed the "Pompe" but in fact made most of his original observations from a hut nearby.



Flamsteed House (bottom left) stands on the site of an earlier fort. The building is in red brick, with stone dressings at its corner. With its tall first-floor casements and twin turrets (one surmounted by a red ball which falls as a time check for ships on the nearby river) it was certainly designed as an architectural set-piece crowning the view from Inigo Jones' Queen's House.

"ROYAL VILLAGE CONSERVATORY"

Our cartoonist is Geoff Berry, Publications Officer at Daresbury Laboratory

Now where was I . . . ?

The following is a list of the permutations and combinations of addresses received over the last couple of years in the Electronics Department at the RGO.

It makes you wonder whether people actually listen to what you are saying when you give the address over the phone.

Although it is supposed to be an advantage to have a 'good address' it's no use if nobody knows how to spell it. Three cheers for the GPO on delivering the goods.

Seabrook Telecommunications
Royal Village Conservatory
Herstmonceux Castle
Halesham Sussex

For the Attention of Mr P D Reid
Royal Greenwich Observatory
Herstaonagox Castle
Hailsham Sussex

Mr T J Bell
Electronic Department
Royal Greenwich Observatory
Herstmonseaus Castle
Near Hailsham Sussex

Mr A Seabrook
Royal Gremwich Observatory
Herstmonceux Castle
Hailsham Sussex

Royal Greenwich Observatory
Herstmoncleux Castle
Hailsham
Sussex

Mr A R Seabrook
Royal Greenwich Observatory
Hurst mon seux Castle
Hailsham Sussex

Mr A R Seabrook
Royal Greenwich Observatory
Herstmonoeux Castle
Hailsham Sussex

J P Bell
Electronics Department
Royal Greenwich Observatory
Huntmonceux Castle
Hailsham Sussex

Mr A R Seabrook
Royal Greenwich Observatory
Herstmoncevy Castle
Hailsham Sussex

Royal Greenwich Obseavatory
Merstmonceux Castle
Hailsham Sussex

Mr Norman
Royal Greenwich Observatory
Herstmoncex Castle
Hailsham
Sussex.

Mr P D Reid
Electronics Department
Royal Observatory
Herstomonclux Castle
Hailsham Sussex

Royal Greenwich Observatory
Herstmongeux Castle
Hailsham
Sussex

H G Gill
Head of Electronics
Royal Greenwich Observatory
Herstmoncuec Castle
Hailsham Sussex

For the Attention of Mr A R Seabrook
Electronic Department
Royal Greenwich Observatory
Hersthonceux Castle
Hailsham Sussex

Ultraviolet Skylark

Conceived by Man that you may probe God's sky
for light much fainter than the earth may know,
a wingless bird that's born so soon to die
and in your death celestial secrets show.

For Man would know what forms the canopy
which clothes the night with constellations,
since long before the noble Ptolemy
the stars commanded meditations.

With steps retarded by a need to see
that bridges built on proven substance stood,
Man's expertise proceeds to rocketry
from things of leather, brass and varnished wood.

At last prepared, compared and primed for flight
stripped of all earthbinding trivials,
you wait while men in bunkers filled with light
suffer a flood of falling numerals.

A spark is parent to a lightning flash
a click progenitates a thunder clap,
two tons of metal make a skyward dash
and soon see earth become a coloured map.

Earth bonds prescribe your trajectory in space
dictate your impact on the desert floor,
for you a dusty, empty resting place
God's message gracing some computer store.

H J B Paxton
(Appleton Laboratory
(ARD) Culham)

Presentations and farewells

Our picture shows the Lord Lieutenant of East Sussex, the Marquess of Abergavenny, presenting Mrs Marples with the BEM at Herstmonceux Castle on 7 May 1975. Mrs Marples is well known to almost all senior UK astronomers, and to a large number of foreign ones, as housekeeper at the castle. Her official grading as Canteen Manageress does not properly reflect the range of her activities which go far beyond her successful running of a canteen serving the staff and visitors at the Royal Greenwich Observatory. She has for nearly twenty-five years given cheerful service at all hours and well beyond the call of duty.

Freedom of the Worshipful Company of Clockmakers

Dr A Hunter the Director of the Royal Greenwich Observatory was admitted to the freedom of the Worshipful Company of Clockmakers at a ceremony in Goldsmiths' Hall on 7 April. One of the stewards who escorted him before the court was Mr John Spencer Jones, son of the tenth Astronomer Royal.

Farewell to . . .

Mr A J "Jack" Johnson, formerly a craftsman in the Engineering Department of the Royal Greenwich Observatory, who retired on 31 March after forty-six years' service. Mr Johnson joined the Royal Observatory at Greenwich as a boy mechanic in 1928 and had been employed on the maintenance and erection of telescopes and ancillary equipment ever since, apart from war service between 1943 and 1946.

Mr J H Whale who retired from the Royal Greenwich Observatory on 31 May, after forty-two years in the public service. He joined the Royal Observatory when it was still at Greenwich in 1947 and he became Secretary and Cashier in 1962. He has thus been responsible for advising three successive directors, each of whom has at different times expressed gratitude for the wisdom that has informed that advice.

"Energy Saver" pays off

Two hundred pounds, even in these days of rising inflation is still a healthy sum of money to take home. Mr C R "Chris" Brown, a craftsman in the Nimrod Electrical Engineering and Auxiliary Plant Group at the Rutherford Lab has been presented with a cheque for this sum by the Director, Dr G H Stafford.

Chris Brown, following the publication early in 1974 of a Laboratory Notice on energy conservation, noted the lighting requirements in different areas of the experimental halls, then operating under half normal lighting for reasons of economy. On bright days the level was adequate but on dull days supplementary lighting became necessary. The basic idea put forward by Chris was to leave a percentage of the lighting switched on and control the rest by photo-cell with overriding control from the main control room. The suggestion was investigated by a Nimrod Operations Group working party and by the Electrical Services Group who recommended certain refinements. The estimated annual savings amounts to many hundreds of pounds.

At the presentation Dr Stafford spoke of the simplicity of this very effective suggestion and, mentioning that Chris had already received an award of £10 for a previous suggestion, speculated on the future if he continued to produce increasingly successful suggestions. Chris, in reply said that he would now be able to pay his large electricity bill!

Professor Roderick Redman FRS

British optical astronomy has lost a gentle giant with the death of R O Redman on 6 March 1975 in Cambridge. He had been ill for only a few weeks, and though he had almost completed his allotted span, the energy and youthfulness he had displayed right to the end of his life prompted those who did not know his real age to think his death untimely.

Redman was attracted into astronomy by the teaching of Eddington at Cambridge between the wars. He gained his practical insight into astronomical spectroscopy at the Dominion Astrophysical Observatory at Victoria, British Columbia. Returning to Cambridge for six years' teaching, he accepted in 1937 the post of Chief Assistant at the newly-established Radcliffe Observatory in Pretoria. He was clearly motivated by the prospect of observing with the 74-inch reflector then under construction in Newcastle, but the outbreak of war prevented the completion of the telescope. For the next nine years he sublimated his frustration by taking part, with R H Stoy of the Royal Observatory at the Cape, in a major programme of stellar photometry that culminated in linking the two hemispheres through observations of intermediate zones from both South Africa and the United Kingdom.

He returned to Cambridge in 1947 as Professor of Astrophysics and proceeded to re-equip the two observatories there, now combined administratively, with modern instruments with which he developed the technique of narrow-band photometry that will always be associated with his name.

He participated fully in the work of SRC from its foundation, serving on the ASR Board and the RGO Committee, and as Chairman of the ROE Committee, from 1965 to 1970. He acted as consultant on the Anglo Australian Telescope from its inception: that it has turned out to be arguably the best telescope in the world is no more than one would expect from his influence. He has been equally concerned in the early stages of the Northern Hemisphere Observatory. He never spared himself in furthering these projects: in particular, he commuted between Australia and the United Kingdom in the last year of his life in a way that would have tested a much younger man.

Redman was completely without the stuffiness shown by some others of his generation. He affected a surface pessimism that was totally belied by the warmth and generosity of his real nature. His characteristic explosive laugh will be greatly missed in SRC committees and over tea at the Royal Astronomical Society; optical astronomy will be the poorer for his absence. **A.H.**

GEOS—Europe's first geostationary scientific satellite

The European Space Agency (ESA) is at present developing Europe's first geostationary scientific satellite GEOS. Scheduled for launch in autumn 1976, GEOS will probe the regions of the Earth's atmospheric environment in space from a synchronous orbit at an altitude of 22,300 miles (36,000 Km).

It will carry experiments devised by nine European scientific groups to study the electric, magnetic and particle fields in the Earth's magnetosphere.

Only one UK experiment is to be included in the GEOS payload. This experiment—the Suprathermal Plasmal Analyser experiment—is to be provided by the Mullard Space Science Laboratory (MSSL), and will observe low energy particles associated with geophysical phenomena such as magnetic substorms, solar flares and various wave particle interactions.

In addition, groups at the Universities of Sussex and Sheffield will participate in the data handling for the GEOS Electrostatic Wave Experiment (S300). This experiment is being built by a consortium of prime experimenters from France, Denmark and Holland.

This section of a radial boom on the GEOS satellite shows (left) a magnetometer that will measure the magnetic field in three axes so enabling its precise direction to be determined at any time. An electron gun (right)—one of four on-board GEOS—will emit an electron beam which after deflection by the magnetic field is sensed by another part of the experiment—so allowing electric field components to be measured.

Birthday Honours

Her Majesty the Queen has been pleased to award Honours to the following: Professor S F Edwards FRS, Professor P B Hirsch FRS, D L Nicolson and Professor A B Pippard FRS were made Knights Bachelor; Professor T W Goodwin FRS and Dr A Hunter were awarded the CBE; and Mr P S Laurie and Mr J Wilby received the MBE.

Professor P B Hirsch FRS is a former member of the Engineering Board and former Chairman of the Metallurgy and Materials Committee. Mr D L Nicolson is a former member of Council.

Professor A B Pippard FRS is a former member of the joint SRC/SSRC Committee.

Professor T W Goodwin FRS is a member of the Biological Sciences Committee.

Mr P S Laurie is a Senior Scientific Officer at RGO.

Mr J Wilby is a Stores Manager at Daresbury Laboratory.

Fellows of the Royal Society

All members of the Council's staff will wish to congratulate the following who have been elected Fellows of the Royal Society: Professor R Mason, Sussex University (Member of Council and Chairman of Science Board); Dr K Dalziel, Oxford University (Member of Enzyme Chemistry and Technology Committee); Professor R Wilson, University College London (Member of ASR Board and formerly Head of SRC Astrophysics Unit, Culham); Professor E C Zeeman, Warwick University (Member of Mathematics Committee); Mr R J Beverton, Secretary NERC; and Dr D A Haydon, Cambridge University (Member of the Colloid Panel of the Chemistry Committee).

Royal Society Soirée

Appleton and Rutherford Laboratories were honoured by our oldest scientific institution, the Royal Society, in being chosen to exhibit at their May soirée. Only about twenty-five exhibits are selected each year for demonstration to the Fellows and their guests.

Appleton's exhibit was 'The influence of solar phenomena and geomagnetism on the weather and climate'. It dealt with the recent discovery that the weather in certain parts of the world, including Britain, is apparently influenced by a wide variety of solar phenomena ranging from short-lived events such as solar flares to the eleven year and twenty-two year sunspot cycles.

Sunspot cycles are accompanied, for instance, by pronounced variations of the annual rainfall (up to fifty per cent in certain parts of the world) and of the winter temperature (up to 6° F). Droughts in some of the world's major food growing regions appear to be associated with the twenty-two year sunspot cycle. This cycle is also associated with a six week oscillation of the date in each year by which various percentages of the annual rainfall occur in Australia.

The number of days each year on which 'blocking anti-cyclones' occur over Europe (and hence the quality of the British weather) varies during the sunspot cycle, as does the temperature of the sea in the English Channel. These sun/weather relationships are obviously of great practical and economic importance and they are under further investigation at the laboratory.

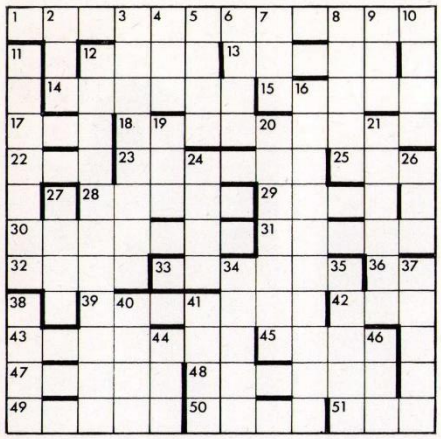
Short lived solar phenomena such as solar flares, and also magnetic sector boundaries that extend into space from the sun and sweep across the earth as the sun rotates, are accompanied by significant variations of the average wind speed over the northern hemisphere. Detailed analyses of sudden changes in the lower atmosphere are being made at the laboratory in order to identify the short lived solar phenomena with which meteorological changes are mostly closely associated.

Evidence suggests that certain sun/weather relationships are associated with charged particles from the sun. The approach of these particles to the earth is controlled by the earth's magnetic field and associations between the lower atmosphere and the geomagnetic field are therefore being investigated. It appears that variations of the magnetic field may play a major role in determining the earth's climate.

The Rutherford exhibit was 'The medical applications of high energy physics techniques' consisting of a Xenon fitted multiwire proportional chamber (M W P C) and associate equipment.

The M W P C detects x-rays and measures the position at which their paths intersect the chamber. The measurements are stored in a computer and used to build up a picture of the x-ray distribution. When an object is being x-rayed it appears as a shadow cast on the detector. If the source position is moved the x-ray distribution at the detector moves as indicated in the diagram. The distance moved depends on the height of the object above the detector and this relationship can be used to examine the structure of the object at specific heights. The object is viewed from eight positions and the information describing each view is stored in the computer. The views are moved a calculated distance so that, when superimposed, shadows cast from one particular height are clear while those from any other height appear smeared out. The effect is similar to focussing a light image of a three-dimensional object onto a screen with a large lens, only part of the object is clear at one setting.

This exhibit was the work of several groups: the Radiological Research Group who had been engaged on the medical applications; the High Energy Physics Electronics Group who provided the computer and electronics; the Nuclear Physics Apparatus Group who dealt with the engineering aspect and the Scientific Administration Group who liaised with the graphics and stand design.



MAXIM 9

Maxim 9

Answers to the clues asterisked will not fit into the diagram until they have been encoded. The nature of the code is indicated by the answer to 1 across. Solvers will also need to know that what some people call 'zero' or 'nought', Maxim calls 'nil' and that the golden rule of entering only one character in each square in the diagram is adhered to. Non-asterisked clues are normal.

Clues

ACROSS

1. 1 Ac, for example. Otherwise N—ah, a prim clue! (12).
12. Male, or put another way, dashing fellow (4).
13. What turns, yet stays constant? (5).
*14. How astronauts feel: light, disturbed, in a small craft (10).
15. A soak drunk in Japan (5).
17. Constellation visible from Seattle Observatory (3).
18. Delights in request for mad ruses (9).
22. He's a little man in himself (3).
23. M40 is highly resistant (6).
25. Stance alternately adopted by bag (3).
28. Note gang-leader in . . . Dickens (5).
29. One mile per second from small cars (4).
30. Hydrogen-consuming means of keeping warm (7).
*31. Wife's behaviour? Mine's upset, inside—result of careless parking (8).
*32. Get nervy in the troubled teens (5).
*33. Draw lots somehow for success in the argument (4, 4).
*36. State House on Tyneside? I'm not joining in (4).
*39. Unpaid, our selected side achieves a draw (7, 4).
42. Part of Scotland in Alloway region, and vice versa (3).
43. LP hints obliquely at method of supporting busts (7).
45. Device for firing in unlikely retreat (4).
46. Nearly unusual, our smell (5).
48. If I'm out, it's something to do with chaps, usually (6).
49. Weed clobbers Yorkshire opener (5).
50. Tight-fitting about the arms (4).
51. What 'aye-aye, sir' implies (3).

DOWN

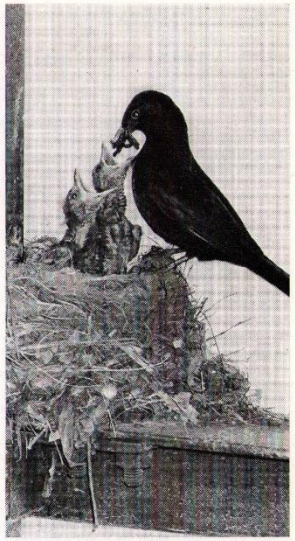
2. 7 down, not up (3).
3. The ample contents of first-aider's position (8).
4. Used to measure area mostly (3).
5. Mr Heath's best-known organ, played on by his depictors (4).
6. In one great power, take symbol of another (4).
7. Nothing after a short wait—typical of the cow (3).
8. What you hear in the 40's—'take paddles' (5).
9. Trouble of the fair kind (3).
10. Trouble with cash for the little prince (4).
*11. Device that gives buzzing noise when most of trunk-caller's inside (9).
*12. Take hose off a thigh in roughly attaining the in thing (6, 2, 7).
*16. '. . . on a -- --, in his tent, That day he overcame the Nervii' (Shakespeare, *JC*) (7, 7).
19. It's just not on, in cricket, to run very fast (3).
*20. Move labour to get continual manning (5, 4).
21. With bags of room in Eastern Islay perhaps (6).
24. Trap one? She used to in the cinema (4).
*26. What makes N a nice doggy (6).
*27. Direction from here and a river you'd come to late in life (6).
34. American in sick-bay, a girl with black eyes (5).
35. Flirt with lady, her first flirt (5).
*37. Roneo breaks down; it's burdensome when me and you are there (7).
38. Opts out? The very place! (4).
40. There's nothing at sunrise like hard work (4).
41. Units that need no stamps (4).
44. Essay that's sometimes converted (3).
46. Bevan—a US city on the coast that it's on (3).

The prize will be awarded to the first correct entry drawn. Please state whether you would prefer a book or record token. The solution will appear in the next issue.

Rutherford gets the bird

An EPIC occasion (or our colleagues at the Rutherford Laboratory, if not for the ornithological world in general, has been the construction of their family home, by a couple of friendly blackbirds, in the east entrance to building R1. Our pictures show not just father feeding the young but mother hatching them.

The nest has been occupied twice by the same pair who have produced two sets of eggs. This is extraordinary in view of the site which is within hand-touching distance of a doorway used by dozens of people every day. The brilliant wildlife photography is by Reg Jones of the laboratory's photographic services staff.



European science writers visit SRC

The Association of British Science Writers organised a three day programme in March for members of the European Union of Associations of Science Journalists. Journalists from Austria, Belgium, France, Germany, Italy, Netherlands, Spain and Switzerland took part in the programme which included visits to Cambridge University, the Huntingdon Research Centre and Winfrith Atomic Energy Establishment. The Science Research Council gave a buffet lunch at State House on Wednesday, 19 March at which senior representatives of all five research councils were present.

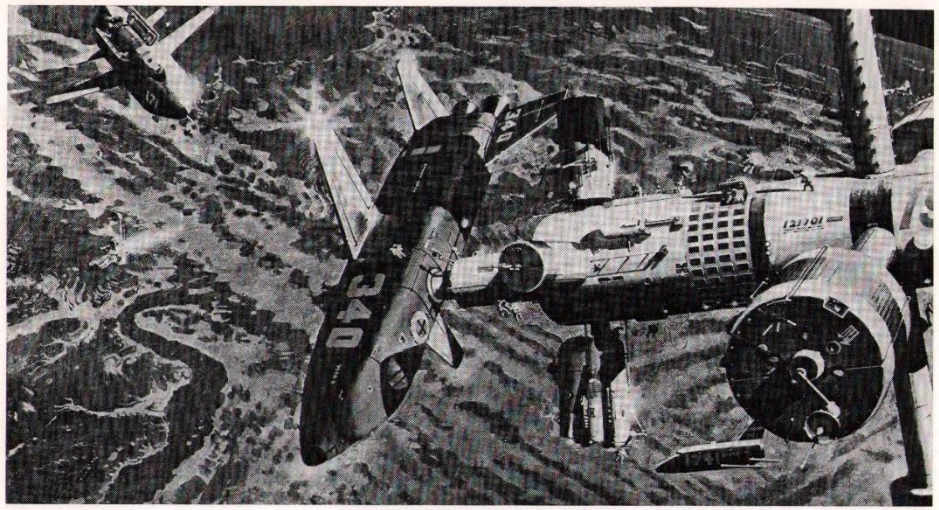
Computational Physics of Liquids and Solids

Atlas held its fifth symposium on the subject of "Computational Physics of Liquids and Solids" at Queen's College, Oxford in April. While the majority of the hundred participants were from the UK there were speakers from the USA, France, Italy, Holland and other European countries, showing the high level of interest in this field.

By the end of the symposium it was clear that high speed electronic computers have made a tremendous impact on the theory of liquids and solids. As one speaker remarked "Computer simulation methods have not so much replaced theory, but have made a theory of liquids possible".

Daresbury's swimming club

In January a swimming club was formed at Daresbury Laboratory. In the few months since then several of the non-swimmers have made great progress and joined in with the swimmers. Tuition is given to new non-swimming members. All the swimmers have been encouraged to improve their standard and learn different strokes and it is hoped to enter a team in local competitions in the future. In the meantime everybody enjoys their weekly night out supervised by Gordon Foster.



Shuttlecraft docking with space station. A scene looking forward to the time when shuttles, like aircraft today, will be specially designed according to their functions. (*Illustration reproduced from "Our World in Space" by Isaac Asimov, by permission of the publishers Patrick Stephens Limited.*)

SPACE TIME DIARY No. 2. In this second article, Gerry Webb reports on the visit last year of popular science writer Isaac Asimov to the Globe Tavern, Hatton Garden, former haunt of the London Circle and reviews Asimov's "Our world in space".

Being crushed to near suffocation amongst a hundred 'sercon' fans (sercon = *ser*ious and *con*structive to non-fans) at the large, shabby bar of the 'One Tun', my thoughts wistfully drift back to June. I had been prophetic indeed! Hearing that the apocalyptic visit of Asimov to the British Isles was at last to take place and that we were going to arrange one last meeting at the 'Globe Tavern' in Hatton Garden in his honour before it was pulled down for redevelopment, I had quipped "so, its after Asimov–the deluge".

The 'London Circle'

Perhaps I had better explain the history of the regular Thursday night meetings of the 'London Circle', now so sadly gone awry. Before the war, a group of the ridiculed minority comprising science fiction readers and those interested in practical space travel (the two being indistinguishable at the time); those interested in the general future possibilities for mankind; and anybody with what the old-timers now nostalgically call 'a sense of wonder', met frequently in London at several locations one of which was the flat shared by A C Clarke and W F Temple, which at times got so crowded that people had to sit on the windowsills.

Post-war, these meetings were put on a regular basis, and weekly gatherings of a small group of people that had kept in touch took place at the 'White Horse Tavern' in Fetter Lane, just off Fleet Street. These early meetings have since been made famous by A C Clarke in his collection of tall stories allegedly told at this pub: 'Tales from the White Hart'. The meetings moved to the 'Globe Tavern' in Hatton Garden, following the now legendary landlord Lew Mordecai.

Meanwhile, back in the bar of the One Tun.... Fate is acting in a mysterious way. Instead of being swept away in some gigantic and sudden biblical-style cataclysm, the remnant of the 'London Circle' (what us old hands like to call ourselves) looks fair to being squeezed out of life by a welter of humanity. The reason for the milling crowd around us is that 'Science Fiction Monthly', a rather novel, showy and popular but at times adolescent and garish publication from New English Library, has for several months been mentioning where and when the meetings take place. Gone for ever is the intimate and stimulating gathering of writers, publishers, professional scientists, and just plain fans, meeting for reassurance that it is indeed the rest of the world, and not themselves, that need changing. After Asimov, it is indeed a deluge.

The 'Good Doctor'

This is not to say of course that the 'Good Doctor' as he is known is in any way responsible for the changes that have taken place at the Thursday night meetings. Indeed, my comment was actually occasioned by his renowned reluctance to depart his

adopted country. In fact, his visit in June was his first foreign trip since, at the age of three, his parents took him to America from his birth place in Russia.

Although now a popular science writer of world renown and one of the doyens of Science Fiction, Asimov remained a full time academic until the late 1950's when he found that writing was more profitable. He still, however, retains associate professor status with Boston University Medical School. On his visit to Britain he was installed as Honorary Vice President of International Mensa. Not noted by his fellow writers for his reticence about his abilities, he is reputed to have begun a speech to a Mensa meeting with the words "It is a pleasure to at last have an audience with an I.Q. equivalent to mine! Sum total, that is!" A remark such as this can be readily forgiven in a man whose output of books has now reached the phenomenal level of averaging one per month and yet still manages to maintain a consistent and high standard.

'Our World in Space'

One example of this prodigious output that I can particularly recommend to readers of 'Quest' is "Our World in Space"*, a book that charts the possible pattern of our World's progress outwards into space, in the next few decades and beyond. In this book, Asimov collaborates with Robert McCall, the Art Director of '2001, a Space Odyssey' and official artist to NASA. The production is in an elaborate and handsome 'coffee table' style, which in the main succeeds very well. But there is a noticeable divergence between text and pictures for the last two chapters, where Asimov discusses man's eventual exploration and settlement of the outer solar system and his ultimate journey to the stars. This criticism is only of minor importance. Both text and paintings provoke many hours of entertaining speculation. To give just one example, Asimov proposes that it will be 'men' from the low gravity environment of the outer solar system that will be colonizing the universe by 2200 AD, rather than the physiologically and psychologically unprepared 'stay at homes' on the high gravity mother planet, Earth.

Asimov has countered those who chide him on his lack of willingness to travel with the comment "I am perfectly content to sit at home and let my mind wander. And wander it does..... very effectively. In the course of the books I have written, it has wandered from the dawn of the Universe to its end and from here to the farthest star. It has wandered almost over every field of human knowledge without ever growing foot sore". As I crouch in the bar of the 'One Tun' attempting to extract ash from my beer, I deeply regret not having adopted the Good Doctor's policy.

*"Our World in Space" by Robert McCall and Isaac Asimov. (Foreword by Edwin E Alderin Jr) Published by Patrick Stevens Limited, Cambridge, June 1974 pp 176, 72 colour pages, £6.95 pence.

Gerry Webb is a Higher Scientific Officer in the Space Research Group at the Appleton Laboratory.

Solution to Nutcracker 17

4	9	8	8	■	4	2	4	2
1	■	4	6	8	4	8	■	9
7	4	6	■	0	■	2	8	2
6	7	■	1	4	1	■	5	8
■	3	2	8	■	1	1	6	■
6	4	■	3	3	2	■	5	1
2	5	8	■	3	■	2	6	1
0	■	3	8	5	1	2	■	3
4	2	3	3	■	6	5	3	2

Clue 6 Down should, of course, have read "Twenty-nine Down multiplied by 14 Down".

The winner was K Stone (Rutherford Laboratory) who wins a £2 book token.

Solution to Maxim 8

T	H	I	R	T	Y	S	I	X	C	O	D	A
W	A	N	E	D	O	F	L	E	A	P	I	T
E	R	A	V	I	G	I	L	R	R	I	C	E
N	I	N	E	S	I	X	T	E	E	N	T	D
T	H	E	R	M	O	N	U	C	L	E	A	R
Y	O	R	E	A	V	O	N	T	E	M	P	I
F	O	U	R	L	E	N	T	O	S	P	I	V
I	T	E	M	S	R	E	I	N	S	O	L	E
V	A	C	U	U	M	C	L	E	A	N	E	R
E	L	I	N	H	E	R	E	S	B	U	R	L
H	I	N	G	E	P	A	P	A	L	D	O	E
A	C	T	O	R	S	G	I	B	E	E	L	S
P	E	O	N	D	I	S	C	U	S	S	E	S

John Barrow (Royal Observatory Edinburgh) wins a £2 book token.

NUTCRACKER 18

In "The Gold at the Starbow's End" Frederick Pohl gives the following example of a Gödelised message:

$$1973^{354} + 331^{852} + 17^{2008} + 5^{47} + 3^{9606} + 2^{88} - 78$$

Such a message is encoded by representing the characters of the message by the prime numbers, taken in order, raised to the power represented by the relevant characters (where A=1, B=2, etc, a space is zero (0), and a full stop 27). These numbers are then multiplied together. Thus: "I am". would be represented by $2^{1} . 3^{0} . 5^{1} . 7^{13} . 11^{27} = 2^{9} . 3^{0} . 5^{1} . 7^{13} . 11^{27}$. This is a very large number. (It has 43 digits) but it can be compressed, as Pohl has done, by representing it as the sum of a number of integers raised to suitable powers. To decode, one simply has to work out the sum and factorise it.

Pohl writes "You could not get even the first letter until you had the whole number, and IBM had refused even to bid on constructing a bank of computers to write that number out unless the development time was stretched to 25 years".

Pohl is wrong. What are the first three characters of his message?

Thanks to John Feather of the Department of Industry for drawing my attention to this problem.

Book or record token prize for the first entry drawn.