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Cover photograph

Geoff Morrison completing assembly of the target crystal in the microwave cavity of the Polarized Proton Target.

(see article on page 4.)

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Editorial

The prospect of the integration of NIRNS into a more broadly based scientific organisation, coupled with the prevailing philosophy of a 'new deal' for Science and Technology, seemed to augur well for our forthcoming change. But the approach of the Science Research Council is casting some shadows before it.

A bigger organisation pursuing science on many fronts (space research, astronomy ... as well as nuclear science) puts our research in more sensible perspective than the isolation of the NIRNS organisation did. It affords possible outlets if high energy physics is curtailed by financial restrictions or if the scientific value of the work should ever exhaust itself. It should enrich the intellectual climate of the Laboratory if there is interchange between the different Divisions of SRC. Also the prospects of interchange broadens and makes more interesting the career prospects of our personnel.

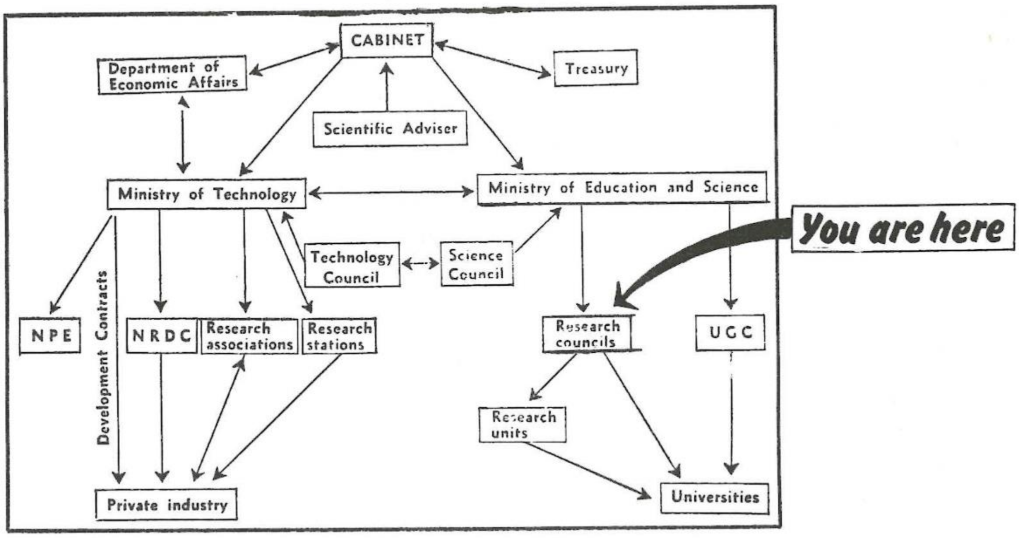
A wave of optimism prevails for a more enlightened attitude to Science and Technology, and the invited 'Policy for Science' contributions to the September 1964 issue of ORBIT indicate how the attitude took hold in the manifestos of all three political parties. Its most celebrated exposition was the 'Labour and the Scientific Revolution' speech at the Labour Party's Scarborough Conference in October 1963. With the Labour Party in power, we await the fulfillment of the promise of Scarborough, 'The party will be able to liberate the frustrated energies of thousands of young scientists, technologists and specialists.'

The broad plan of the reorganisation of Science and Technology is as shown in the accompanying diagram (published in The Guardian on 12 January). We, in the SRC, will be grouped with the Agricultural Research Council, the Medical Research Council and a new Natural Enviroment Research Council, under the Ministry of Education and Science. (The Atomic Energy Authority and most of what was DSIR is under the Ministry of Technology). The necessary legislation to implement these changes is being hurried through Parliament and may come into force on 1 April. Information as to the effect the reorganisation will have on the life of our Laboratory is difficult to come by: perhaps because no-one knows.

Two issues are causing apprehension. The first is that of conditions of service for future recruits. At the time of writing it seems probable that, while not actually Civil Servants, they will be subject to conditions virtually identical to those of the Civil Service, which are admitted to be inferior in some respects to those set up for the AEA in 1954 and carried over into the NIRNS. The NIRNS personnel will, at least initially, make up 60-70% of the SRC, but the conditions of service of the small proportion of DSIR which is to join us in the SRC, will be taken as the standard. All attempts to reverse this decision have so far failed. At the second reading of the Science and Technology Bill, Mr. Airey Neave, M.P. for Abingdon moved an amendment (Hansard 20 January Column 363), '... that new entrants should enjoy the same pension rights as the staff enjoy now.' The amendment was rejected and Mr. Boyden for the Government said that to endorse the existing conditions for new entrants would be 'perpetuating an anomaly'.

It means that after 1 April newcomers will be on poorer terms than the rest of us. This could have an affect on morale, could make recruitment difficult, especially with AERE next door who can still offer the better terms. (Mr. Airey Neave pointed out that '... the Medical Research Council unit at Harwell is on Civil Service scales and is having tremendous difficulty in recruiting all kinds of staff - scientific, administrative and secretarial.') It could involve duplication of some of the negotiating machinery between staff and management, and could require increased staff to cope with the two categories of people. Within our Laboratories, the new measures will create an anomaly.

An important related point was raised by Mr. Richard Crossman, previously Shadow Minister of Science, in an article in Encounter who emphasised 'the deficiency of inadequate interchange of staff.' Anthony Tucker in The Guardian on 16 January, said 'One of the pur-



poses of the Governments' reorganisation of civil science must be to promote the easy interchange of scientists between Government establishments, the universities and industry .... the Science and Technology bill seems likely to establish barriers where none existed.'

The second issue concerns the possibility of increased bureaucratic control as we move into the SRC. (A second Guardian article on 8 February was headed 'Scientists fear long arm of Whitehall'.)

Over the past eight years the National Institute has pioneered a relationship with the universities which has never been developed on such a scale by any other Government funded organisation. Almost everything reasonably possible is set up to make the using of our facilities a smooth and easy process. The working conditions in the Laboratories are good and much is done to make visitors feel that the Laboratories are effectively extensions of their own Universities.

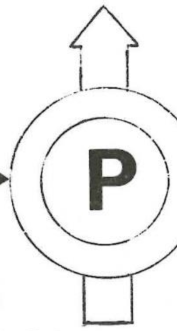
There are signs that the experience gained in establishing and managing this relationship may not be fully recognised in the new organisation. When the AEA was formed and when the NIRNS grew out of the AEA, the people involved in setting up the new bodies were people with enthusiasm for what they were doing; people who knew by intimate contact the whys and wherefores of what they were doing. The indications with regard to the SRC are that, despite the two-thirds NIRNS compliment, the experience and enthusiasm of the National Institute is not being called upon in setting up the new organisation.

One of the biggest factors which has made it possible to create this unique relationship has been the comparatively free hand given to the National Institute to use its allocated funds, within the agreed programmes, in the way it considered most fruitful. Flexibility is especially necessary in our research with its continual changes of direction and fluctuations of emphasis. If the coming of the SRC removes some of this delegated authority and introduces more detailed control, the life of the Laboratories could deteriorate. Inability to move money and effort quickly to mount an assault where it is needed could cripple the research work. Measures which monitor spending in a more bureaucratic way or measures which considerably lengthen the chain of decision taking would be retrograde steps. If university scientists began to find it difficult to do their research at our Laboratories they would eventually go elsewhere.

None of this is to imply that the money spent on our work should not be questioned or monitored. It is the Government's duty to decide in broad terms how the taxpayers' money is to be allocated and to ensure that it is used efficiently. But having taken the decision to set up Laboratories like ours, the country is committed to heavy capital and recurring expenditure. This commitment could be wasted by cheese-paring on the small sums involved in making the Laboratories function to the best of their potential, or by delaying projects by making their authorisation a more elaborate procedure.

We have set up modern Laboratories. To revert to Civil Service thinking about how they should be run could make our position, in competition with some of the finest Laboratories in the world, virtually impossible.

The Polarized Proton Target



by H.H. Atkinson

In his Christmas Message, the Director quoted the polarized proton target as a good example of the growth of technology in high energy research. This article traces the development of the technique, explains the principles involved and describes the target built at the Rutherford Laboratory. It was used in the π1 experiment (conducted by our resident high energy physics team led by P.G. Murphy and J.J. Thresher) which has recently been completed. We hope to carry an article on the experiment in the next issue of ORBIT.

Introduction

The forces between 'elementary' particles often depend considerably on the values and orientations of their spins. Unfortunately these important properties are difficult to investigate, since conventional beams and targets are 'unpolarized'. This means that although each individual particle comprising the beam or the target may have a non-zero spin, so that a definite axis or direction can be associated with it, on the average these axes are randomly orientated since there is no external force present to line them up: they are 'unpolarized'. If spin dependent effects are to be measured, it is clearly desirable to have a polarized beam (where meaningful: e.g. π mesons have zero spin), a polarized target, or both.

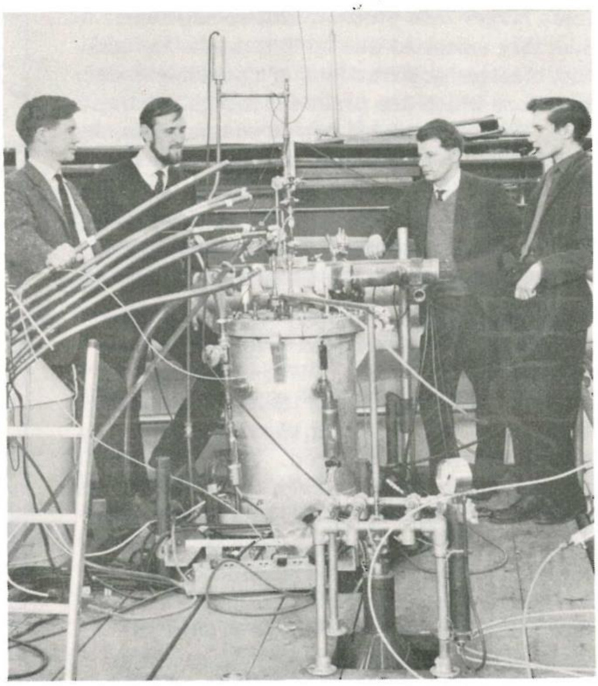
Polarized beams can be produced in certain cases. For example, a polarized proton source has been operating successfully for some time on our own P.L.A. This is extremely useful for observing scattering of protons from any particles which can be conveniently arranged in a target, e.g. other protons or more complicated nuclei. However, clearly we cannot make a target of mesons, or of unstable particles, so, for example, πp or Kp interactions cannot be studied. Also, while such a source works well on a linear accelerator, no one has yet attempted to accelerate a polarized beam in a synchrotron, where it is expected that magnetic field perturbations might depolarize the beam. Methods have however been proposed for avoiding this difficulty.

Although initially polarized beams have not so far been accelerated to high energies, partially polarized beams of high energy can be sometimes produced by scattering an unpolarized beam from a target, when the particles emerging in certain directions are often polarized. This important method (which can also be used to analyse polarization) is limited by the very low intensity of the scattered beam.

Polarized targets are now also possible due to the fine work of Abragam at Saclay near Paris, and Jefferies at Berkeley in the U.S.A. Abragam discovered the 'solid effect' described below) and using this, proceeded

The arrival of the magnet for the polarized target
- one of the anxious moments en route to the finished project.

An A B C D of the polarized target: Left to right - Harry Atkinson, Brian Belcher, Brian Colyer and Ralph Downton on the upper deck of the polarized target. The helium reservoir can be seen, together with the helium transfer tube and pumping line, the waveguide and the NMR leads. The tail of the cryostat, which contains the crystal, and the magnet are underneath.



to make the first polarized proton target to be used on a nuclear physics experiment: the observation of spin dependent effects in the scattering of a beam of polarized protons at 20 MeV from the polarized target. Due to the high absorption of the low energy particles involved, the target itself has to be made very small. The apparatus was most ingenious in all respects and gave polarizations of about 20%.

For experiments in high energy physics much larger targets were required and Berkeley physicists succeeded in making a target in the form of a 1" cube. It has been used most successfully in several experiments, operating at polarizations of more than 50%. The design of our own target was much influenced by the Berkeley apparatus.

The 'Solid Effect'

The process of lining up protons is not as easy as it might at first seem. Every schoolboy knows that a proton, because it is charged and is spinning like a top, behaves like a small bar magnet, the North South direction lying along its spin axis. Thus, all we need do to line up the spins of a number of protons is to immerse them in a (sufficiently strong) magnetic field. It might be expected, for example, that the protons in water should therefore line up in the earth's magnetic field. In fact, although they try to orientate themselves along the lines of force, the protons are such weak magnets that the random thermal motions of their neighbours, at room temperature, quickly knock them out of alignment: on the average, for each twenty thousand million protons, 10, 000, 000, 001 point along the earth's field lines but 9, 999, 999, 999 point in the opposite direction. Hence the polarization (defined as the number of protons pointing North minus the number pointing South, divided by the total number of protons) is extremely small. (It is, however, observable by the sensitive method of nuclear magnetic resonance, NMR. This forms the basis of a most sensitive device for measuring magnetic fields, the proton magnetometer.)

Not surprisingly, nuclear physicists are not inclined to be impressed by such polarizations. The degree of alignment can be improved by strengthening the magnetic field to increase the directing force, and preferably at the same time by decreasing the temperature to reduce the randomizing forces. However, even with a field of 20, 000 gauss at 1^{o}K (-458^{o}F), the polarization rises to only 0.2%. To achieve an acceptably high polarization, say 50%, at the highest practicable DC field, about 100, 000 gauss, the temperature must be reduced to $1/50^{o}$K, which is much too low to be maintained using present cryogenic techniques.

Polarized targets have become possible due entirely to the 'solid effect' mentioned above. This makes use of the fact that 'free' electrons have a magnetic moment about 1, 000 times larger than protons, and so are considerably easier to line up in a magnetic field. High electron polarizations are possible under conditions which are practical though not trivial. Abragam showed how it was possible, by adding such free electrons to the target, for the electrons to transfer their high polarization to the protons. This was done using microwaves at the frequency of a 'forbidden' transition very near that for electron spin resonance.

The effect is most easily explained by considering a simple system consisting of a single free electron and proton. When placed in a magnetic field, the axes of the electron and proton spins will lie either parallel or antiparallel to the lines of force. There are thus four possible arrangements of the system, each having a different energy (see the figure). For example, the lowest energy state, A, is that in which both particles are parallel to the field. States B, C and D are of higher energy since work has been done on the system to twist one or both of the small magnets round against the field.

However, at 1.2°K in a field of 18,500 gauss (the conditions in our target) the thermal energy is so low (about 0.0001 eV, compared with 1/40 eV at room temperature) that at equilibrium most of the electron proton pairs are in the two lowest states A and B. These are about equally populated since the energy difference between them is much smaller even than the very small thermal energy.

Now suppose the electron proton pair is irradiated with microwaves of frequency ν, such that the energy $h\nu$ of each electromagnetic quantum equals the energy difference between B and C, that is, the energy required to reverse both the electron and proton magnets simultaneously. Although this transition is strictly forbidden by quantum mechanics, the magnetic coupling between the electron and proton allows it a small chance of occurring. Since the probability of absorbing a radio frequency quantum is the same as that of stimulating the emission of a quantum of the same energy, the number of electron proton pairs in state C will equal that in B provided sufficient microwave power is available. However, state C quickly disposes of its excess energy, passing to state A by means of a 'natural' transition in which the electron only turns round to point along the field, the proton spin not changing. On the other hand, the proton relaxation, which tends again to equalize the population of states A and B, occurs very slowly. Hence in

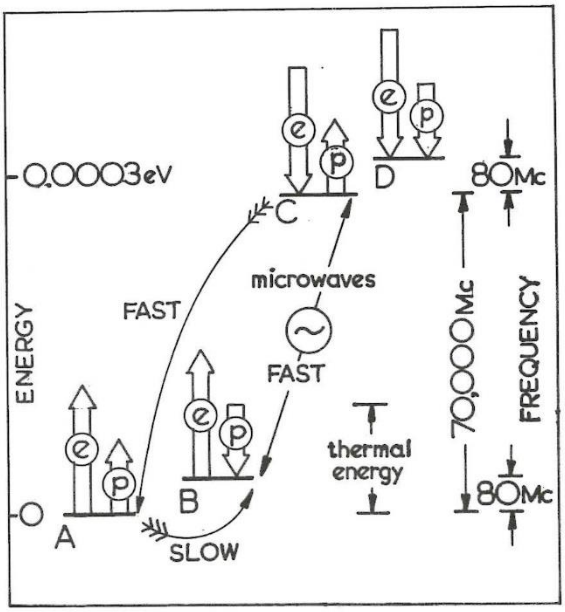


Diagram showing the four possible arrangements of an electron 'magnet' (long arrow) and a proton 'magnet' (short arrow) in a vertical magnetic field. The energy of each arrangement is shown on the vertical axis in terms of electron volts (on left), and equivalent electromagnetic wave frequency (on right), for a field of 18,500 gauss (g = 2.7 for the 'electron'). When irradiated with microwaves at (70,000-80) Mc/s, the system spends most of its time in state A, the protons thus being positively polarized.

the dynamic process: B (by microwaves) to C (by electron relaxation) to A (by proton relaxation) to B, the processes B to C and C to A are very fast (a fraction of second), but A to B is very slow (many minutes). Thus most of the pairs find themselves in state A, which corresponds to proton polarization along the magnetic field, or 'positive' polarization.

By irradiating the system at the frequency corresponding to the energy A to D, it is easily seen that state B is populated and we have 'negative' polarization.

It is interesting to note here that Abragam and Jeffries have recently independently proposed a rival to the 'solid effect', the 'proton spin refrigerator'. Jeffries has obtained polarization of 10% using this method, in which a suitable crystal is merely rotated in a magnetic field, microwaves not being needed.

Our Target

In a practical polarized target the electron magnets are provided by adding a small number of paramagnetic ions (in the present target, 1% of neodymium) to a diamagnetic crystal (lanthanum magnesium nitrate, $La_2 Mg_3 (NO_3)_{12} \cdot 24 H_2O$ or 'LMN'). The protons to be polarized are the hydrogen nuclei in the water of crystallization. The details of the way the paramagnetic centres couple to adjacent protons, of how the polarization spreads to more distance nuclei, and of the different relaxation processes are quite complicated and will not be described here.

LMN seems to have an almost unique set of properties which makes it by far the most successful target material yet investigated. Unfortunately only about 3% of the nucleons in the crystal are 'free' protons (hydrogen nuclei) which can be polarized. The remaining nucleons, being bound in heavier nuclei, cannot be aligned, although they scatter the incident beam of high energy particles in much the same way as do the free protons. In many experiments special techniques can be used to distinguish 'bound' and 'free' scattering, but this is not always possible and a target containing more hydrogen would be most desirable. However, materials partially fulfilling the last requirement, for example irradiated polythene, have not so far given high polarizations.

Apart from the target crystal, a cube of side one inch, the 'Polarized Target' needs a magnet, a bath of liquid helium in which to immerse the crystal, a source of microwaves and a method of measuring the polarization. The field

Ralph Downton in the control area for the target.

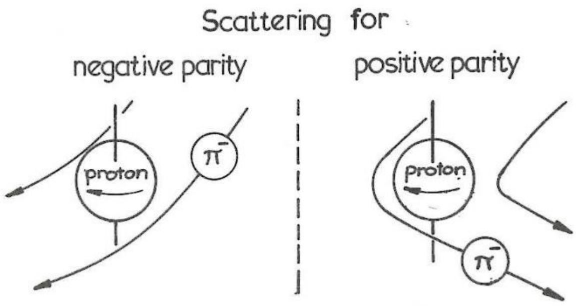
of the magnet must be very uniform over the volume of the crystal (better than $\pm$ 1 gauss) and should be very stable over long periods of time. The helium bath is connected to a large vacuum pump to reduce the pressure above its surface to about 0.6 mm Hg, the resulting evaporation causing the bath temperature to fall to 1.2°K. The crystal is continuously irradiated with about 1 watt of microwaves of frequency about 70,000 Mc/s (wavelength roughly 4 mm) from a carcinotron oscillator: this frequency must be very stable, for a change of only one part in 500 would completely reverse the polarization.

Measuring the polarization

Measurement of the polarization is by no means easy. One way, the nuclear magnetic resonance method, is to surround the crystal with an electrical circuit tuned to resonate at the frequency corresponding to the energy required to twist the protons against the magnetic field direction. When a minute amount of electric power of this frequency is applied to the circuit, some of it is absorbed in tuning through 180° a small fraction of the protons which are lying along the field. However, the applied radiation will also stimulate the same small fraction of those protons lying against the magnetic field to release energy. For positive polarization there is a net absorption of energy and by measuring this the polarization can be calculated. For negative polarization there is a net emission of energy, which can result in the system acting like a maser, amplifying or even oscillating, if the resistive losses in the tuned circuit are comparable with the energy released from the protons.

The polarization can also be measured by using the target in a nuclear physics experiment the results of which are known by other methods. This technique was used to calibrate our target in the π 1 experiment, for the beam line could easily be adjusted periodically to observe the scattering from the crystal of protons of 315 MeV and 725 MeV, energies at which accurate data is available from double scattering experiments at Berkeley. A preliminary analysis of these results indicates that during the experiment the target polarization was at least 50%.

Another method of calibration, used first on the Russian target at Dubna, is to place the target in an unpolarized beam of 'slow' neutrons, and to measure the resulting polarization of the transmitted neutrons by means



of a magnetised iron plate. This effect occurs due to the very large spin dependence of scattering of neutrons (of energy up to 10 keV or higher) from protons. The highly (at least 40%) polarized neutron beams which can be produced by this means should find a wide range of future applications in solid and liquid state physics, as well as in nuclear physics.

The π 1 experiment

In the π 1 experiment the polarized target has been used to study, amongst other things, the πp resonance at 900 MeV ($N^*_{1/2}(1688)$) and 1350 MeV ($N^*_{3/2}(1920)$). This experiment will be described in detail by John Thresher in the next issue of Orbit, but, in the meantime, a rough picture of the way the parity of these resonances can be determined is included here as an example of the use of the polarized target.

A π meson (pion) passing close to a proton tends, for a brief moment, to go into orbit round it. For a negative pion of energy about 900 MeV this effect is particularly strong, and the two particles are said to form a resonant state. A theory due to Hamilton and his co-workers says that the pion will try to go round the proton in a direction which is opposite to that in which the proton is spinning about about its own axis (in other words, one of the quantum numbers of the state, the parity, will be positive rather than negative). This results in the pion being scattered asymmetrically. The effect is illustrated in the figure, which also shows that the negative parity state would result in scattering in the other direction. Provided all the protons in the target are pointing in the same direction, the pion beam from Nimrod will be asymmetrically scattered as a whole, and thus the parity can be measured. It is clear that for an unpolarized target, the asymmetries from each individual scattering event would cancel out, and the essential information would be unobtainable.

Tailpiece

Polarized proton targets have opened the way to a whole range of new experiments, difficult or impossible by other methods, in which spin dependent effects can be measured. It is therefore not surprising that high energy physics laboratories throughout the world have shown so much interest in polarized targets. Apart from those already mentioned, targets have been built at CERN, the Argonne and at A.E.R.E. (for the cyclotron). Others are under construction in several places, including Brookhaven and Liverpool.
However, present targets have many disadvantages. The target crystals contain only 3% free protons, and the equipment needed to polarize them is complicated and expensive. New materials must be investigated and new methods discovered for the next generation of targets, which should make possible an even wider field of experiments.

Computers

Advisory Panel on Computers

The University Grants Committee under the Ministry of Education and Science has set up an advisory panel on computers. The panel will advise the Committee on proposals for providing computer facilities in institutions of higher education. Sir Willis Jackson is Chairman and Dr. Howlett, Director of the Atlas Computer Laboratory is a member of the Committee.

On-line Computer

A small computer (office desk size) known as the Programmed Data Processor (PDP5) is being used in experiments on accelerators at Berkeley. A fully equipped unit costs about $ 27,000 and five are now in operation.

The data collection system is adaptable for virtually all the particle detection systems (counters, spark chambers) other than bubble chambers. The computer replaces pulse height analysers, data combiners etc. to give a quick analysis of data as direct oscilloscope displays, in histogram or graph form, to the experimenter. It can also be used to modify the detection system directly. Detailed analysis is done later on a larger computer but the small on-line computers have greatly improved the speed and efficiency of data collection.

('The Magnet')

A PDP7 has been ordered for Oxford University for use at the electrostatic generator in Oxford. Manchester University are buying a PDP8 for use eventually on NINA. Southampton University are buying a PDP8 for use in a spark chamber videcon system on NIMROD and the Rutherford Laboratory has also ordered a PDP8.

Focus on Neutrinos

A conference on neutrino physics was held at CERN from 20-22 January. Scientists from CERN, Belgium, Germany, France, India, Italy, Britain, America and Russia took part.

The existence of the neutrino (symbol ν) was postulated in 1931 to explain the spectrum of electron energies observed in the beta decay of nuclei, but it's existence was not confirmed experimentally until an experiment in 1956 by Cowan and Reines in the U.S.A. which identified neutrino induced interactions by the neutrino flux from a reactor. Detection is difficult because the neutrino has no mass and no change and travels great distance through matter without interaction. In 1961, experiments on the 33 GeV proton synchrotron at Brookhaven, U.S.A. indicated that there are two types of neutrino (each with an associated antiparticle): one type is associated with the μ meson, the other type is associated with the electron.

Four types of force are known to operate in the universe - strong electromagnetic, weak and gravitational. The strong forces operate for example, to bind the nucleus together: electromagnetic forces operate between charged particles: weak forces are apparent in the "decay" of particles, and gravitational forces, for example, hold the earth in orbit around the sun. (The possibility of a fifth force has been suggested as an explanation of the apparent violation of charge - parity in the decay of K_2^0 into two π mesons. This is currently being studied on NIMROD, at Brookhaven and at CERN.) The weak interactions in which the neutrinos play a major role are 10^{25} times more powerful than gravitational interactions.

Neutrino experiments have been mounted on the Brookhaven and CERN accelerators. They have involved deploying massive resources: CERN has a large part of Switzerland's strategic reserve of steel serving to filter out all other particles from the accelerator allowing only the penetrating neutrinos through to the experimental equipment, Brookhaven has armour plating from an old battleship performing the same function. In addition to the identification of the two types of neutrino, these experiments have given some relevant information on a particle called the intermediate boson. This particle is predicted by a theory of weak interactions, as the intermediate or carrier particle of the weak force (just as the π meson is the carrier particle of the strong force in the nucleus or the "graviton" of the gravitational force). The intermediate boson is sometimes called the "vector boson" since it would have directional characteristics of a vector. The experiments indicate that if the boson exists, it is more massive than can be produced with the present accelerators. The lower limit set on its mass by the experiments is 4000 times the mass of the electron.

At present there is great interest in a new branch of neutrino research - "neutrino astronomy". Far greater fluxes of neutrinos than can be produced artificially by accelerators come from natural sources; for example, the sun is estimated to emit some 10^{37} neutrinos every second, and super-novae some 10^{50} every day. The study of the rate at which neutrinos arrive on the earth's surface and their geographical distribution is only just beginning, detection again being the great problem - almost all of those arriving at the earth's surface will pass straight through the earth.

This ability to penetrate matter is the reason for excitement about their possible use in obtaining some information relevant to astronomy. Only neutrinos can escape from the interiors of the stars and thus carry information about the interiors which is inaccessible by any other means at present. All conventional astronomy is based on observation of surface effects. With the sun, for example, light, radio waves and X-rays all originate near the surface; only neutrinos can hope to escape from the central regions.

Calculations indicate that the "neutrino sun" should look very small (about a hundred times smaller than the light emitting sun) and that the neutrino beam arriving on the earth carries about a fourteenth as much energy as sunlight. If, for example, the temperature of the neutrino sun can be measured it would be the first direct check on the fusion processes in the interior which are presumed to be the source of the sun's energy.

The experimental requirements for this work are on a science fiction scale. Scientists in Italy propose to set up a Laboratory in the Mount Blanc tunnel where 11,000 feet of rock will shield their neutrino detectors from other particles. British equipment (a team from Durham University have assembled a bank of neon tubes covering 20 square yards) is already installed 8,000 feet below ground in the fold mines at Kolar in India and scientists in the U.S.A. are thinking of using the deep ocean troughs to sink equipment thousands of feet down on the sea bed. Another experiment involves the construction, at a cost of over £200,000 of a tank of 100,000 gallons of perchlorethylene by a team from Brookhaven. Millions and millions of neutrinos will pass through this tank every day and it is estimated that maybe ten of them will be stopped by the chlorine atoms in the liquid each producing an atom of radioactive argon and an electron. After several weeks helium gas will be bubbled through the tank to collect the argon and the measured radioactivity will then be a measure of the neutrino interactions.

This elusive particle may be the source of very interesting information in the next few years.

Letters to the Editor

(Pseudonyms are accepted provided the author's name is known to the Editor.)

Sir,

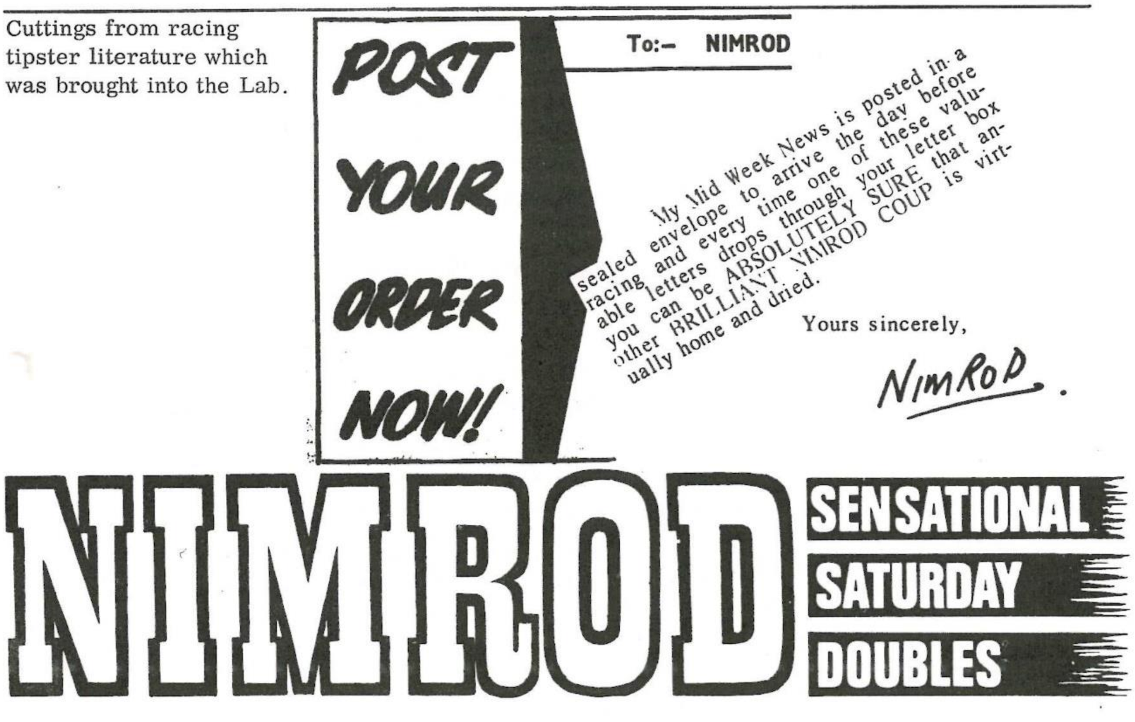
I recently sent out an order for 3 capacitors costing £270: for this the usual eight copies were produced on form NI 381. This number is presumably necessary so that all interested people have a copy. I have in fact received one back myself stamped "received by Estimates & Records section, 8th December, 1964". Since then I have received a further two originals and three further copies of the order transferred to form C.16. Assuming that each return came from a different source there would appear to be two more to come.

While I am extremely happy that my order is receiving such devoted attention I am nevertheless a little bewildered at what to do about each form when it arrives. The first was sent, I felt, by some thoughtful soul for my own information, but now I feel that there are six unknown gentlemen waiting for me to do something further. Perhaps each of the original eight people has sent all the others a copy to show how the order is progressing, in which case there are now 72 copies of my original order, 64 of them on form C.16.

Can it be possible even that each copy received, invokes a reply copy resulting in another 64 copies to give a grand total of 136, less the eight which in my ignorance, I have been unable to contribute ?

C.R.Walters

Cuttings from racing tipster literature which was brought into the Lab.



This copy of office rules issued by a Sydney firm in 1852 is published with acknowledgement to the South Australian Public Service Review

The Good Old Days

M....... & S.......

MERCHANTS AND SHIPS CHANDLERS

Sydney Town, 1852

Rules for the Clerical Staff

1. Godliness, Cleanliness and Punctuality are the necessities of a good business.

2. On the recommendation of the Governor of this Colony, this firm has reduced the hours of work, and the clerical staff will now only have to be present between the hours of 7 a.m. and 6 p.m. on weekdays. The Sabbath is for worship, but should any man-of-war or other vessel require victualling, the clerical staff will work on the Sabbath.

3. Daily prayers will be held each morning in the Main Office. The clerical staff will be present.

4. Clothing must be of a sober nature. The clerical staff will not disport themselves in raiment of bright colours, nor will they wear hose unless in good repair.

5. Overshoes and top-coats may not be worn in the office, but neck scarves and headwear may be worn in inclement weather.

6. A stove is provided for the benefit of the clerical staff. Coal and wood must be kept in the locker. It is recommended that each member of the clerical staff bring four pounds of coal each day during cold weather.

7. No member of the clerical staff may leave the room without permission from Mr. Ryder. The calls of nature are permitted, and the clerical staff may use the garden, below the second gate. This area must be kept in good order.

8. No talking is allowed during business hours.

9. The craving for tobacco, wines or spirits is a human weakness, and, as such, is forbidden to all members of the clerical staff.

10. Now that the hours of business have been drastically reduced, the partaking of food is allowed between 11.30 and noon, but work will not, on any account, cease.

11. Members of the clerical staff will provide their own pens. A new sharpener is available, on application to Mr. Ryder.

12. Mr. Ryder will nominate a senior clerk to be responsible for the cleanliness of the main office and the private office, and all boys and juniors will report to him 40 minutes before prayers, and will remain after closing hours for similar work. Brushes, brooms, scrubbers and soap are provided by the owners.

13. The new increased weekly wages are as hereunder detailed:

Junior boys (to 11 years)	1/4	Junior Clerks	8/7
Boys (to 14 years)	2/1	Clerks	10/9
Juniors	4/8	Senior Clerks (after 15 yrs. with the owners)	21/0

The owners hereby recognise the generosity of the new labour laws, but will expect a great rise in output of work to compensate for these near Utopian conditions.

The Union is my Shepherd, I shall not work,
It maketh me lie down on the job.
It leadeth me beside the still factories
It restoreth my insurance benefit.
Yeah tho' I walk thro' the valley of the
shadow of unemployment,
I will fear no recriminations,
For the Union is with me.
Its restrictive practices and shop stewards
comfort me.
It prepareth a Works Committee before me
In the presence of my Employers.
It anointeth my hands with pay rises,
My bank balance runneth over.
Surely never-never payments and union dues
Shall follow me all the days of my life and
I will dwell in a council house (no rent
increases)
For ever and ever.

Anon.

Natural Breaks

Outside the streaming windows of Building R 200, the wind blew in violent gusts carrying huge sheets of rain horizontally between the intervening buildings which stretched away towards the town of Chilton. Inside, the gentle warmth of the central heating was all the more welcome, and the quiet hum of the air-conditioning plant lulled the Suggestions Committee as they sat round a large table. The Chairman drowsily reminised on the latest proposal by a member of the staff.

"... Most of you will be too young to remember the days when the R. 200 site was a motley collection of low, flat roofed, huts naively termed contemporary. However, that's by the way. But you know, the whole site ran and operated through the medium of tea groups then. At first the normal tea breaks became extended for certain classes such as Physicists and Group Leaders to discuss problems of mutual interest. They grew into long lectures which were enhanced by an influx of lecturers not only from the U.K. but indeed from the other side of the world. So it gradually came about that the tea break with discussion became the discussion with tea break.

Obviously this move among the scientists could not be allowed to continue unchallenged, and the Engineers were the first to set up their own separate discussion groups. In the heated atmosphere of learned talk on the merits of diesel versus steam, or tea versus coffee, they soon captured a vital spirit in their meetings. Engineers have a reputation for pioneering, and once they had established their bridgehead others followed. Workshops discussed the rake angle of lathe tools. Administrators planned bigger and better forms and found exquisite delight in calculating the number of copies required. Even the stores people joined in by holding conventions on the maximum rate of change of catalogue numbers that could be achieved by using Atlas.

Anyway, one day this came abrubtly to an end when it was observed that the total Nimrod machine running time for one week was down to five minutes with experimental time of four minutes three seconds. All discussion groups were promptly relegated to evenings in the Lecture Theatre. This was unpopular, of course, but it was the death knell for the tea breaks during working hours. Over the past twenty years, the unions have worked steadily to give us the four-day sixteen hour week that we now enjoy. We should not forget that this has been largely due to the agreement to abolish tea breaks and thus still achieve the same work output.

And now, again, we have the proposal that tea breaks be re-instated to facilitate learned discussion and interchange of ideas. Gentlemen, I do not believe that we can face ..."

A quiet tap came on the door. It opened slowly and a head peered warily round the room before the door was pushed fully open and a tray was brought it, on which tea cups chinked, hidden under a white cloth. A contented smile settled on the Chairman's face. "Gentlemen, could we all sit under the table for the next ten minutes, please."

The Secretary reported that he had taken up the question of spaghetti with Mr. Greenwood who said that the type used to make spaghetti bolognese was in fact the long stranded variety. The spaghetti when served was chopped up because Mr. Greenwood had received repeated complaints that the length of the spaghetti was a source of embarrassment to some Restaurant users.

Restaurant Committee Minutes
10 December, 1964.

Correspondence has recently been received at the Laboratory addressed to "R. I. LINK ESQ." We have also had "The National Institute for Research in Unclear Science", and, from a Plastics Company, "Rubberford High Energy Laboratory".

Bernard Dolman writing in the January issue of "Office Methods and Machines" drew attention to the amount of time wasted by having all spelling mistakes retyped in business letters. He suggested that correction by hand is quite adequate.

According to "Anbar Abstracts" there is one U.S. firm that doesn't correct spelling mistakes at all. Instead they use a rubber stamp at the foot of the letter.

She can't type
but she's
BEAUTIFUL

Surveys conducted by the British Association of Industrial Editors have indicated quite clearly that the most widely read section of journals is that dealing with the 'Personnel News' type of material. For a long time we have wanted to increase the scope of this section, to find more news, and to make it rather more informal than it has been.

Harry Norris is now Editor of this section which has been renamed 'Orbiting Around'. We hope gradually to improve these pages. If you have any news or know of any news stories - if you have become engaged or been married; if your dog has won a prize; if you have climbed a mountain or won a billiards tournament; etc, etc, etc. ... - let us know.

Orbiting Around

Editor: H. F. Norris
Building R20, Ext. 484.

Comings and Goings

Dr L P Robertson joins P.L.A. Nuclear Physics; L L Coulter and I R L Tucker join P.L.A. Engineering; D A Sharples joins P.L.A. Accelerator Physics.

Miss D Pyrah and H Jones join General Administration; A D Rush joins Counter Group; C H G Smith joins Theoretical Studies; W G Glen joins Bubble Chamber Group.

J R Brampton, J Coupland, A E Grice, K J Haines, M J Hayes, V A Morris, and N R Goddard join Central Engineering.

C Greenhalgh joins Nimrod Machine Engineering; R W Wheatley joins Nimrod H.E.P. Engineering.

Miss M C Williams and M Atkinson join Central Engineering as College-based Dip. Tech. Students.

Miss C A Woods, Dr K Smith, R H Minter, D G Jones and G W Craig have left us.

Congratulations to

Brian Prior, Central Engineering, and his wife Norma, on the birth of a daughter, Lesley Denise, on 10 January.

Malcolm Arnold, Central Engineering, and his wife May, on the birth of a son, Graham, on 12 January.

Keith Robins, Variable Energy Cyclotron Group, and his wife June, on the birth of a son, Richard Duncan, on 12 January.

Ron Hopes, Central Engineering Group, and his wife Heather, on the birth of a daughter, Emma, on 27 January.

Pete Nicholls, L.A.O. in Building R2, and his wife Hester, on the birth of a son, David, on 2 February.

Tony Jeffries, General Administration, and his wife Bridget, on the birth of a son, Mark James, on 3 February.

Bart Fossey, Atlas Laboratory, and his wife Maureen, on the birth of a daughter, Agnes, on 3 February.

Sandray Hayes, Personnel Group, on her marriage to David Draper of A.E.R.E. on 6 February.

Celia Pitson, Theoretical Studies and Peter Beckett, Variable Energy Cyclotron Group, on their recent engagement.

Editorial Board

Mick Hecken from Electrical Services in R18 has succeeded Jim Kerr, now of H.E.P. Group, on the ORBIT Editorial Board.

Record Programmes

Programmes will be held every Tuesday in March at 12.30 p.m. in the Lecture Theatre.

2 Mar: Humph at the Conway

A recording made in 1954 of a live performance at the Conway Hall of Humphrey Littleton and his jazz band.

9 Mar: Brahms Symphony No.4

A performance by Bruno Walter and the Philharmonia Orchestra completes the series of Brahms Symphonies.

16 Mar: Light Music

Rossini	Thieving Magpie Overture
Sibelius	Karelia Suite
Britten	Young Persons Guide to the Orchestra.

23 Mar: Modern Jazz

A programme of music by the Modern Jazz Quartet and by Max Roach.

30 Mar: Music from Vienna

Mozart	Horn Concerto
Schubert	Lieder Recital (Fischer Dieskau accompanied by Gerald Moore)

For more details or possible changes in programme content see the 'Social News' section in the Rutherford Laboratory Bulletin for the week concerned.

The Plane Makers

211 (Newbury) Squadron, Air Training Corps have a complete and working Link Trainer and wish to contact anyone with experience of operation and maintenance of this machine who would be willing to give advice and/or assistance in getting it into perfect condition.

Due to the high cost of operating aircraft in the R.A.F., the cadets do not get much actual flying experience during the course of a year, and this machine is of great use to them. With the help of a knowledgeable person, the efficiency of the apparatus could be improved and wider use made of it.

If you can help, contact Brian Marsh, Building R.20, Ext. 365.

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