orbit

Christmas Issue
December 1964

Journal of the Rutherford High Energy Laboratory

Cover photograph:

The children's Christmas party
held in the Restaurant, 1963

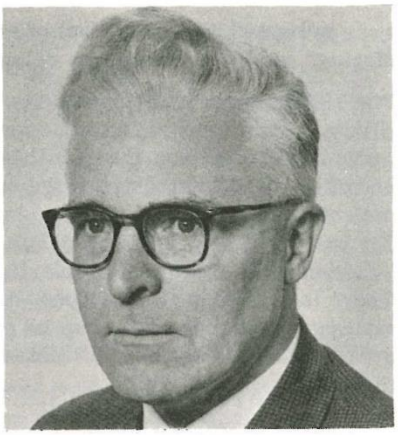
Editor: B Southworth, Room 40, Building R20,
Rutherford High Energy Laboratory,
Chilton, Didcot, Berkshire.
Phone: Abingdon 1900, Ext. 6286

Editorial

Christmas is the annual occasion for our round of "thank'you's" to those who help in the production and distribution of ORBIT.

First, to the Editorial Board for their criticisms and their ideas. To the contributors, who have given the Editor another year of excellent co-operation from almost everyone approached for information for ORBIT. (Special mention is due to Harold Wroe, a spontaneous contributor whose excellent articles have found their way into virtually every issue.) To Dave Baker, our resident cartoonist - the brilliant little crowd scenes Dave did for the Open Week in April were something in particular to remember. To the printers; both Technical Administration Ltd., from Reading who served us very well for 18 months and our new printers XPDO, Didcot who have already made quite an impact on the journal. And finally to the distribution network looked after inside the Laboratory by Frank Cullen and outside the Laboratory by Jae Fraser.

We wish all Laboratory personnel and their families an enjoyable Christmas and a happy and successful year in 1965.



From the Director

1964 has been a year of most important events in the life of the Laboratory. At the beginning, Nimrod was not yet in regular use for research. "Period 1" began in February, a little later than had been hoped, but when it ended 6 months later all the experimental teams had reached the stages in their work which they had planned at the outset. The achievement of this desirable result was helped by a higher average intensity and also by more beam-sharing, than had been assumed. As the original schedule was for "hours at 10^{11} protons per pulse", some groups were startled to find that they had been given more than 24 hours a day during their runs.

Shortly after the August shut-down, the planned intensity of 10^{12} protons was exceeded for the first time and it became possible to schedule Nimrod for regular operation at 10^{12} - the equivalent of "the ton" in the high energy accelerator business. With the start of "Period 2" several new experimental teams joined in the work, and experiments began to be more sophisticated. A good example of the growth of technology in high energy research was the successful commissioning of the polarized proton target. A demonstration of the fact that our physicists can approach the front of the field when given good equipment and adequate support is the speedy mounting of the "K_2^o" experiment.

The 1.5 metre British Hydrogen Bubble Chamber made its first runs at the CERN proton synchrotron, and produced a large number of good photographs. The 82 centimetre Saclay bubble chamber arrived in the Laboratory and has been assembled by our French colleagues. The British heavy liquid chamber is being assembled by the University College team.

The P.L.A., too, has distinguished itself during the year. For the first time, 5000 hours of actual research use was exceeded in the period between annual shutdowns. Nimrod has no monopoly of heavy equipment, as the "$N\frac{1}{2}$" P.L.A. magnet demonstrates. This mighty instrument was completed and commissioned during 1964.

There has been good progress on our extra-mural projects, the variable energy cyclotron and the electrostatic generator on which we are collaborating with the A.E.R.E. and Oxford University respectively. A great deal of equipment has been installed in the new A.E.R.E. cyclotron building and the new building of the Nuclear Physics Department in the Keble triangle.

The Atlas Computer Laboratory has started to function, and the first customers have gone away temporarily satisfied, to prepare fresh demands which will, no doubt, be bigger and more complicated.

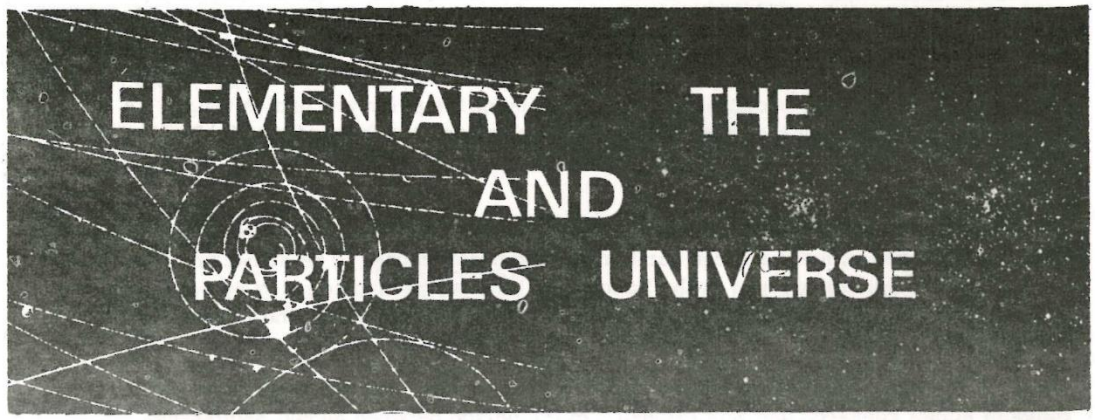
Of course the most dramatic event during the year was the formal opening of the Laboratory and the inauguration of Nimrod by Mr. Quintin Hogg, an event which was preceded (just in time) by the completion of our much-needed Lecture Theatre. Crises seem to be in all human activities, and the crisis for the Opening Ceremony was provided by a violent rainstorm which turned the floor of the marquee into a sea of mud. The effects

were mitigated by a great deal of hard work by many people, involving planks and trench-digging, and by an emergency shipment of bottled beer rushed in on the day.

For 1965, we can look forward to a broadening and intensification of the research at Nimrod, with experiments to be mounted on the French hydrogen chamber and the national heavy liquid chamber, the probable return of the British hydrogen chamber towards the end of the year and the use of the external proton beam. We shall be hosts for an international High Energy Conference in the Aix-Sienna series to be held in Oxford in September. The grip of the P.L.A. on medium-energy physics should be strengthened by the use of a much better polarized proton beam, and a greater use of the new magnet. There is a greal deal to be done, and we have the means of doing it. Already about 150 visiting research workers depend on our Laboratory for an important part of their research, and this number will probably grow to 200 or more during 1965.

1965 will see the demise of N.I.R.N.S., the organisation for which we have worked for over seven years, but we shall become a part of a new body devoted to scientific research in many fields. On all counts, then, there are good grounds for believing that 1965 will be another dynamic year.

I wish all my colleagues at the Laboratory and in the associated Universities and the Authority, and their families, a happy Christmas and a prosperous New Year.



ELEMENTARY PARTICLES AND THE UNIVERSE

E.R. Harrison

The universe consists mostly of hydrogen. Perhaps as much as 10% is helium and in addition there are relatively small amounts of heavier atoms. The essential "bricks" for building planets, stars, and galaxies are therefore mainly electrons and protons and a relatively few neutrons. To complete the picture, one must add photons, and throw in a few neutrinos and positrons because of radioactivity. With the aid of these few particles, science has succeded in producing order in an apparently chaotic universe. For example, it is possible to calculate quite accurately the rate at which nuclear energy is released in stars.

In the last twenty years we have seen the emergence of a new branch of science - high-energy particle physics. In this new field the physicist has shown that the number of "bricks", or elementary particles, is in fact very large, perhaps indefinitely large, and that all these particles interact with each other in amazing and complicated ways. In what way has this changed our picture of the universe ? The astonishing fact is that this entire new realm of knowledge, with its array of particles of different isospin multiplicities and strangeness, has made no impact whatever. Yet it is not an exaggeration to say that the high-energy particle physicist is sustained by a

deep-rooted belief that our knowledge of elementary particles will, in the future, unfold a more profound understanding of the universe.

In this short article I want to suggest that we are already at a stage where a beginning can be made in this direction. It should be stressed that many of the ideas are speculative and are still in an early state of development.

Exploding Galaxies

In the universe there are about 10 thousand million galaxies; each consists of between 1 and 100 thousand million stars. The galaxies, with their structure and clustering, are the most superb and mysterious objects of the heavens. As many as 1% of them contain events of great violence which last for about a million years. Each galaxy in the course of its lifetime has had perhaps as many as ten or more violent upheavals. These events are titanic explosions in the nuclei of galaxies, and the energy released (as great as the rest mass of a 100 million stars) is so prodigeous that often galaxies are disrupted into two or more systems which shoot apart at immense speeds.

Recently, as many as a dozen objects have been discovered, which are also the regions of great violence. They are compact massive star-like bodies, called quasars, which have burst forth in the sky in the last million years. To me, it seems highly likely that with these objects we are witnessing the explosive birth of new galactic systems, and that the birth and growth of a galaxy is a process of discontinuous or intermittent creation of matter. To understand this process we must use general relativity and particle physics.

The Origin of the Universe

The universe is expanding and all the galaxies are receding from each other. Some 10 thousand million years ago the universe was very small and everything was tightly packed together. Lemaître imagined that in the beginning the universe was a large "primordial atom" which exploded because of intense radioactive decay processes. Gamov later visualized that in the beginning the universe was even more compact and was in the form of a neutron fluid, called "ylem", having a radius of 100 light seconds. It is now known that the initial state was far more dense and was probably determined by what is called the "quantization of the metric". The density of this initial state was incredibly large. In fact, the universe had the radius of a single proton.

There is no doubt that the study of the universe in its early stages must shed considerable light on the nature and meaning of elementary particles. Perhaps a better name than Lemaitres primordial atom is 'primordial nucleon', or 'architron'. In the next few years, we shall no doubt unravel many of the properties of the architron.

The Creation of the Galaxies and Stars

The vast energy of the architron is contained in a small unbounded region of space because it is expanding rapidly. As it expands it seems quite likely that the binding energy changes abruptly, first when the density is equal to nuclear matter, and secondly when the density is equal to atomic matter. As a result, one finds that there are two stages at which matter tends to subdivide into discrete regions or units of mass. General relativity tells us that the maximum mass one of the regions or 'cells' can have is a stellar mass at the first stage, and a galactic mass (100-1000 million stars) at the second stage.

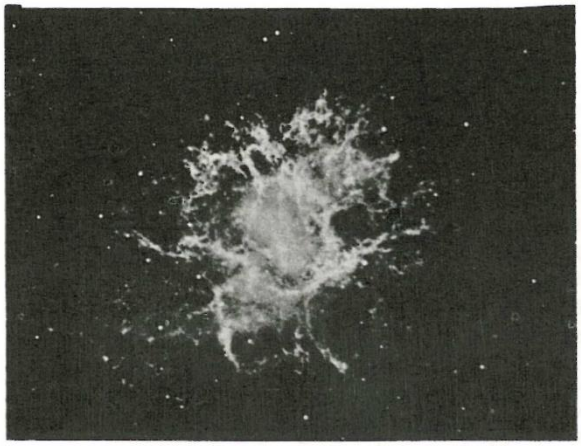
To an observer outside of a particular cell, the cell is unobservable owing to the extreme gravitational red-shift. Also, although the cells move away from each other as the universe expands, time inside a cell changes very slowly relative to an outside observer. The cells themselves are expanding, each at a slightly different rate, but because of the time effect the rate of expansion is very slow. As they expand, their time, if one can so put it, speeds up and the observer sees them at different epochs suddenly bursting forth in the sky. Obviously, the galaxy is the first to appear and is seen as a mass of hot gas. At subsequent periods the stars burst forth within the hot gas.

cont. overleaf

All things by immortal power,
Near or far,
Hiddenly,
To each other linked are,
That thou canst not stir a flower,
Without troubling a star.

Francis Thomson

"Oriental Ode"



Mt. Wilson and Palomar Observatories

XXIX—The Crab Nebula

The remnants of a cosmic explosion, equivalent in violence to the simultaneous explosion of about 1,000,000,000,000,000,000,000,000 hydrogen bombs. This cloud now has a diameter of some thirty million million miles.

This is an extremely brief outline of a process of discontinuous creation which can account in a satisfactory way for quasars, the violent events in the nuclei of galaxies, and other features that have not been mentioned. Unlike the continuous creation theory, it fits the facts, and also does not violate the conservation of energy principle.

The New Horizon in Physics

The searchings of the giant optical and radio telescopes and the probings of high-energy accelerators are uncovering strange new fields of phenomena. It is quite possible that the discoveries in both fields are closely related. My own view is that the conditions reigning during the early stages of our universe were intimately connected with the nature and meaning of elementary particles and were capable of predetermining the macroscopic features of the universe as we now see them.

THE Accelerator WORLD

News and views
from the world of
high energy physics,
accelerators,
and computers.

Oxford Project 'At Home'

The Laboratory Bulletin advertised the "At Home" for Saturday afternoon 31st October and since we had nothing better to do, I took the opportunity of showing the family (wife, and boys aged 9 and 14) some of the wonders of modern science.

We found the usual display of diagrams, photographs and explanatory data about the project (obviously left over from the Official Opening of the Rutherford Laboratory in April!). The boys soon tired of this "static display," they were much more fascinated by the electrostatic behaviour of the hair on the head of a doll mounted on a miniature Van der Graaff machine, when the high voltage terminal was repeatedly earthed and un-earthed (with accompanying inch long sparks) by a "do it yourself" lever.

At the lower end of the main vertical generator, everybody gazed with awe at the huge boiler like vessel and peered through port holes and into mirrors set at angles to display the internal workings to best advantage.

A narrow deserted stairway was found proceeding upwards (endlessly it seemed) into darkness, which obviously called for exploration to the boys. Floor after floor provided access platforms around the vertical "boiler" and eventually the summit was reached, in a surprisingly large room full of people. Guarded by a rope (was it ?)

fence we gazed down the deep well of the incompletely assembled machine, marvelling at the beautifully rounded shapes and polished surfaces of the electrodes.

It was now time to investigate the lift and, after intricate press button manoevres we reached the lower basement despite impatient ringing of the "call" button by other users. There were more displays, too numerous to investigate thoroughly, and also the horizontal tandem, smaller physically than the vertical injector. Unlike the vertical machine, this was exposed to view at one glance and, together with the horizontal beam bending magnet, was installed in a long broad, tunnel-like room with plenty of scope for future growth. Narrow passages led to an experimental area, notably both for the tidiness along the beam lines, and for an ingenious method of supporting connecting cables.

We had just time for a quick look at the control room - like all control rooms, but impressive to the uninitiated - which had the inevitable hidden closed circuit TV so that visitors could admire themselves on monitor screens. Walking up stairs on the way out we found a room whose centre was occupied by what, at first sight, appeared to be some kind of greenhouse but proved to be a rectangular, glass walled, gallery giving an unusual, overhead view of the control room - rather like the spectators gallery in a hospital operating theatre.

We left hurridly (to do some last minute shopping and return home in time for Dr. Who). In retrospect, the main impressions are of an attractive, well laid out building with a neatly designed and constructed machine.

One final word; when I pointed out the Professor of Nuclear Physics at Oxford amongst the crowd, my wife remarked that he didn't look like such an exalted person!

One of the Visitors

CDC 6600 at Berkeley

A new CDC6600 computer has been installed at the Lawrence Radiation Laboratory, Berkeley, U.S.A. The machine cost over $7 million and is the fastest and biggest computer yet constructed. It uses "time sharing" even in the actual arithmetic and logical portion of the computing process so that up to 10 programs can be progressing concurrently. A second CDC6600 is currently being prepared for CERN.

The world's fastest printing machine has been installed at the Laboratory to handle a significant portion of the computer output. 500 lines a second (60,000 characters) can be achieved.

The printer, built by Radiation Inc. at a cost of $350,000 is the first of its kind in the world. It uses an electrosensitive system in which specially sensitized paper is fed continuously under a closely spaced row of 600 styli in a fixed line about 10 inches long. To record a particular character, the appropriate styli are energised by current pulses and the resulting flow of electrons burns the character onto the paper, causing a rapid and permanent colour change in the chemical compounds on the paper.

(the magnet)

THE FUTURE EUROPEAN HARMONIC

Report of a working party appointed by the Arts Research Council

Introduction

Art today is on the threshold of far reaching discoveries which will come to fruition with a new theory of the nature of art and the fundamental processes of artistic expression. Before the advent of the Harmonic Pendulum, art was a haphazard, subjective and often highly emotional act on the part of the artist, but now we possess a powerful tool for the investigation of the very nature of Art itself.

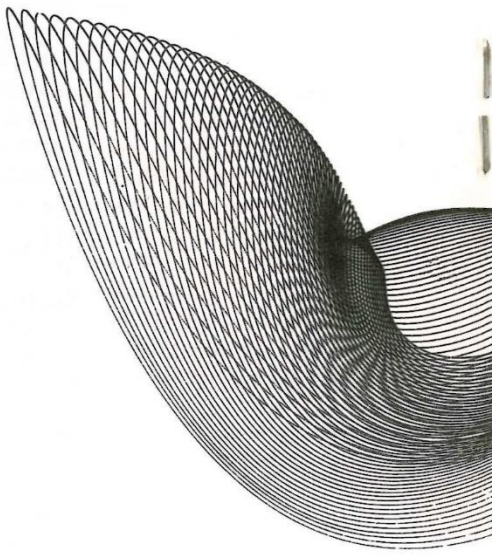
Harmonic patterns have recently revealed an astonishing and unexpected richness in the form of over 100 recognisably different patterns. We now know that the majority of these are variations, "excited states" as it were, of a few stable elementary patterns and to understand their properties we must soon go to still longer pendulums. Our present knowledge tells us that the increase in length, if it is to be significant, must be substantial. Progress is such that we shall need the new facilities in the early 1970's.

The future European programme

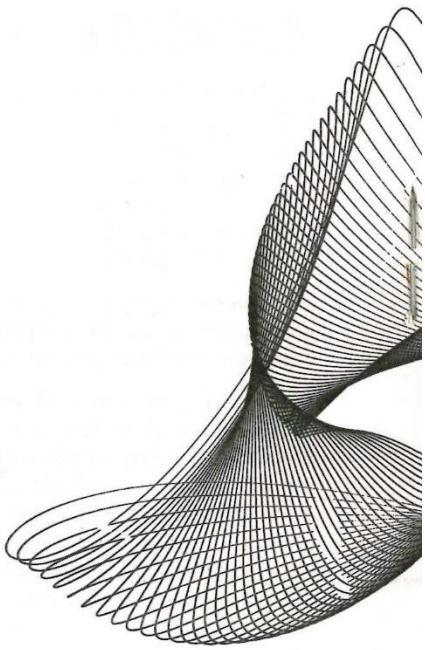
Each substantial increase in pendulum length in the past has been amply justified. Election to the Royal Academy has always been won by going to a longer pendulum.

There are two proposed advances. One is to have a substantial increase in length and precision while at the same time achieving greatly improved writing speeds, i.e. an increase in the intensity of the patterns is of vital importance. To minimise the frictional effects of the pen, the mass of the pendulum (i.e. its kinetic energy) must be very large. We are therefore proposing a precision, high intensity, high energy pendulum (HEP), 600 foot long, oscillating in a vacuum vessel 100 foot in diameter. All damping will be controlled by ten on-line computers.

The second requirement is to increase the pendulum length to the maximum possible extent without necessarily achieving a high intensity. To meet this urgent need we propose a 1400 foot pendulum suspended from the Eiffel Tower. Since the Tower itself is only 985 foot high this would require a hole 415 foot deep to be dug at its base, but the resulting facility would enable European

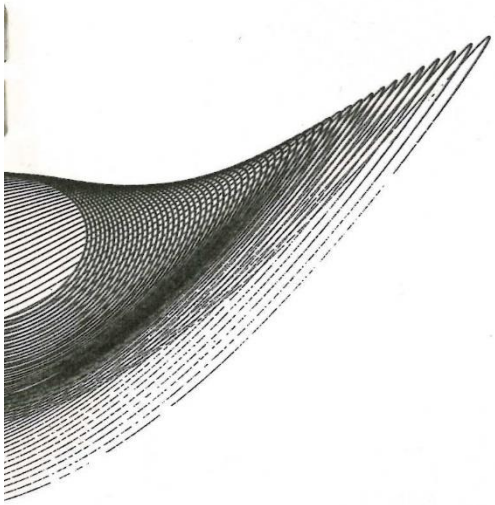


Two of the stable ele

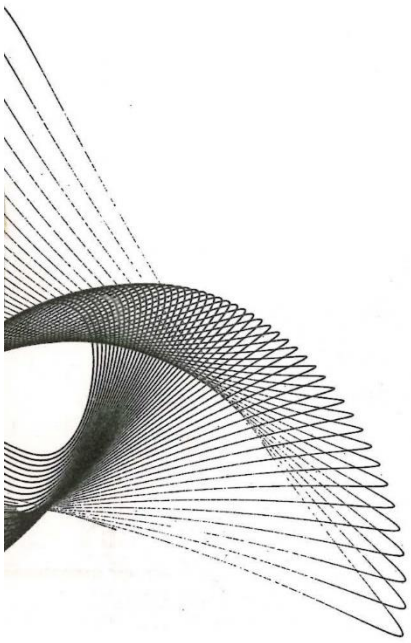


PENDULUM PROGRAMME

Bananatron



ementary patterns



Trianglatron

artists to compete on almost equal terms with the Americans. The American Congress has recently approved a project for a 1472 foot machine suspended from the Empire State Building. This device would provide information in the very long pendulum region where the most exciting developments are predicted.

The two proposals - the high intensity machine and the ultra long pendulum project - are not alternatives but two complementary aspects of the same programme of high energy pendulums, each in itself desirable.

Finance and Manpower

Experience indicates that only those countries with a massive home-based programe of HEP studies will derive maximum benefit from the large international projects like those discussed above. It takes many years before a young artist is fit to make use of these large complicated machines and merely to ensure their efficient use, we have to insist that the first consideration be the wholehearted support of university art departments and the national colleges of art.

The total cost of these activities has been doubling every six months so that by the early 1970's, we shall require £100 million per annum compared with the 19/6d per annum of the first pendulums.

We estimate that by 1970 there will be about 20 artists who will have to be accommodated elsewhere unless these new facilities are provided. Thus there is no difficulty in providing the necessary artistic manpower. However a team of about 5000 engineers and technicians will be required to construct and operate the machines and we are concerned about the shortage of outstanding engineers for pendulum design. The qualities required, a grasp of structural engineering, wide experience in vacuum technology and a strong head for heights, are rare in contemporary engineers. This appears to be connected with a deficiency in the basic training.

High Intensity Machine in Britain

It is very desirable that the 600 foot machine be built on British soil. There are several disused mine shafts of adequate depth which could be enlarged to accommodate the vacuum vessel and by reopening the railway lines we

could have the good accessibility, so valuable in large international projects. The presence of a large artistic community in our midst would be of enormous cultural value and the consumer spending of the staff, mostly foreign, would amount to a third of the U.K. contribution. A simple financial adjustment - for example a tripling of all salaries - could make the consumer spending equal the cost of the project.

Summary and Conclusions

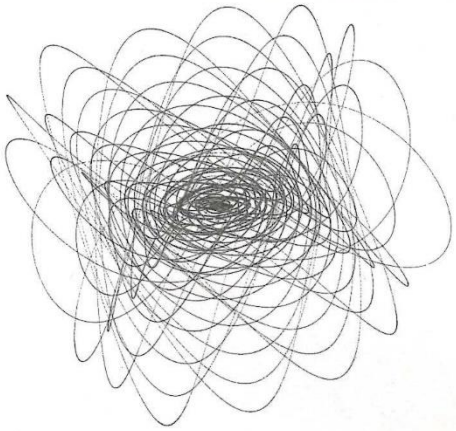
The present generation of pendulums has provided us with a tantalising picture of art. At the next stage of machine development, or the one after, we are likely to see all the art forms of past times unified by our knowledge of harmonic patterns. Quite apart from the exciting intellectual challenge of taking part in this great synthesis of artistic thought, the new picture of the nature of art is bound to have far-reaching effects on our whole way of life.

It seems inconceivable that a country which has been in the forefront of the world's artistic development for so long should not continue to take part in this most fundamental branch of the subject. Other European nations are determined to go forward. It would be a severe blow to the international development of art if we were not to remain with them and this country would certainly face a further increase in the art drain.

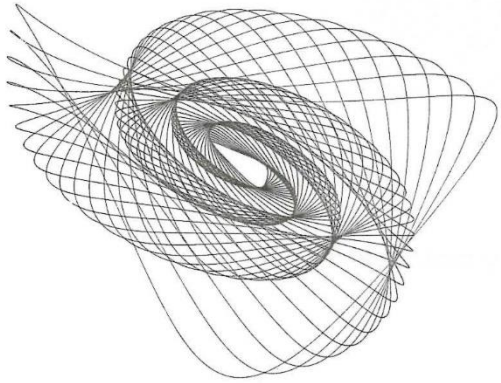
If the present programme is approved and the new 600 foot machine built in this country, it is likely that the requirements for HEP will be satisfied for a long time to come.

The artistic case for Europe continuing forcefully in this field is overwhelming; the equipment needed is technically feasible; the artistic manpower needed will be available; the money is trivial. Only conservatism or timidity will stop it.

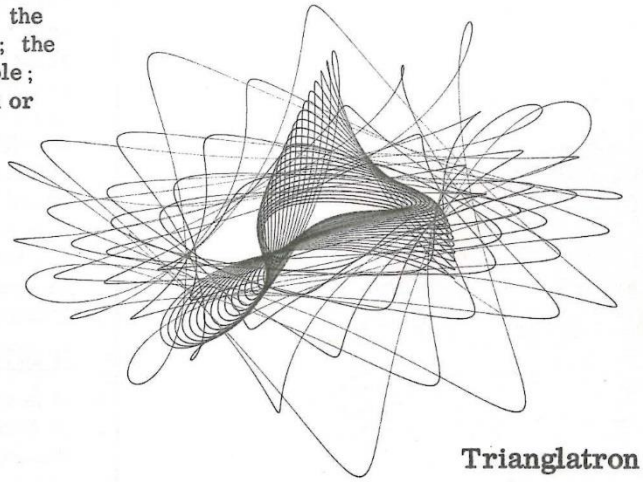
Light Hysterion



Two of the unstable excited states or berserkatrons



Heavy Depression Berserkatron



Trianglatron

The decay of an unstable berserkatron into a bananatron

from the PAPERS

What's in a non-name?

THERE'S exciting news from the Ministry of Technology. The DSIR has been split up into the IRDA and the SRC (which will look after the NIRNS, the SRMU, and the RRS). A new NERC has been formed, and the ACSP has been changed to the CSP. But what will happen to AEA and its relations with CEGB? Where will NPL go, and RAE? Will NRDC overlap with IRDA, and what is the future role of RRE?

Isn't it about time, in this white-hot technological revolution, that someone took the trouble to invent initials which can be remembered or understood? The CSP is nothing less than the Scientists' Cabinet. The SRC (Science Research Council) will spend about £20 million a year, and the IRDA (Industrial Research and Development Authority) will spend around £13 million a year.

Surely if we're expected to be interested in these things, we're entitled to memorable initials: Or could it be that we're not supposed to remember them? An excellent example has been set by the DTC, which changed its name to MOD: and by the international organisations, like GATT, UNO or NATO (even though the French insist on saying them backwards).

But what is one to make of an organisation which tries to attract public interest under names like NRDC or the ICFC (Industrial and Commercial Finance Corporation), whose only memorable version is Icky Ficky?

THE OBSERVER
NOVEMBER 22

Sir,—One of the most important effects of the Government's income tax proposals must surely be an immediate and considerable acceleration of the so-called "brain-drain".

A typical young scientist, for example, or manager or professional man with a wife and two children, who achieves a taxable earned income of only £4,000 will now have to pay in direct taxation £1,003, or more than one-quarter of what he receives.

THE TIMES
NOVEMBER 16

The Bishop of Pontefract, the Right Rev. Eric Treacy, has drawn up 10 Commandments for Business men.

1. Thou shalt not flap. (It produces nervousness and irritability in persons on a lower level.)

2. Thou shalt not put thy business before thy family. (Many business men find out too late that they have become strangers to their children. This is too high a price to pay for commercial success.)

3. Thou shalt learn the art of delegation. (Divided responsibility assures the future success of the organisation.)

4. Thou shalt encourage criticism. (To live without criticism is to develop the dangerous disease of infallibility.)

5. Thou shalt neither eat nor drink too much, but shalt seek temperance in all things.

6. Thou shalt be without prejudices. (Do not dismiss new ideas because they come from a source you do not like. Example: prejudice against some Japanese products because it comes from "those beastly Asiatics".)

7. Thou shalt be forward looking. (Businesses have been ruined because their directors failed to read the signs of the times.)

8. Thou shalt not covet thy neighbour's house, car, wife, secretary, work's manager, or anything that is his. (There is a jealous aspect to covetousness which often produces bitter inactivity.)

9. Thou shalt not burn the candle at both ends. (Some businessmen boast of working 14 hours a day. Taking work home is a dangerous habit, showing lack of discipline.)

10. Thou shalt not let another take thy place in staff relations. (With so many personnel management specialists coming into businesses, some men at the top contract out from the important master-man relationship.)

THE GUARDIAN
November 30

Getting into ORBIT for the Christmas Holidays

ORBIT is a magazine for children which has been published by the BBC to accompany a series of programmes of the same title to be broadcast three times a week in the Home Service during the Christmas Holidays. There will be only one issue of the magazine and it contains such things as photographs of the places visited by reporters during the programmes, drawings of birds, animals, and plants, diagrams and instructions for things to make. All these will be necessary for reference during the programmes, which are designed to appeal especially to nine- and ten-year-olds. The whole venture, which is being prepared by the BBC School Broadcasting Department, has one simple aim: to show children how to get more fun from their holidays.

Copies of ORBIT magazine may be obtained by sending a crossed postal order for 1s. 6d. to BBC Publications, P.O. Box 123, London, W.1, or by ordering through your bookseller or newsagent.

New Uses for Laboratory Paperwork

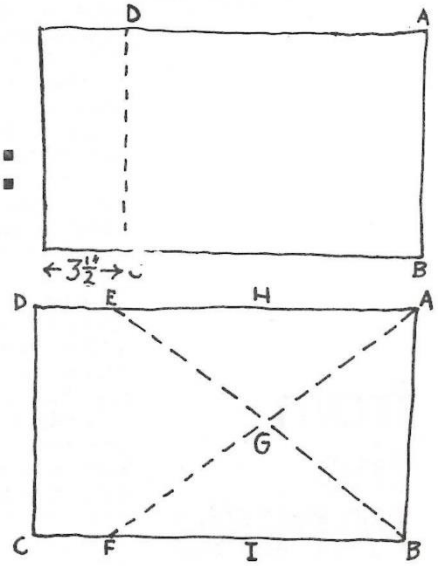
A Paper Aeroplane:

The most important point about this aeroplane is to choose the right sort of paper in the first place. If it is too thin the model is floppy and folds up when you launch it, if it is thick you get the wing loading too high. For the best results with foolscap size, a thickness between four and five thou. should be chosen in good quality paper - it should be nice and crisp when you start.

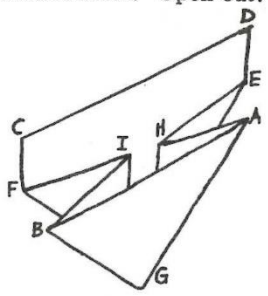
Good class typing paper is the best, but Banda and Zerox paper are good. The I.P.C.S. literature is inferior and should be avoided. Rutherford Laboratory Bulletins and I.G.N.s are excellent. (Thinks: "Good ploy that"). Some of the best models of all seem to appear when the IGN deals with a particularly weighty matter like "Form of the Institute's contract of employment in relation to the particulars specified in the Contracts of Employment Act, 1963 - Non Industrial Staff" - perhaps the ink gives an optimum distribution. ORBIT unfortunately is the wrong size, otherwise this would be a very elegant way of guiding it into the wastepaper basket.

The best way to launch the model is to hold it upside down and throw with an under arm action, when it will climb vertically and roll out at the top. If you throw the model in a straightforward manner you just get a loop followed by a severe stall.

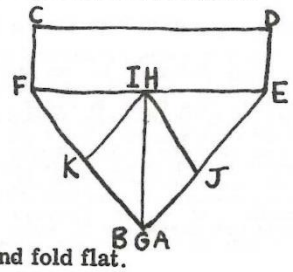
A good game for the children is to try to catch the model before it touches the ground. This is splendid exercise and makes for quick reflexes. (Thinks: "And tires the little devils out nicely.")



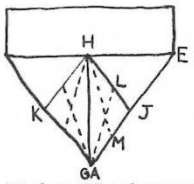
1. Cut about 3½ inches off one end of a piece of foolscap size paper.
   Take the larger piece, ABCD, and lay AB along AD and crease hard. Open out, lay AB along BC and crease hard. Open out.



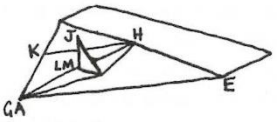
2. Pinch together centre points of AE and BF and fold flat.



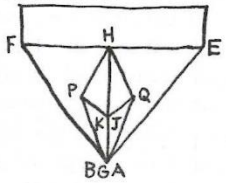
3. Lay AH along HG and fold flat.
   Lay BI along IG and fold flat.



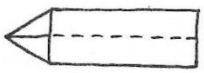
4. Lay HJ along HG and crease. Open out.
   Lay JA along HG and crease. Open out.
   Lay IK along HG and crease. Open out.
   Lay KB along HG and crease. Open out.



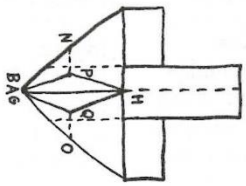
5. Pinch together L and M.
   Repeat for other side.



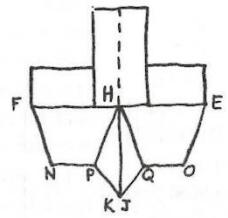
6. Fold points J and K flat towards G.



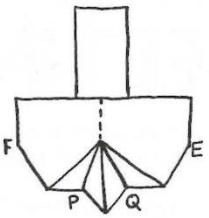
7. Take small $3\frac{1}{2}$ inches wide piece, crease down centre and fold ends to a point.



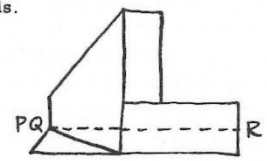
8. Insert into wings.



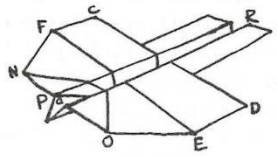
9. Fold along NO, taking G underneath towards H.



10. From the other side it should look like this.

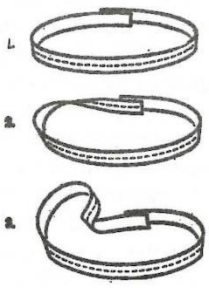


11. Fold along centre bringing F and E together.



12. Fold back each side along PR and QR to complete.

SIDES AND EDGES



This simple but intriguing problem is reproduced with acknowledgement to Fibreglass Ltd., who published it in their advertisement series "Test your own IQ".

Take a long strip of paper and paste the ends together. You will have an ordinary ring with two sides and two edges, like the strip itself. If, before pasting the ends together, you give the strip a 180° twist you have the ring shown in Figure 2. How many sides and edges has it ? If you give the strip a 360° twist you get Figure 3. How many sides and edges now ? Finally, if you cut each of these rings in two down the middle of the strip (along the dotted line) what happens to them ?

* * * * *

Ring 2 with the 180° twist (it is called a Møbius strip) has only one side and one edge (you can check this by running your finger round it : you always come back to the same place). Ring 3 with the 360° twist has two sides and two edges.

When you cut ring 1 down the middle you obviously get two rings, but when you do the same to ring 2 you get a single loop with two sides and two edges twisted like ring 3. When you cut ring 3 you get two linked rings, both with a 360° twist.

STAFF MEETING

On 25 November a meeting of senior staff was held in the Lecture Theatre.

After presenting the John Wilkins Prizes, Dr. Pickavance referred to the recommendations of the Trend Report which are now being implemented by the Government. The Director didn't feel he could comment fully at the time because things were still in a state of flux, but he did promise another meeting when the situation clarified. However it seemed clear that NIRNS, like DSIR, would be dissolved and that our activities would be taken over by a Nuclear Physics Division of the Science Research Council, under the Ministry of Science and Education. This arrangement would cover the work of the Rutherford and Daresbury Laboratories and the contribution in nuclear physics to the Universities and CERN.

Some interesting financial statistics were presented, briefly as follows:

Total Rutherford Laboratory budget for 1964/65 - £6m.
Cost of electricity - £0.4m; Standing charges - £0.8m; Salaries and wages - £1.5m: R and D budget - £1.8m; Capital equipment - £0.8m; Buildings - £0.3m; University agreements and research reactor work - £0.4m.

Total expenditure on Nimrod - £5m; Total expenditure on the P.L.A. - £0.4m.

In the year ahead, the annual budget would probably be slightly larger with rather less expenditure on capital equipment. As regards future work, there would be increased attention given to data handling and the whole problem of rapid assessment and processing of experimental results. Also some thought is being given, "quietly", to the problem of increasing the beam intensity from Nimrod. It was pointed out that the intensity had been increased by two orders of magnitude since Nimrod first operated, but the Director considered that a further increase of two orders of magnitude might take a little longer. (A target of 5×10^{13} has been mentioned elsewhere.) In general, Dr. Pickavance felt that the achievements of the Laboratory since the last Staff Meeting had been substantial and reflected credit on all concerned.

Dr. Stafford spoke on the High Energy Physics work, directing his remarks to those not directly involved in it, since he considered the audience "a very mixed bag". He pointed out the difficulty of communicating the excitement and interest of HEP and felt that he had to say something about the justification of spending large sums of money on the subject, since it had "had a bad press recently". As a concise definition of the aims of high energy physics, Professor Weisskopf was quoted and then Dr. Stafford affirmed that in his own mind there was no doubt whatsoever that large scale support of the subject was completely justified "as an advanced cultural activity", and he described it as a "beautiful intellectual exercise". The situation was comparable to the support of the arts by wealthy patrons in the middle ages - "our patron is the government".

The progress of the HEP research on Nimrod during the past year had been very satisfactory. Eight experiments were mounted and three completed; about 110 physicists and 9 university departments being involved. That experimental time on Nimrod is now at a premium is shown by the "amount of heat generated at scheduling meetings." Two experiments were singled out for particular mention, the Z^+ and the K^o_2. In the former, the Z^+ particle was not in fact observed and the experiment did not hit the headlines, but the fact that it was mounted in a few weeks and that 72 hours of beam time were devoted to it, demonstrated the enthusiasm and flexibility of our organisation. Similarly, our response to the exciting and important K^o_2

experiment had been as quick as that of any Laboratory in the world. In reply to a later question from the audience, the senior staff considered that all this was not the same as "jumping on the latest band waggon". Dr. Stafford issued an invitation to anybody who felt remote from the HEP work to join an experimental team for a shift and "press buttons."

Finally, Dr. Hanna spoke about activities on the proton linear accelerator, referring people to the October Orbit for an up to date account. A major achievement of the PLA had been the recording of over 5000 hours of operating time between shutdowns. The operations group were now keen to get the "time for which the physicists agree that the machine is just as they want it" to over 90% of the scheduled time. One of the most important developments on the machine itself was the new polarised proton source which, it was hoped, would have double the polarisation and ten times the intensity of the old one. Eight teams of physicists had been preparing experiments during the recent shutdown. Some thought was also being given to the possibility of accelerating particles other than protons (such as deuterons and helium nuclei) and if this came about it should really be accompanied by a change of name for the Proton Linear Accelerator Division.

MADE IN BIRMINGHAM ?

Admirable Plastic Decoration Lamps Set

The following instructions were included in a box of Christmas tree lights recently acquired by a member of the Laboratory staff:

'This set is technically designed for attraction, duration and completely insulated to ensure safety. It is an item of economy and facility for use on lighting trees, walls, windows, in showcases and rooms.

DIRECTIONS

1 To prevent the set not lighting up, make sure that all bulbs are screwed firmly into sockets.

2 Besides the SAFETY BULB placed firstly next to the adaptor or plug, the rest bulbs have PERMANENT CONTACT to enable the set to remain light when one or more bulbs burnt off.

3 Replace any bulb which does not light with the 4 freely supplied spares immediately.

4 If 1/3 bulbs of the set were burnt, it means that the set having been in maximum operated for 1,500 hours and reached the faded position, then more replacement bulbs should get from your dealers for them, otherwise stop to use, to avoid the remaining bulbs become overloading.

PERSONNEL NEWS

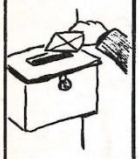
Comings and Goings

P E Griffiths, J W Hainen, A Heath, W G Black, G W Craig, L Foreman, J Gilbert, A R Hunt and D P J Flint join Nimrod Machine Engineering.

J S Long, R W Hatley, P N Lewis, A P Nicholl, N L Martindale, M J Rose, K Wilkes, L E Willson H W Harvey and R F Mackey join Central Engineering.

Miss J Gladwin, Mrs. R A Joseland and Miss M R Williams join Secretarial and Typing: F F Allen joins General Administration.

R L Roberts joins the Bubble Chamber team at CERN: G A Tuck joins Bubble Chamber and Emulsion Group.



Dr. A Deloff joins Theoretical Studies: M R Claringbold joins Atlas Operations.

Mrs. L M Armitage joins Finance and Accounts: I Wadman joins Nimrod Beams Group.

D E Boulter joins PLA Engineering: P B Smout joins HEP Engineering; W J Phillips joins Bubble Chamber Group.

* * *

D A Harrigan, G T J Arnison, Mrs. S M Timmis, C W G Shears, Mrs. J H Francis have left us.

M C Morris and B Reed have transferred to the Daresbury Nuclear Physics Laboratory.

Suggestion Awards

At the twenty-second meeting of the Rutherford Laboratory Suggestion Awards Committee held on 25th November, the following awards were made:

£1 10s. 0d to J Fraser whose proposal to fit two Terry clips to the Vent system operating panel to hold the "Duning Dewar" when it is not in use, is being adopted.

£1 10s. 0d to E G Starr whose suggestion drew attention to a minor defect in the construction of the Main Entrance of R2. This is being rectified.

B Briscoe, Secretary.

Record Programmes

RECORD PROGRAMMES

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

5 Jan: Brahms — Symphony No.3

12 Jan: Light Music

Walton	Portsmouth Point
Sullivan	Music from "The Gondoliers"
Offenbach	Gâîté Parisienne

19 Jan: Duke Ellington

Records covering 30 years of the Duke's work

26 Jan: Opera

Wagner — Rienzi Overture

Arias sung by Beniamino Gigli

Verdi — Grand March from Aida

Printed by XPDO Ltd., Bourne St., Didcot. Tel. 3125