

19 December 1977 - 16 January 1978

Director's Christmas Message

I am writing this Christmas message 30,000 feet above France on my way back home after attending my final meeting on the CERN Council as the UK delegate. Our new Chairman Professor Geoffrey Allen now takes on that responsibility as I take on the job of Chairman of the Scientific Policy Committee. Our involvement with CERN illustrates the important role that high energy physics will continue to play in the work of the Laboratory even though Nimrod will be closing down for good in June next year.

This has indeed been a very good year for the Laboratory. The tricky job of moving our main computer over to the Atlas building and doubling its capacity was accomplished with far less difficulty than might have been expected. The Central Laser Facility has come into operation and when it was officially inaugurated at a small ceremony in June, the Secretary of State for Education and Science, Mrs Shirley Williams was able to arrange for the approval of the Spallation Neutron Source to be announced.

Finally, approval has just been obtained for the installation of a National Electron Beam Lithographic Facility which will be housed in the computer area vacated by the IBM 360/195.

The Laboratory's fortunes have therefore made a dramatic turn-around this year and we are obviously going to be very busy in the year ahead. It is therefore a particularly appropriate moment to thank everybody for their efforts in 1977. Have a good holiday with your families and return refreshed to tackle the exciting challenges which will confront us in 1978.

INTERNAL EVENTS

THEORETICAL PHYSICS MEETING

Lecture Theatre

Wednesday 4 January 1400
1600

Thursday 5 January 0945
1145
1415
1605

Friday 6 January 0945
1145
1415

The programme is as follows:-

Semi-classical Gauge Theories
Flavour Interactions of Leptons and Quarks

E Corrigan
H Fritzsch

Lepton-hadron Experiments
Asymptotic Freedom and Scale Breaking
Status of Gribov Reggeon Calculus
Recent Developments in Quantum Gravity

T W Quirk
G Parisi
A Schwimmer
G Gibbons

$e^+ - e^-$ Experiments
New-onia
Exotic Hadrons and New Particles

B K Gunderson
J Ellis
H J Lipkin

NIMROD LECTURE SERIES

Monday 9 January
1130
Lecture Theatre

An Experimental Test of Exchange Degeneracy in Hypercharge Exchange Reactions

C Damerell/RL

HEP SEMINAR

Wednesday 11 January
1100
R61 Conference Room

Analysis of Weak Structure Functions in CERN Bubble Chamber Neutrino Experiments

P B Renton/Oxford

NIMROD LECTURE SERIES

Monday 16 January
1130
Lecture Theatre

Predictions from Quantum-chromodynamics for large P_T Production in Strong, Weak and Electromagnetic Processes

C H Llewellyn-Smith/Oxford

SHORT COURSES AT READING COLLEGE OF TECHNOLOGY

An Introduction to Micro-Processors
Introduction to Micro-Processors, Practical Course,
Intermediate Electronics for Mechanical Engineers.
Applications of ICs, Laboratory Course
Laboratory Course in Electronics for Mechanical Engineers.
Opto-electronic Devices
Principles and Applications of Semi-conductor Triggering Devices
Colour Television Practical Course

12 meetings commencing 9 January
6 meetings commencing 31 January
8 meetings commencing 25 January
8 meetings commencing 26 January
8 meetings commencing 23 January
4 meetings commencing 25 January
8 meetings commencing 25 January
8 meetings commencing 24 January

All courses are held at 1900-2115 hours. Further information from Training Section, Building R20, Ext 6186/266.

OVERSEAS VISITS

Dr G E Kalmus and Dr M G Albrow, to
Spatind, Norway, 6-14 Jan to attend
Nordic Meeting on Elementary Particle Physics.
Mr M J Hotchkiss, to CERN, 9-25 Jan, to work on WA3
experiment.
Mr C D Osland, to Amsterdam, 15-21 Jan, to participate
in SHARE European Association Winter Projects Meeting.
Dr R J N Phillips, to the USA, 18 Jan-3 Feb, to
collaborate with Physics Dept members at the University
of Wisconsin.

FAIRCHILD SEMINAR A Fairchild Memory and Mini-processor Applications Seminar will be held at the Bloomsbury Centre Hotel, London on 6-7 February 1977. This is Fairchild's first major seminar in the UK and they are bringing in several experts from the USA. Further information from Training Section, Building R20, Ext 6185/266.

SALES TO EMPLOYEES Sales of scrap metal/plastics as set out in RLN 12/75 will be made on 6 and 20 January 1978.

POPPY APPEAL 1977 A letter from Hilda Salmon, Welfare Section AERE asks that her sincere thanks be conveyed to those who contributed so generously and to the collectors who did such a marvellous job. The total amount collected from the RL (including R27) came to £63.79.

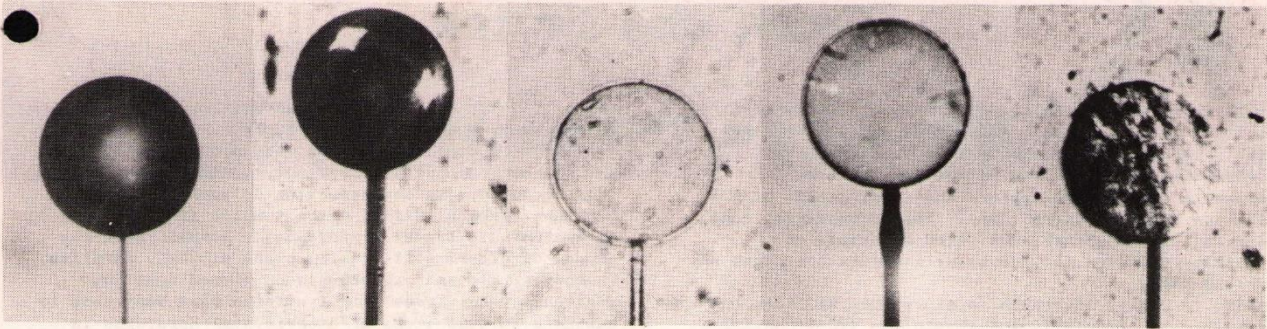
IPCS

GENERAL MEETING - 1 PM - WEDNESDAY 11 JANUARY

LECTURE THEATRE

M S Ridout will speak about PAY 1978!

Balloons & Lollipops



A selection of balloons and a lollipop - can you pick out the lollipop?

Titles can be misleading, but they do attract attention! Scientific tests have shown that once the reader's eye has been caught, he will often continue through an article even though he is not the least bit interested. However, the present subject is so fascinating that you will probably find yourself compelled to read on for we are to discuss balloons and lollipops smaller than the "dot" at the end of this sentence.

We are of course referring to the tiny targets used in experiments at the Laboratory's Central Laser Facility. The laser beam is focussed down to below 0.1 mm (100 micron) diameter - which is finer than the thickness of a human hair - and the intense laser power directed onto a small flat disc-shaped foil (affectionately known as a "lollipop") or onto a minute hollow spherical target (or "balloon").

How to make Lollipops

The recipe for making good lollipops has been handed down from one expert to another. The favourite method at Rutherford is to cut a tiny disc shape (about 100 micron diameter) from a thin sheet (only a few microns thick) of aluminium or plastic and glue it onto a stick made from a 5 micron-thick carbon fibre.

...and Balloons...

Believe it or not, the balloons are glass-walled spheres of about 100 micron diameter, filled with different gas mixtures. The empty shells for making the balloons are available commercially in the resin industry. A compound is mixed with glass and heated, producing a powder (feeling rather like talcum) consisting of hollow glass spheres of various sizes and non-uniform shapes. You can buy about 1,000,000,000 of these shells for one penny, but the problem is to select only round spheres of a given size and uniform wall thickness.

BALLOON SIZE - chosen using an ultrasonic sieving process, which sends the spheres upwards through alcohol (what a way to go!), selecting the diameter to an accuracy of about ± 5 micron.

ROUNDNESS - tested by crushing the spheres under a hydraulic pressure of about 300 atmospheres. Deformed balloons collapse, perforated balloons fill with water - and so the debris can be separated from the round spheres by flotation methods.

WALL THICKNESS - selected by making an accurate density determination by flotation in high-pressure freon.

FILLING THE BALLOONS - done by heating them to about 500°C in the required gas mixture at a pressure up to 200 atmospheres. The gas mixture diffuses through the thin glass walls and enters the spheres. As the balloons are cooled to room temperature, the gas mixture remains trapped inside.

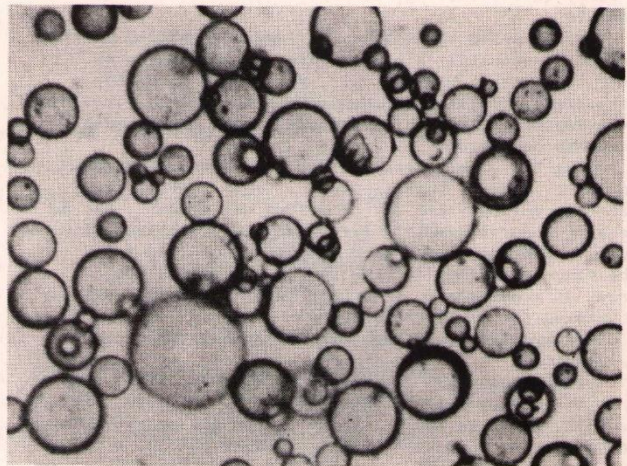
FINAL SELECTION - made using a microscope to choose the exact size of sphere, and picking a given uniform wall thickness by observing fringe patterns in an interferometer.

To put the balloon on a stick, the sphere is glued to a thin carbon fibre with rapid-setting epoxy. If required, an outer layer of aluminium is deposited onto the surface of the balloon.

The Laser Lab Scientists require about 30-40 balloons (or lollipops) in a typical week. To produce one balloon, one has to reject about one million by the above selection procedure. Each balloon is accurately positioned in the main target vessel where, after irradiation by the intense

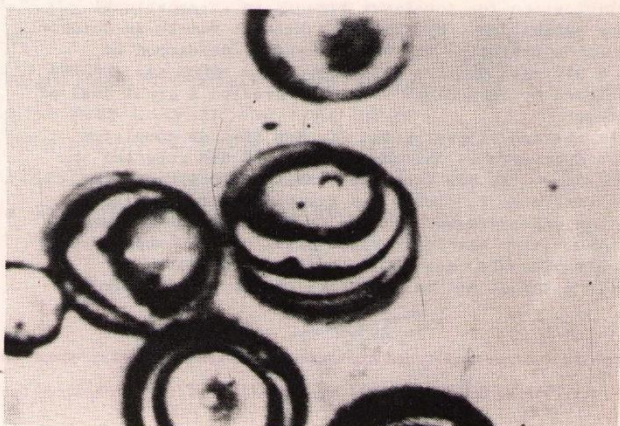
laser light, it forms a hot plasma and vaporises into the vacuum environment. Contrary to the normal reaction when a balloon has burst, the scientists are overjoyed with the success of the laser experiments using these targets.

We hope that this story has relieved some of your deep-seated worries about how to make miniature lollipops and balloons, especially over the Xmas holidays, and we thank Phil Rumsby for an interesting tour of the target fabrication laboratory and for the photographs.



Above: Hollow glass balloons in their raw form.

Below: Viewing interference patterns to select uniform spheres with a given wall thickness.



Answer: In the photo at top of page we show (from left to right) two balloons coated with a thin layer of aluminium, two uncoated hollow glass balloons, and one aluminium lollipop.

From the Editor

If 1976 was a year of change with diversification well under way, 1977 has been a year of consolidation and indeed a widening of the Laboratory's commitments.

Undoubtedly the big news of the year was the Governments' decision to approve the construction of the Spallation Neutron Source (SNS). The announcement came at the end of the speech, delivered on behalf of Mrs Shirley Williams, at the Laser Inauguration Lunch on Monday 20 June.

Owing to urgent Government business Mrs Williams had been unable to officially inaugurate the SRC's Central Laser Facility; in her absence, Sir Sam Edwards, then nearing the end of his term of office as Chairman of the SRC did the honours in a simple ceremony in the Laser Control Room.

Two months earlier the Laser Division had announced laser compression with the first shot of the two beam laser and the RL had become the first Western European Laboratory where such observations had been made. The most recent event which hit the headlines was the detection of 14 MeV neutrons produced by the implosion of micro-balloons filled with a deuterium-tritium gas mixture and in this last edition of the Bulletin for 1977 we carry an interesting, if light-hearted look at 'targets'.

Before leaving the subject of lasers we should mention the very successful 'Eleventh European Conference on Laser Interaction with Matter', run by the RL at the Mathematical Institute and Keble College, Oxford, 19-23 September 1977 which attracted some 170 delegates from many countries.

During the summer break in the High Energy Physics programme, Nimrod, then in its last full year of life, learnt an entirely new set of tricks and probably became for a few hours, Europe's first spallation neutron source. Running at a proton energy of 0.7 to 0.9 GeV (the range specified for the SNS), it was used for a series of experiments, producing data, valuable in optimising the final SNS design.

Computers and computing were in the news on a number of occasions.

Early February saw the move of the IBM 360/195 from R1 to its new home in the Atlas building (R27) to join its twin, known as 195/2. Later in the Spring, two mini-computers were installed in R27, a PRIME 400 and a GEC 4070, for software development and evaluation. The whole computer set-up has become so large and complex that maybe the Bulletin coverage has been inadequate. However one of the many developments in this field published recently was a report from Kate Crennell on the first book to be produced (probably in the world) using the FR80, a microfilm recorder containing a small computer.

Another significant event this autumn was the RL's participation for the first time in an international trade exhibition - SYSTEMS '77, held at Munich in October. The Lab's exhibit - the ASPECT system, developed by C & A Division and the design programs, GFUN and THESEUS developed by Technology Division, created a great deal of interest.

At the end of September, Sir Sam Edwards completed his 4 year term as Chairman of the SRC and returned to Cambridge. The new Chairman, Professor Geoffrey Allen, took office on 1 October and six weeks later visited the Lab and addressed members of staff in the Lecture Theatre, later touring various parts of the Laboratory.

This year also saw the departure of a number of people although not on the scale of the previous year,

the most notable being the retirement of the Chief Engineer, Mr P J Bowles and Professor W D Allen.

So far no mention has been made about High Energy Physics and although we have not carried a lot of news, this is not due to any reduction of work in this area. A glance through 'Visits Abroad' which if incomplete due to last minute travel arrangements, demonstrates the amount of effort still taking place at CERN, Fermilab, Vancouver, etc and experiments on Nimrod have not slackened pace, indeed great efforts have been made to complete various items of experimental apparatus in order to mount some experiments - time is rapidly running out with the proposed closure of the machine in mid-summer 1978. Experimental apparatus has features largely in the Labs programme and throughout the year we have reported on both the Technology and Instrumentation Divisions activities.

Further spin-off from HEP was reported in June with the joint development between the RL and the Dept of Eng Sci Oxford of a sophisticated machine to measure length changes in cardiac muscle under the influence of various drugs.

In the field of high intensity polarized neutron beams a new tool, a polarizing filter developed by members of the NBRU, operated successfully early in the year. A development for the same unit was announced in August - a "minitarget", produced by Technology Division's Advanced Apparatus Development Group for use at ILL. In the same issue we announced a further success from the same group, the first axially polarized target produced at the RL, known as PT55.

The European Muon Collaboration which involves 13 groups of scientists from France, Italy, Germany and the UK, has required the large scale preparation of equipment at several major European Laboratories. The UK contribution has been the supply of several major items of experimental apparatus either by the RL direct or in collaboration with several universities. The large amount of work has meant the involvement of several groups from the Instrumentation, Engineering and Nimrod Divisions, the drift chambers by their very size creating interesting problems in transportation and yet in construction, extreme delicacy in handling the very fine 'sense' wires, less than one thousandth of an inch in diameter. The Muon Project has already resulted in a number of successful 'Suggestions Awards' with others in the pipeline; a method of fast and accurate trimming of the large printed circuit sheets produced a record breaking SRC Award of £600 as reported in the last issue.

Space limits a full coverage of the year's activities as seen through the Bulletin, however many readers may not realise that 1977 has been a good year for press coverage the Laboratory's activities being widely reported ending as some will know, with a recent article in the Financial Times by David Fishlock - 50 column inches, although I am still trying to discover more about the sexy engineering angle.

As this is the last issue for 1977 I would like to thank all those concerned with the Bulletin during the past twelve months - to the Messengers, members of the Reprographic Section (Jean, Bill and Gordon), Mike and Reg for their photographs and members of the typing centre for their patience and good humour.

May I conclude by wishing readers everywhere, a Very Happy Christmas and New Year.

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