

Rutherford Appleton Laboratory Bulletin

Editor Tony Rush

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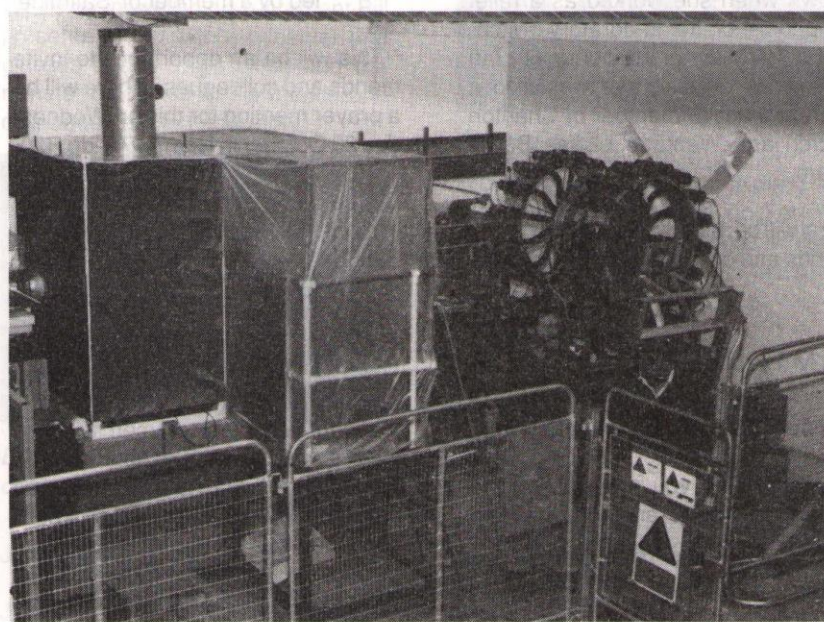
MUON CATALYSED FUSION AT ISIS

It is possible for the nuclei of deuterium and tritium to combine, or fuse, creating an α particle and a neutron and releasing a large amount of energy. The electric repulsion between the charged nuclei can be overcome by heating to very high temperatures ($\sim 10^7$ C) as in the sun and, perhaps, in fusion reactors such as JET at Culham.

A relatively simple way of achieving fusion at normal temperatures would be to use negative muons (μ^-) produced at accelerators such as ISIS. The μ^- particles are like heavy electrons and can form exotic atoms with radii sufficiently small for fusion to take place (in 10^{-12} seconds), releasing the muons to catalyse further fusions during their 2 microsecond lifetime. Theory and experiment indicate the potential of reaching 1000 fusions per muon between 1000 and 2000 C.

The process is limited by the fraction of muons (w_s) that stick to the α particle and are lost to catalysis. Until now muon catalysed fusion experiments have detected only the neutron, W_s being measured indirectly as a small loss process in the range $1/2 - 1\%$.

A direct determination of W_s can be obtained by measuring the ratio of $\mu\alpha$ -n to α -n coincidences. The short α range requires a small gas target at the density of room temperature and pressure (p_{RTP}). Such an experiment at LAMPF (Los Alamos Meson Physics Facility) last year had an enormous background coming from the $>99.9\%$ of the μ^- that stopped in the target wall. This background is avoided by starting the experiment $1/2$ microsecond after a μ^- pulse has stopped in a silver walled target (the μ^- in silver has a lifetime of $1/10$



The muon beam experimental area

microsecond). This has been achieved by exploiting the time structure of the ISIS proton beam and using the world's most intense pulsed muon beam.

In June a Birmingham - Bologna - Brigham Young - Culham - Delft - Idaho - LANL - RAL collaboration made a direct measurement of W_s at RAL. The $\mu\alpha$ -n and α -n coincidences could clearly be seen in the raw data. The clarity of the data is achieved by reducing the backgrounds using the $1/2$ microsecond delay, excellent shielding and good muon beam line optics.

The experiments simultaneously measured the fusion neutron 'singles' rate at target densities of 2, 1 and $2/3 p_{RTP}$. The event rate varies approximately as ρ^2 and the previous lowest density at which single fusion neutrons had been seen was $10 p_{RTP}$ where a new

phenomenon - epithermal production - was glimpsed. The intermediate state of the atom is formed energetically, equivalent to a high temperature. At low densities its slowing down via collisions is so delayed that it spends significant times at energies equivalent to 1000 - 2000 C. Varying low target densities provides information similar to that of the much more difficult 1000 - 2000 C measurements at PSI (formerly SIN), Zurich.

There is now considerable interest in muon catalysed fusion both for the interesting physics and the possibility of energy production. Many of the experiments require a pulsed muon beam and a major European - USA - Japanese initiative for further muon facilities at RAL is being pursued.

J.D. Davies (Birmingham University)

OBITUARY

We are sad to report the death of Coral Luther, Finance Division, after several years of illness.

Coral joined the Laboratory as a scanner in 1969 and worked with HEP Counter Group for nearly 12 years, moving to Finance and Accounts in 1983 as scanning work drew to a close.

She was a popular and well-liked member of staff who became widely known when she worked as a relief telephonist on the Laboratory switchboard. A stalwart supporter of craft exhibitions on site, she was also a keen and active member of Charlton church and Wantage Ladies Bowls Team.

Coral will be sadly missed by her many friends and colleagues at the Labora-

FILM BADGE NOTICE

It is period 11. Colour strip Brown.

Please ensure you are wearing the correct dosimeter and return all old ones to Jenny Coates, R12.

MISSING

Beckman Multimeter T100B
Last seen in G100 R25.
Information to A Watkins, Ext 6530.

Gould Bryans XY/T Recorder
Serial No TB425P, Loan Pool No 2194
Loan Pool property.
Information to A Langley, Ext 5339.

Macintosh Computer and Disc Drive
Serial Nos C828145 & 4820BGUA9
Removed from R25 Delivery point.
Information to A C Peters Ext 6203.

ARTS AND CRAFTS

The Arts and Crafts Exhibition this year will be held 18 and 19 October in R68 Conference Rooms. For further information please contact Fran Childs, Ext 6499.

CHRISTIAN FELLOWSHIP

The Fellowship meets in R2 Conference Room at 12.30 every Thursday. Visitors are always welcome.

Future Programme

13 Oct. Bible Study 'Body of Christ' (i)
led by Eric Greenslade.

20 Oct. Quiz
led by Margaret Summers.

27 Oct. Evangelistic Meeting *
led by a member of 'Saltmine'

* This will be an opportunity to invite friends and colleagues. There will be a prayer meeting for this on Wednesday 26 October in Room 47 Bldg R20.

Coffee get togethers first Wednesday in month. All enquiries to Frank Smith Ext 5540.

AN UPLIFTING EXPERIENCE

In recent years the commercial dome fitted to the United Kingdom Infrared Telescope on Mauna Kea in Hawaii has deteriorated to the point where continued use of the telescope was placed in jeopardy. The Council Works Unit was asked to look into the problem. A complete renewal and change of approach to the bogey, rail and drive systems was recommended together with extensive remedial welding and additional steelwork.

Design work was carried out in the UK and in April of this year a very large container full of rails, jacks, bogeys, drive motors, control panels, grout and drums of Swarfega (in short supply in Hawaii) was shipped out to Hawaii and transported up the 4200 m high mountain.

A critical part of the programme was to bolt eleven large jacks onto the outside of the reinforced concrete base and then lift up the complete 19 m diameter, 45 tonne dome by approximately 450 mm to gain access to the track and bogeys. A not-insignificant requirement was to secure the dome position at this stage so that it was not blown away down the mountain by the sudden high winds which occur on Mauna Kea (up to 200 km/hr).

RAL WOMEN SCIENTISTS

At an Institute of Physics meeting earlier this year many women physicists said they felt isolated when working in groups where there were very few women. The RAL Women Scientists Society has been set up to alleviate this sense of isolation. Although the main purpose of the Society is social, meetings usually begin with a discussion on a topic of current general interest led by a member of the Society.

Meetings are held on the first Tuesday of the month, the next one being on 1 November in Conference Room 2 at 12.30. The subject under discussion will be the new Institute of Physics product 'Career Breaks Kit' which has useful advice on the planning of career breaks for further education or motherhood. Jan Szechi (Central Laser Facility) will introduce the subject.



Work underway on the Dome
(Photo Fred Gilbert)

On 1 August the telescope was taken out of commission and on 9 August the dome was raised using a highly sophisticated control device to synchronise the eleven jacks - a whistle, purchased locally, bearing the words "made in England". Hurricane Fabio caused many anxious hours of worry and at one stage the dome was welded down to ensure it would not be blown away. Despite all difficulties the dome has now been lowered onto its new track and bogeys. The telescope is about to be brought back into operation with a new lease of life thanks to Fred Gilbert, Barry Bridgeman, Robin Lascelles and Keith Sinclair of RAL, ably assisted by the resident UKIRT team.

Roy Tolcher

FAREWELL

Jack Akhurst

Jack was born in Newcastle on Tyne and moved to the south of England when he was seventeen to become a bus conductor. Apart from war service he stayed in this area of work until joining the Laboratory in 1973.

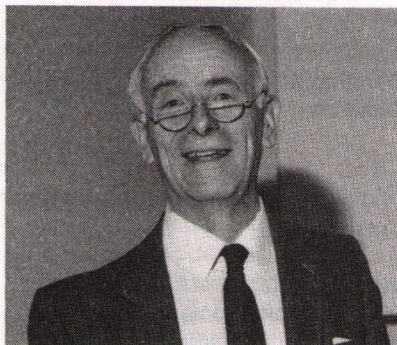


Wide grins from Roy (left) and Jack.

Roy Price, making the retirement presentation spoke of Jack's determination and conscientiousness in every aspect of his work. Presenting him with a lawnmower, garden table and chairs, and an individually styled clock Roy wished Jack a long and happy retirement.

Tom Gubbins

The war had just started when Tom left school and went to Cambridge University. He did his war service in the Admiralty and got his degree at the end of the war. In 1948 he joined AERE Harwell and has had unbroken service in the AERE / RAL area until now.



Tom, with a characteristic smile.

Jim Valentine, making the farewell presentation to Tom of gifts including a camera and travelling bag spoke of the dedication and determination Tom had always shown in all areas of his work. Jim, on behalf of everyone, wished Tom and his wife Betty a long and happy retirement.

Fred Page

Born in Sussex, Fred joined the Royal Air Force as an apprentice and in his thirty years of service was stationed throughout the world. On leaving the RAF he joined Securicor before taking up employment as a security officer at the Laboratory.

Bill Turner spoke of Fred's two careers, one in the security of his country and the other in the security of RAL. Wishing him well in his retirement Bill presented Fred with a decanter and glasses and a ships clock and barometer on behalf of his friends and colleagues at the Laboratory.



Bill (right) and Fred examine the decanter

Jack Pattinson

Jack joined RAL in 1969 after working for the Southern Electricity Board and AERE Harwell.

David Gray, making the presentation referred to Jack's detailed knowledge of the ISIS power installations and the thoroughness with which he approached each task.



All smiles, David (left) and Jack.

Presenting Jack with a clock and barometer and a strimmer on behalf of his friends and colleagues, David wished him a long and happy retirement.

Phil Walker

Phil was born in Manchester and joined UKAEA Risley in 1958 after having worked for the Manchester Guardian and Holt's brewery. He joined Daresbury Laboratory in 1963 and moved to RAL on promotion in 1979.



Richard (left) and Phil.

Richard Lawrence-Wilson making the presentation of a toolbox, socket set, chess set and a bottle of Malt Whisky on behalf of friends and colleagues wished Phil a long and happy retirement.

Ann Cox

Ann joined the Atlas Computer Laboratory in 1968 as a machine operator. Doug House described Ann as 'a Jack of all trades' willing to take on any and every task as it appeared. Now as an operations supervisor - having risen through the ranks (Doug's terminology) she was now off to pastures new.



Ann keeps a firm grip on her decanter.

Wishing Ann every success in her future employment as a deputy operations manager with an industrial company, Doug presented her with a cut glass decanter and glasses plus a bottle of vintage port on behalf of her friends and colleagues.

VISITS

Dr Ron Coleman, the Chief Scientist and Engineer of the Department of Trade and Industry and also a member of SERC visited the Laboratory recently. His visit was primarily to have a general view of RAL's work including some areas in which DTI has an involvement.



Bob Hopgood, Ken Robinson (standing), Gordon Walker, Dr Coleman (centre) observes the Informatics demonstration by Chris Crampton.

The tour included ISIS, Informatics Département, Space Science Department and the Laser and Central Computing Facilities. The visit to Informatics included a demonstration of cooperative design between two individuals on separate workstations connected by a high speed line.

RECSOC

SUNDAY FOOTBALL LEAGUE

Before the season even started RAL Sunday Football Club had won a trophy! We hosted and participated in a six team tournament and won the event after a dramatic penalty shoot-out following 40 minutes of stalemate against First Division Frilford F.C.

Since then we have played a number of friendlies and done reasonably well in the league. The 1st team have beaten Burgess Sports 3 - 2 only to lose to A.C. Nielsens 3 - 5 in their next game. Life is somewhat tougher in the Second Division of the League.

The 2nd team are faring a little better having beaten Didcot M.O.D. 3 - 0 away and drawn 1 - 1 against the Crown, Abingdon.

Andy Wells

The Engineering Industry Training Board recently organised a number of "Computing as a Career" courses to encourage more girls to go into computing. This year Kate Crennell, Informatics Department, was a tutor on the course held at the University of Reading.

The students learnt a little programming and visited various industrial establishments in the local area. Kate brought a group to RAL to see computers being used for data analysis and display, in management information and in communication networks.

Kate would be pleased to hear from anyone with an interesting demonstration for similar visitors in the future.



Bob Mannix explains the ISIS computer control system.

DARTS COMPETITION

This year the competition had over 20 entries so a preliminary round was necessary to allow the first round to start with the required 8 pairs. Once again the standard of play was high without being "Magic" - to quote a well known commentator.

The final saw the much favoured Paul Marchant-Angel and Martin Wrench facing the stalwart Andy Napper and Nick Buckel. First leg went to Andy and Nick, second leg to Paul and Martin. True class showed in the third and final leg with Paul and Martin taking the game on a double 11.

Gordon Walker presented the shields and trophies to League and Pairs winners and runners - up.

Andy Napper

ROSPA Safe Driving Awards

This is the time of the year when the National Safe Driving Awards are being announced. The scheme started in 1927 by the Royal Society for the Prevention of Accidents attracts large entries and the Awards are highly valued. The details of the 1987 awards are as follows:-

Driver	Award	Accident Free Years
J.Culley	3rd Bar to 20 Year Medal	23
M.Fitzgerald	4th Bar to 5 Year Medal	9
E.Smith	5th Bar to 20 Year Medal	25
A.Shoebridge	3rd Year Diploma	3
B.Turner	1st Bar to 5 Year Medal	6

In 1987 RAL's drivers have driven almost 3 million miles free of accidents for the Laboratory.

WELFARE FUND APPEAL

The Welfare Fund Committee would like to thank all employees who responded so generously to the recent Appeal. They hope the knowledge that it will help others in times of trauma and tragedy will give satisfaction to the benefactors.

BOULOGNE TRIP

A Christmas shopping trip has been arranged to the Boulogne hypermarket on Friday 18 November.

Cost £20 per person, deposit £10 on booking, balance by 10 November, please.

Anyone interested should contact:

Geoff Thomas ext 5116
or Mark Wheeler ext 6234

FOOTBALL CLUB DISCO

Fancy Dress Hallowe'en Disco
Friday 28 October RAL RECSOC
8pm

Tickets £3 available from:
R. Brumfitt R1, A. Wells ATLAS,
B. Brett R2, M. Wheeler R25.