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Lancashire and Cumbria Branch

LANBRIA

The newsletter of the Lancashire and Cumbria Branch of the Institute of Physics

Issue 30 May 2008

Editor's lines on the leaves

A talk on Cassini and Saturn will precede the AGM on 21 May.

LANBRIA has reached its 30th issue. It includes a message from the chair of the branch, a report on the A-level prize-winners' ceremony and the lecture on solar neutrinos, plus a report on the Fox Glacier in New Zealand.

May is the month of our AGM in Preston, and before it we have a fascinating lecture. The branch is delighted to welcome back Michele Dougherty to give us a talk about Cassini and Saturn.

In 1997 she told us about the capabilities of the Cassini probe that had just taken off from Cape Canaveral. Now it is busy collecting data on Saturn and its moons. Recently there have been data that suggest that Titan may have an ocean of water beneath an ice layer – in addition to small hydrocarbon lakes and methane snow.

Although my time on the branch committee comes to an end at the AGM, I will be continuing as editor of *LANBRIA*. If you have an article – or an idea for one – then please get in touch. I would like to feature news about physics developments in our region.

Chris Bowdery, editor

Chair shows us how to get involved

Can it really be almost a year since I was elected as chair of the branch? The time has passed so quickly and I still don't feel that I have fully grasped all that needs doing. Fortunately there are lots of other people involved in all of the branch activities and despite their other occupations they are very generous in giving their limited spare time to perform the organisational tasks that are required.

The range of activities performed by branch officers has come as a surprise. Apart from the committee meetings, I had expected my involvement to be occasional visits to London for the Nations and Regions Board and attending the evening meetings. However, the variety of outreach events has been a real eye-opener.

I recently got directly involved with these events for the first time. The Lab-in-a-Lorry needed demonstrators during Science Week. It was parked outside Burnley Football Club and contained three experiments to show to primary schoolchildren. I was allocated the demonstration of sound waves and resonance. This involved using a Slinky to show waves, rubbing wine glasses into resonance and demonstrating some splendid equipment that allowed the stroboscopic viewing of standing wave deformation for a resonating wine glass driven by a loudspeaker at a tuned frequency.

I donned the Lab-in-a-Lorry T-shirt (rather too small for my current portly form) and first observed a flawless performance from Dayna Mason, who was in charge of the lab. She efficiently got the children to participate in a great learning experience, full of action and humour. Then it was my turn, and I attempted to copy her example. The first show was a disaster. When I picked up the large Slinky spring, it twisted in my hand and half of it shot down towards the table, knocking off a large wine glass, which smashed on the floor. Once we'd swept up the glass safely, I tried to continue, but in the meantime I had incorrectly remembered the resonant frequency for the glass, which stubbornly refused to behave in the way I was describing to the audience.

Afterwards the others assured me that this was a fairly normal level of competence for a first performance, but at the time I felt like an utter idiot. Fortunately the remaining demonstrations all went well, apart from some unaccustomed problems in coping with the short attention span of tired, overexcited 10-year-olds. It was certainly a useful learning experience for me, if not entirely for them. I thoroughly recommend *LANBRIA* readers to find the time to volunteer to staff the lorry for future events in our area.

We will be having the branch AGM soon. We are looking for new committee members and I will be glad to hear from anybody interested in finding out what is involved and what the opportunities are.

Ian Saunders, branch chair

Blue ice demonstrates the incredible beauty of physics






John Bradshaw visited the Fox Glacier in South Island, New Zealand. Despite record rates of melting in some of the world's glaciers, this one is actually advancing due to global warming. The beauty of the bright-blue ice is a spectacular example of the wonder of physics.

"The rate at which some of the world's glaciers are melting has more than doubled, data from the United Nations Environment Programme has shown," stated the BBC website on 16 March (http://news.bbc.co.uk/1/hi/world/7299561.stm).

But as usual not every glacier retreats in the face of global warming. I had the pleasure of visiting the Fox Glacier in South Island, New Zealand, which is actually now advancing after many years of retreat, and all because of global warming.

The glacier, with its neighbour the Franz Josef Glacier, is fed by the 30 m per annum snowfall on the west face of the Southern Alps, which lie in the path of the roaring forties. However, the latitude of the glaciers is 44° south, so it exists in a relatively mild climate and the surrounding hills are covered with subtropical rainforest.

The reason that the glaciers can exist at all is a combination of the snowfall and the slope of the valley. Fox drops 2600 m in 13 km – an average slope of 20%. This means that the ice advances at about 1 m per day. It also melts at nearly the same rate, just managing to grow a few metres each year. In part this rapid melting contributes to its survival. Melt-water from the surface percolates down through cracks and crevasses to the base of the ice, then acts as a lubricant as the weight of the ice (300 m thick) keeps it liquid. On its way down it carves out fascinating caves. The idea of sliding into one, becoming trapped and having freezing water dropping on you is not a happy thought. However, the guides keep you at a safe distance and crampons stop you slipping – most of the time.

Scattering from the included air makes the ice quite a bright blue. Even stranger is the colour of the melt-water in the river at the base of the glacier – also a milky blue due to scattering from the suspended rock dust ground out by the glacier as it scrapes embedded rock over the base of the valley.

Strangest of all is the abrupt temperature change as you leave the warm forest, having sweated up the hillside to a safe access point to step onto the glacier, some 25 °C colder. Only the guide was hard enough not to have to wrap up.

The millions of tonnes of snow, compacting into ice, then flowing under the influence of gravity and temperature, scattering light to give it its distinctive look, can be seen as another example of physics in action. It is incredibly beautiful.

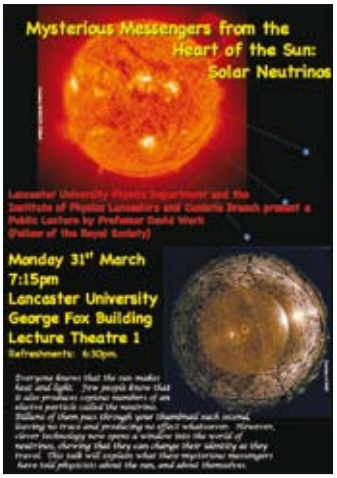
John Bradshaw, branch secretary

Neutrinos from the Sun oscillate between three different flavours

The April branch lecture came early this year – on 31 March. It was timed to coincide with the annual conference of the Institute's High-Energy Particle Physics Group at Lancaster University. The branch and the physics department invited attendee Prof. David Wark from Imperial College London to give a public lecture on solar neutrinos. In excess of 70 people turned out to hear him.

More than 60 billion solar neutrinos pass through your fingernail every second after having left the core of the Sun just eight minutes earlier. Their energies range from less than 0.01 MeV up to 20 MeV and would need more than nine light years of lead to absorb them, we were told. Not surprisingly, almost all solar neutrinos pass straight through the Earth without interacting at all. However, experiments over 40 years have managed to detect some of them – initially about one every other day – and there has been a surprise.

Although the number of neutrinos emitted by the Sun's nuclear fusion reactions is the same as has been predicted, many of the neutrinos change their identity before they even reach the Earth.



The April branch lecture on solar neutrinos, given by Prof. David Wark, was well attended.

This is possible because neutrinos come in three known varieties, called flavours: the electron neutrino, the muon neutrino and the tauon neutrino. Only electron neutrinos are created in the Sun but "quantum couplings" between the flavours allow electron neutrinos to oscillate into the other flavours. Prof. Wark illustrated this point by using two pendulums. Each can be made to swing independently but, when connected by a simple rubber band, a swing of one pendulum leads to a swing of the other. Energy is transferred back and forth, and this is the oscillation phenomenon.

Consequently, experiments that are only sensitive to electron neutrinos detect fewer neutrinos than those that are "flavour blind", such as the Sudbury Neutrino Observatory (SNO). This detector can infer the presence of any flavour of neutrino when one of them breaks up a deuteron (in heavy water) into a proton and a neutron. SNO has published results that conclusively show that the solar neutrinos can oscillate from the electron flavour to at least one of the other flavours.

Although not mentioned in the talk, it is now clear that the experimental results show that solar neutrinos above 5 MeV undergo enhanced oscillations as they fly through the dense plasma of electrons in the Sun compared with the vacuum of space on the way to the Earth.

Prof. Wark ended his presentation by introducing the T2K experiment in Japan, which will eventually investigate whether antineutrinos oscillate in exactly the same manner as neutrinos do.

Chris Bowdery, editor

Special public lecture
Cosmic rays and global warming
Wednesday 7 May, 6.30 p.m.
Emeritus Prof. Terry Sloan (Lancaster University)
George Fox Lecture Theatre 1, Lancaster University

Is global warming a swindle? Do cosmic rays from distant exploding stars affect the Earth's cloud cover? Are our carbon emissions nothing to do with climate change? Careful new work by the speaker casts doubt on these claims. Come and hear the facts and decide for yourself.

Congratulations to Dr Viktor Tsepelin (Lancaster Physics) who has jointly won the 2008 IUPAP Young Scientist Prize in low-temperature physics.

Government backs nuclear fission stations

The government has decided to support a new generation of nuclear fission power stations. These are likely to be built on the sites of existing stations. This means that we may have a new reactor at Heysham.

Apparently a number of designs are currently being considered by commercial operators: Atomic Energy of Canada Ltd – ACR 1000; EDF/Areva – the European pressurised reactor (also known as the evolutionary power reactor); GE-Hitachi – GE ESBWR (economic simplified boiling water reactor); and Toshiba/ Westinghouse – AP 1000.

Apart from the ESBWR, all of these designs use pressurised water as a coolant. They also use the water as a moderator, except for the ACR 1000, which instead uses heavy water for this function.

Would you be interested in the branch holding a future lecture about these new technologies? Please write and let me know.

Chris Bowdery, editor

EVENTS DIARY 2008

21 May
Lecture and AGM
Recent results from Cassini at Saturn
Prof. Michele K Dougherty (Imperial College London)
M49 Maudland building, University of Central Lancashire, 6.30 p.m.
The Cassini spacecraft has been in orbit at Saturn for almost four years. Some of the most exciting recent results will be discussed, with a focus on Enceladus – a small moon from which water vapour plumes emanate from cracks at its south pole.

11 June
Introduction to nanoelectronics
Prof. Colin Lambert (Lancaster University)
Cavendish Colloquium Room, Lancaster University, 6.30 p.m.

Branch awards A-level prizes

Every year the branch awards prizes to the top four AQA A-level physics students in Lancashire and Cumbria.

This year the award ceremony took place at Lancaster University, before the start of the solar neutrinos lecture, on 31 March. Prof. David Wark kindly agreed to present the certificates and book tokens to the prizewinners.

The winners were Rowan Frame (Queen Elizabeth Grammar School, Penrith), James Walmsley (Lancaster Royal Grammar School), Kevin Crooks (Carr Hill High School, Kirkham) and Jonathan Crawford (Hutton CE Grammar School).

The winners were Rowan Frame (above), James Walmsley (top right), Kevin Crooks (centre right) and Jonathan Crawford (bottom right). Prof. David Wark presented them with their certificates and prizes.

CERN prompts old-time computing memories

The April 2008 issue of *CERN Courier* magazine, produced for CERN by IOP Publishing, included an interesting article from its archives dating back to April 1965.

It comments that CERN had just taken delivery of a new CDC 6600 computer, which was the most powerful machine available at the time. Not surprisingly, the vital statistics of that computer were very impressive for 1965. The number of tape drives was 16 and the number of lineprinters was three. What did surprise me though was the number of card readers – the only way to input jobs into the system. There was just one. I had expected that there might be two or three, but I guess that the luxury of multiple job entry points did not arrive until the 1970s.

CERN

General view of the original 6600 computer room at CERN. The computer is in the background and the tape units can also be seen.

Of course, there would have been many key punch machines to prepare jobs on punched cards. And CERN in 1965 had a much smaller site than today – all of it was in Switzerland – so walking to the then computer centre with a deck of cards would have been much easier.

When I first went to CERN, in the summer of 1979, using a bicycle to get to the new computer centre was not uncommon. (It was an uphill ride though.) Thankfully by then computer job entry was carried out via visual display units, so bike trips were only needed for other reasons, such as taking 8 inch floppy disks to minicomputers.

Who can remember 8 inch floppy disks now, let alone punched cards?

Chris Bowdery, editor

The deadline for contributions to the September issue of this newsletter is:
Friday 1 August.

Please e-mail your submissions to:
chris.bowdery@physics.org

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