

LANBRIA

The newsletter of the Lancashire & Cumbria branch of the Institute of Physics

Issue 15 May 2005

The editor's lines on the leaves

This issue of LANBRIA is almost completely devoted to advertising the AGM. In previous years people have said that they have not seen the AGM announcements. There's no excuse this year!

It is very nearly that time when all responsible persons go to do their democratic duty in the time-honoured manner. I am, of course, referring to attending the branch AGM.

From past experiences, we know that very few members will turn up. This is understandable

when there is little incentive to travel a long distance for an hour of formal reports and a brief election. Worse, some members probably feel that putting in an appearance will inevitably lead to pressure to join the committee. Relax. This does not happen.

The fact is that the branch has a constitution that requires an Annual General Meeting with a quorum. Without this we cannot function. Also, the AGM is the opportunity for the membership to hold the branch officers to

account, and to elect new officers when their terms of office are over.

This year we are experimenting with holding the AGM at an earlier time to allow retired members to attend, as well as encouraging Lancaster University personnel to take part. As in previous years, a talk precedes the AGM to tempt members to come. John Brindley, director of membership and electronic services, will be there to bring us the latest news from the Institute in London and

deal with membership matters. There'll be food and drink too!

In future, we would like to hold the AGM at different places around the two counties, provided we can ensure they are quorate. We would like to hold officer and committee elections by post and e-mail to extend the democratic process to those who cannot attend the AGM.

If you can come on 1 June to Lancaster University, the branch will really appreciate you doing your bit to help in Einstein Year.
Chris Bowdery Chair

Annual General Meeting notice

Wednesday 1 June 2005

**Cavendish Colloquium Room
Lancaster University**

**4.00 p.m.: Special talk by Prof. Barbara Maher
IOP Chree Medal and Prize winner 2005
Rocks, magnetism and climate change**

5.00 p.m.: Annual General Meeting (with food)

Full details on p2

AGM 2005: Lancaster meeting promises a climate for change

This year Prof. Barbara Maher, professor of physical geography and head of the geography department at Lancaster University, will be giving a special talk in conjunction with the branch AGM.

Prof. Maher won the 2005 Chree Medal and Prize for her pioneering work using the magnetism in rocks and soil to understand how changes in the Earth's climate have been caused by humans and by natural events in the past. This work is helping researchers to predict how the Earth's climate might change in the future.

As a professor in the Centre for Environmental Magnetism and Paleomagnetism, she was the first person to link the magnetic properties of rock and

soil with changes in climate and the environment. Understanding this relationship allowed Prof. Maher to reconstruct the Earth's climate over geological time-scales; identifying changes induced by humans as well as natural variations in climate.

As fears grow over global warming, modelling and predicting climate change has become more important than ever. Prof. Maher's work has provided researchers with accurate information on what the Earth's climate was like in the past, including long sets of time-series data against which they can test their models and attempt to improve them.

The talk and AGM will take place at the Cavendish Colloquium Room, which is part

of the Faraday Lecture Theatre Complex and is up a flight of stairs from the foyer. The Faraday Complex is close to the centre of the Lancaster University campus (see campus map below). There should be signposts to help you find the room once you are inside the complex. The purple campus signs should be sufficient to find the building.

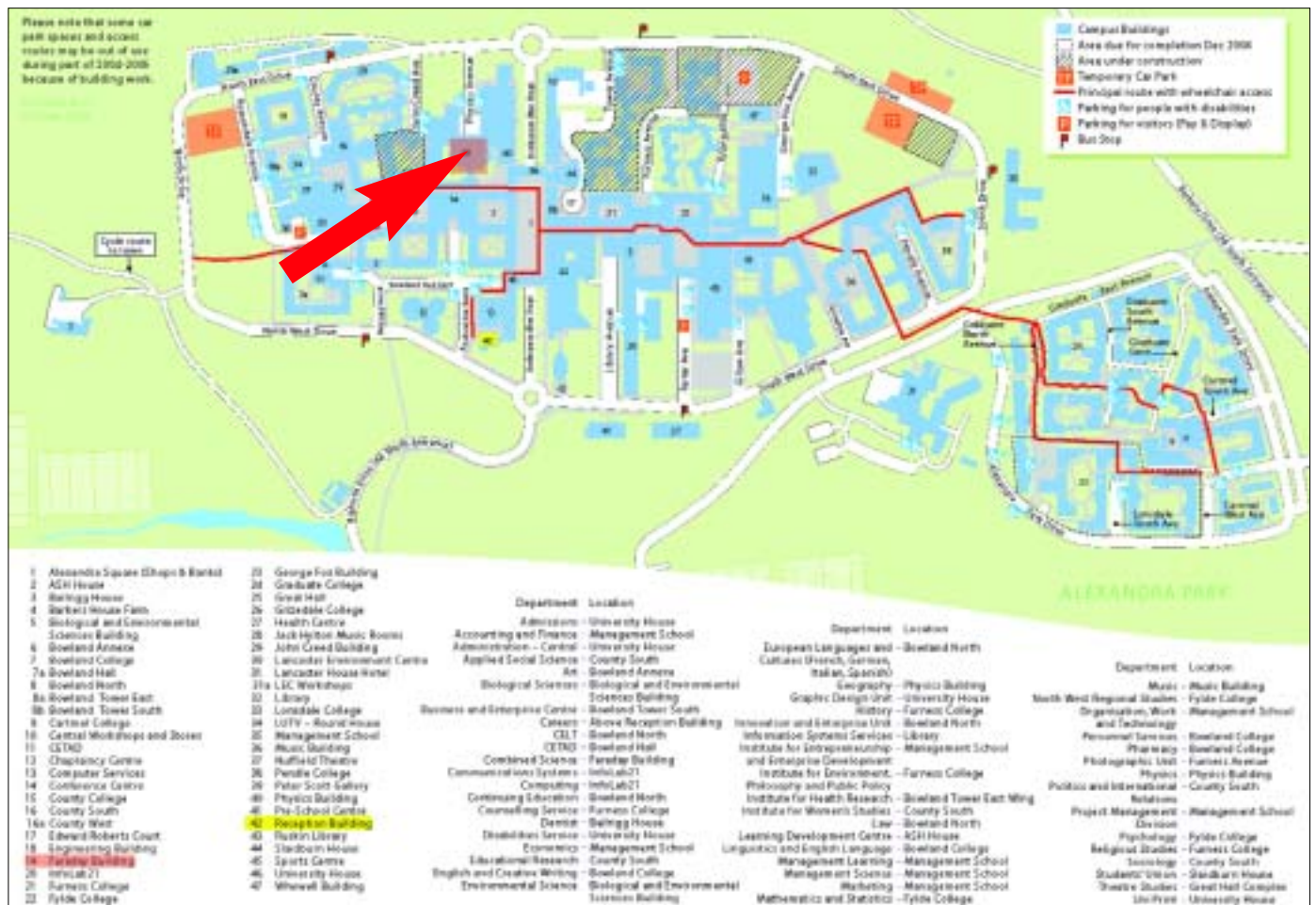
Maps can be found at <http://www.lancs.ac.uk/travel/travel.htm>.

The honorary secretary's term of office ends this year, but Steve Bailey is willing and eligible to stand again for the post. However, any branch member can stand for election for this post or as a general committee member.

Nominations and secondings by branch members are welcome and should be sent by 20 May to the honorary secretary or the chair (contact details on p4). If there is a contest, a formal vote will be held at the AGM.

From next year, we intend to move the AGM around the two counties and hold it as part of our local meetings. So that everyone should still be able to vote, even if they cannot come to the AGM, there will be postal and e-mail voting.

● The Institute of Physics Awards 2005 were presented at a special dinner at the Savoy Hotel in London on Thursday 20 January. The annual awards honour Britain's top physicists and groundbreaking research in a variety of fields.



Please check your e-mail address in your Institute details on the Web to ensure that you receive the e-mails we send you

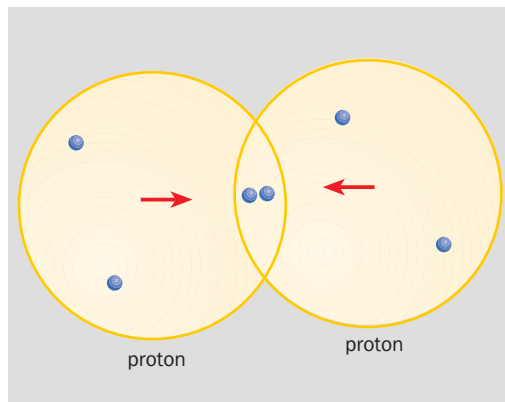
www.iop.org

The deadline for your contributions to the June 2005 issue of this newsletter is:

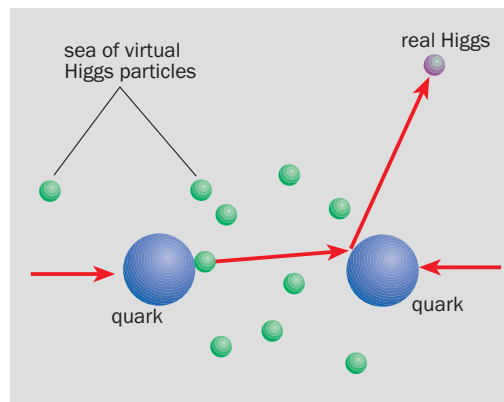
Friday
6 May
2005

Please e-mail materials to
chris.bowdery@physics.org

Hunting for Higgs: LHC seeks out the Scarlet Pimpernel of particles



The LHC will exploit the way in which quarks (shown here in blue) interact when two protons collide.



A virtual Higgs particle can be changed to a real Higgs particle when two quarks interact.

In last month's LANBRIA (p3), we looked at the origin of mass for leptons (e.g. electrons) and quarks. We saw that a mysterious Higgs field exists everywhere and impedes the motion of matter particles, causing them to have an energy-momentum imbalance (what we usually call mass). The article ended by asserting that CERN's Large Hadron Collider (LHC) will test this idea. This month we will examine how this will be done.

First, though, we will examine how quantum theory modifies our classical ideas of a field – something that has a value at every location. The enhancement is the concept that a particle can be created, and later annihilated, at any point in the field. Thus the classical idea of a continuous, “sticky” Higgs field is replaced by the notion of a soup of Higgs particles popping up, and then disappearing, throughout space. These particles are called virtual particles. Although no single virtual Higgs particle has a long-term existence, the presence of all of these fleeting particles makes an impact on any quark or

lepton in the vicinity.

To test the existence of the Higgs field, we need to pump energy into it and turn a virtual Higgs particle into a real Higgs particle that can be detected. This could be done by colliding together two high-energy electrons. Since they have virtual Higgs particles in their vicinity, sometimes just the right amount of energy and momentum from the collision will be passed to one of the nearby virtual Higgs particles, making it a real one.

The LHC will exploit a different collision – that between two quarks inside different protons in collision. This allows higher energies to be used because protons are easier to accelerate in a circular machine than electrons – and CERN has a currently unused circular underground tunnel that is 26 km long.

When the LHC becomes operational in 2007, it will be possible to collide counter-rotating protons, each with 7 TeV of energy (7×10^{12} eV). The LHC has two separate rings that intersect at certain places so the collisions can only occur at a

few fixed locations.

Enormous particle detectors are being built at these intersections to study what happens. Most of the proton-proton collisions will not produce particles of interest. Only a tiny fraction of collisions will contain a Higgs particle. Consequently, sophisticated filtering techniques will be needed to separate out the interesting collisions from the rest. Careful analysis will be required to spot the tell-tale signature of a Higgs particle being created and then decaying – because Higgs particles only survive for about 10^{-25} s. This is far too brief a lifetime to leave a measurable trail. Instead, the presence of a Higgs particle will be inferred by the particles into which it decays.

Once the existence of Higgs particles has been confirmed, the next stage will be to study a large number of them to see how often they decay to all the expected quark/antiquark pairs and lepton/antilepton pairs. This will verify (or otherwise) that the Higgs particles are responsible for mass generation.

Visit the branch website at
<http://lancashire.iop.org>

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See <http://lancashire.iop.org> for details of committee members, events and how to join the Lancashire & Cumbria branch.

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'Won't-see' events for your diary

When you have observed a daytime occultation of Venus, but missed a transit of Mercury and a total eclipse of the Sun because of cloud cover; seen Halley's Comet; missed a clear sight of a blue Moon because your father didn't tell you; seen the zodiacal light while cycling across the Hampshire downs; and watched the *aurora borealis* from Southampton – what else is there to see, or narrowly miss seeing, in the future? Meeus and Vitagliano (*J. Br. Astron. Assoc.* 2004 **114** 3 132–5) have been speculating along just such lines. For the truly long-lived, here are just a few of the astronomical treats in store.

On 17 September 13 425 AD, a transit of Mercury will occur nine

hours after the end of a transit of Venus, followed four days later by an occultation of Mercury by Venus. That far ahead, the difference between Dynamical Time (which changes due to the slowing of the Earth's rotation) and Universal Time will have brought these events forward to 13 September and 17 September 13 425 AD Universal Time respectively.

A little later, simultaneous transits of Mercury and Venus will occur on 26 July 69 163 AD and 27–28 March 224 508 AD

For those who cannot wait that long, on 22 June 5501 AD the Moon will occult Mercury during a solar eclipse, although Mercury will be outside the solar disc. On 11 August 9966 AD

there will be a total eclipse of the Sun during a transit of Mercury, and on 5 April in the year 15 232 AD a transit of Venus will take place during a total eclipse.

If space travel progresses in the future, an observer on the Moon on 13/14 November of that year will see the Earth passing across the Sun during a transit of Mercury.

Later, in 571 741 AD, an observer on Mars will be able to view simultaneous transits of Venus, the Earth and the Moon across the solar disc.

So it certainly seems that there are plenty of strange phenomena for us to look forward to in the heavens.

Ian Ferguson former vice-chair

Schools Roadshow 13–17 June Physics Fun Day 19 June



Galactic Gig is the dramatic presentation about sound and the planets that is being written and performed by the branch. See lancashire.iop.org or next month's LANBRIA for full details.