

LANBRIA

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

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Einstein visits two more primary schools

In April Chris Bowdery and I visited two primary schools in Cumbria that were holding science weeks. The Van de Graaff generator, rotating chair and wave demonstrations made yet more journeys up the M6.

The first, Greystoke Primary School near Penrith, was a new venue for us, and we visited following a request for help with science week from one of their teachers. The school was tiny, with only 53 pupils, and picturesquely located in the village centre. Ominously, the teacher had said that all of the children would be dressing up as scientists for the week and could we do the same? So the Einstein mask from Galactic Gig was added to the kit at the last moment "just in case". It was worn for a few minutes when we first met each group of children and we talked briefly about the achievements of Einstein, Newton and Galileo before beginning the "hands-on" demonstrations. On talking to the children, we were surprised to discover how many of them were called Thomas Edison.

The following week we were at Kingmoor Infant School in Carlisle – the fourth year in a row that branch members have visited. We did all of the same demonstrations to five groups of children for about 40 minutes each, making it a relatively long day for us. The morning demonstrations were recorded by a photographer from the *Cumberland News*, who spent a good deal of time perfecting his shots of children with the Van de Graaff generator, rotating chair and stroboscopic string.



The pupils enjoy the science-based hands-on demonstrations.



Fun with the Van de Graaff.

We had lunch in the staff room and afterwards, noticing the children playing outside the window, I suggested that one of us could don the Einstein mask and venture into the playground to see the reaction. "Well, you can if you want," was Chris's reply, somewhat distracted.

I thought no more of this until, wandering back towards the classroom, I saw "Einstein" in a small courtyard surrounded

by a cluster of excited children. Einstein then ventured into the main playground where, within a few moments, he had acquired a crowd of more than 50 followers, from which he found no escape despite running in circles at high speed. The word "mob" rather than "crowd", and concerns for health and safety, sprang to mind as Einstein's nose was assaulted and small balls were thrown at him.

Feeling rather left out of the action, I began to engage some of the children standing around in conversation, saying with a smile that the visitor was Albert Einstein, the world's most famous scientist, who had come to pay their school a special visit. The result of my deceit was that soon, I became a centre of attention too, and I was pulled in all directions by excited but good-natured small children. The excitement soon subsided and the afternoon activities continued in an orderly manner.

Bob Jones, vice-chair

Particle-physics school brings students to University of Cumbria

Although the University of Cumbria does not have a physics department, its Ambleside campus recently played host to a gathering of international particle-physics students: the Third Linear Collider Physics School. Organised by members of the physics department of Lancaster University (Andre Sopczak, Jonathan Gratus and Chris Bowdery), 41 students and lecturers from 16 countries spent the week of 17–23 August learning about the particle-physics, accelerator and detector challenges associated with a future linear electron positron collider. Such a machine would complement CERN's Large Hadron Collider (LHC) and make better measurements of anything found by the LHC experiments.

The top particle-physics topic was the Higgs boson. This particle (or particles) is expected to be the visible manifestation of the mechanism that gives mass to all of the fundamental matter and force particles. What you may not have heard is that the Higgs boson is incompatible with the Standard Model of particle physics. The Higgs would suffer quantum-field effects, which would give it an enormous mass and prevent it from doing the job of mass generation. There must almost certainly be some new physics added to the Standard Model to make it all work, which was the number two topic. Does our universe have an extra symmetry that links fermions to bosons (supersymmetry)? And/or does it have extra dimensions – the Kaluza Klein idea? Both of these ideas can stabilise the mass of the Higgs boson(s).

As for the collider, there are two competing ideas: the



Mohamad Bazzi

The Third Linear Collider Physics School gathered international particle-physics students at the University of Cumbria, Ambleside.



A comparison of the technologies of the proposed superconducting International Linear Collider and CERN's Compact Linear Collider.

superconducting International Linear Collider (ILC) and the more radical Compact Linear Collider (CLIC). The former uses radio-frequency (RF) waves generated by conventional klystron amplifiers to accelerate particles. The latter uses a high-power low-energy electron beam to create the RF waves, which then accelerate a low-power beam to very high energies (like a transformer) but it has never been used

before. It is not known which machine technology will be chosen. However, all of the lecturers agreed that no linear collider is likely to be built unless the LHC makes at least one major discovery.

The school was a great success despite the weather being showery nearly every day. One lecturer declared it as possibly the best school that he had ever attended.

Chris Bowdery

Editor's lines on the leaves

It is a month later than expected, but LANBRIA this month comes with the programme wallchart for 2009/2010. Hopefully you will display it somewhere prominent and come to at least one of the events in the coming year.

Since the last issue of the newsletter there have been major changes to the branch committee with many new people joining. This should lead to new activities, especially in the Sellafield area. Emma Littler and Christopher Gallagher are keen to organise talks at the Sellafield Visitors' Centre and the first one was held in September this year.

This issue contains the good news that Bob Jones's comedy drama about the life of Galileo is set to open later this year or maybe in 2010. See p6 for the full story. There are still plenty of opportunities to help out and get involved. LANBRIA wishes the show every success.

Digital switch is coming soon

The switch-off of the analogue TV signal in the Granada area will begin on 4 November. Hopefully you are already prepared otherwise BBC2 will disappear on that day.

Tony Lenton e-mailed to point out that there is a new document, *Aerial Installer Newsletter* (August 2009), which is available online. It gives useful information about the digital switchover (DSO) and a rearrangement of TV channels in the multiplexors before DSO. To read the full newsletter search online for "Granada region *Aerial Installer Newsletter*". If the PDF file is missing, have a look at the html copy, which should be there.

The deadline for contributions to the next issue is Sunday 1 November
E-mail your material to chris.bowdery@physics.org

Directions to get to the branch talks in Preston

Our programme wallchart shows maps of where our branch talks take place. But if you do not know how to get to the venues, Ian Ferguson has written a guide to travelling to the University of Central Lancashire (UCLAN) in Preston.

Preston station to UCLAN

Walk up the road outside the station. Turn right at the top and cross the road (Fishergate). Turn left (Corporation Street) and continue. Cross the ring road and turning right, and then left, continue along Corporation Street. Cross Strand Road at the traffic lights and continue to the roundabout. There turn left and continue down the hill to the university entrance.

South on the M6 to UCLAN

At junction 32, turn onto the M55 (Blackpool motorway). Move into the left-hand lanes (exit 1). Exit the motorway and at

once turn left from its exit roundabout. Take the A6 (coming south from Lancaster) into Preston. Go through the traffic lights passing Lightfoot Lane on the right. Go through the traffic lights passing the Black Bull Hotel on the right. Go through the traffic lights passing a Shell garage on the right. Go through the traffic lights, Moor Park is on your left. Go through the traffic lights passing a church on the left. Take the right-hand fork at the next traffic lights onto Moor Lane (A5071). At the double roundabout (which has UCLAN at one corner), proceed as follows: ignore first exit (sharp left, Walker Street), ignore second exit (Friargate) then through pedestrian lights and ignoring right turn, at third exit swing right (if you go straight ahead you will go to the main UCLAN entrance with expensive paid parking), move into the far

left-hand lane. Exit the roundabout at the traffic lights and at once turn left into Maudland Road. You can park here and walk to UCLAN's main entrance or turn left into Leighton Street, where you can park. Or turn left into UCLAN as the road snakes right and look for free parking.

To return to Lancaster

Leave UCLAN turning left into Leighton Street, turn left into Marsh Lane, turn right onto the roundabout and take the third left exit into Moor Lane. At the traffic lights turn left onto the northbound A6.

North on the M6 to UCLAN

At exit 31 on the M6 turn onto the A59 for Preston and go up the hill. At the roundabout turn right onto the A5085 (Blackpool Road). Keep going straight on. Go through five traffic lights. Moor Park is now on the left. At the next traffic lights turn left around Moor Park towards Preston.

High-speed rail travels to Preston

Network Rail has published its plans for a new high-speed railway in Britain and it is going to come to Preston on the way to Glasgow and Edinburgh. Presumably it will take a route close to the M6 through Lancashire, bypassing Lancaster and through Cumbria to Scotland.

This is good news for the north west of England, although it is likely to be at least a decade before the first trains run between Preston and London.

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Recent space probes explore Mars and Saturn

NASA's Phoenix Mars probe landed on 25 May 2008 at 68.35N, in an area that is covered by carbon dioxide ice 1 m thick in the Martian winter. This probe was clearly imaged during its descent to the Martian surface by the Mars Reconnaissance Orbiter.

Significant data were obtained by the Phoenix probe before it ceased transmissions on 10 November 2008, overwhelmed by the cold of the approaching Martian winter. It was found that:

- The soil was moderately alkaline, pH 8–9.
- It contained chlorides of

magnesium, sodium and potassium, bicarbonate and probably calcium carbonate. Strongly oxidising perchlorate was also present. Perhaps this may one day prove to be a source of oxygen for settlers or fuel for spacecraft.

- Water ice, at least 20 cm thick, was found several centimetres below the Martian surface.
- At night, snow was observed falling from cirrus clouds in the Martian atmosphere.

The space probe Cassini has been investigating the Saturnine system for several

years. It has recently found jets of water vapour being emitted from Saturn's moon Enceladus. These appear to contain ammonia. This information hints at the presence of water below the surface of Enceladus and maybe to the presence of life.

The solar system was formed 4.6 billion years ago. Computer simulations indicate that about 40 million years later the Moon was formed from the debris ejected when a Mars-sized body struck the Earth obliquely.

About 700 million years later the entire solar system was subjected to a very heavy bombardment. Consider the

surfaces of the Moon and Mercury. Many of the planets have odd moons moving in strange orbits around them. These, and other observations – for example, the Trojan asteroids associated with Jupiter and Neptune – appear to be explicable by a computer model, the Nice (French pronunciation) model. This considers the implication of a rearrangement of the positions of Saturn and Jupiter in the solar system caused by an orbital resonance between them, and the consequent effects on the orbits of Neptune and Uranus.

Ian Ferguson

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

Galactic Gig needs helpers

It has become a tradition, since Galactic Gig first began in Einstein Year 2005, to go on tour for three days in mid-June and in early December. These times always seemed to suit the schools and our student actors best. However, this year we had difficulties getting together a full cast and we were restricted to just one day.

We did two performances in Devonshire Primary School, almost in the shadow of Blackpool Tower, bringing the grand total since 2005 up to 43 performances (figure 1). Children from five local schools attended the performances, which were given in a spacious hall to large audiences of about 60–80 people. In the earliest performances of Galactic Gig we considered 30 to be large.

Only a small proportion of the questionnaires handed out were returned, but the mean scores out of 4, calculated according to the usual Institute of Physics formula, were the best ever (see table). On this criterion, Galactic Gig has been improving steadily for the last two years and, in the eyes of the children at least, there is not much room for improvement. Some answers to questions 4 to 6 are below.

4. Write up to three things that you have learned from this event.

- “Nodes and antinodes”
- “Different planets have different climates”
- “I didn’t know aliens (sic) could dance”
- “You can get a double star” (Zuben-el-genubi?)
- “I learned that most planets are rocky planets”
- “I didn’t know that sand was made out of crushed rocks”
- “I learned that Jupiter is huge”

5. What were the three best things?

- “Feeling dizzy with the weights”
- “Static and sparks”
- “The play”
- “The patterns”
- “The part where Zubi was dancing”
- “Seeing people with sticky-up hair”

Exit questionnaire results

	strongly agree	agree	disagree	strongly disagree	mean score
1. I am glad that I came to this event	13	3	0	0	3.8
2. I learned something about physics here that was worth learning	12	4	0	0	3.75
3. I feel more positive about physics now than before I came here	12	4	0	0	3.75

6. How could this event have been improved?

- “Things to take home like a small book about physics and albert instine (sic)”
- “More up-to-date scientist”
- “Learn more about stars”
- “Nothing”
- “Bringing in instruments and making that an activity or part of one (feeling vibration)”
- “Make the acting more realistic”

Future plans

This summer we say goodbye to three of our student actors who have just graduated from Lancaster University: Emma Hodgkins, Shelley Richardson and Paul Butler. We thank them all for years of faithful service to Galactic Gig, learning lines when they should have been revising for exams. We are particularly grateful to Shelley for still agreeing to use a plastic toy telescope, the best prop that we could offer her, after doing her MPhys project on a fully computerised 14 inch Schmidt-Cassegrain telescope with spectrometer and CCD camera. We also thank our longest-serving student actor, Ruth Perkins, who was in the Galactic Gig team from the start, for agreeing to occasionally come back from Manchester to help us even though she left Lancaster University several years ago.

The branch has agreed that an effort should be made to foster closer links with the Isle of Man and put on a tour there to include talks and hands-on activities for schools. There was also hope of getting a team together in time for Galactic Gig performances there in mid-September, but



Figure 1: map of the 43 Galactic Gig performances since 2005.

with almost every one of the actors that we have previously used unavailable at this time, it proved to be impossible.

In the longer term, we will need to recruit several new student actors to deliver performances in December. Traditionally these have been physics students, but we will cast our net wider and advertise for actors throughout the campus, such as members of the students’ theatre group. We will also need more general helpers for activities, such as van driving, operating spotlights, projection and helping with the hands-on demonstrations.

I will retire from full-time work in October. This will not stop me from helping – I will have even more time to join in the fun – but we should try to operate with a bigger safety margin than in the past few years, when often the team has consisted of only four actors and myself. We have been lucky so far and never had to cancel a performance, but the luck might run out. From the feedback that we continue to get, there is still an almost infinite audience out there, so we should not let them down but ensure that, as they say, the show will go on.

Bob Jones, vice-chair

John Bradshaw visits the first US transatlantic radio station

Almost by definition, coincidences stick in the memory. On a recent vacation touring in New England, in Cape Cod to be precise, we came across a site named Marconi Beach on the Cape Cod national seashore. The coincidence is that some years ago on another touring holiday, around the coast of Eire, we had come across the site of the first transatlantic radio station between Europe and Canada built by Marconi near Clifton in western Eire in 1901. This became the first commercial station in 1907.

Marconi Beach was therefore a must see. It turned out to be the site of the first transatlantic radio station in the USA, sending its first message (from President Roosevelt to King Edward VII) in 1903.

As you can see from the images there is little trace of the original four masts of the transmitter – the site is now marked by the information shelter. The station stopped transmitting and was dismantled in 1920. Since then about three quarters of the site has been eroded by the sea.

(Geological aside: Cape Cod is shaped like a crooked finger pointing first east, then north, into the Atlantic south of Boston. It is composed mainly of glacial moraine and moraine washout, plus some sand dunes and it is being slowly eroded by the sea, particularly on the outer (Atlantic) northward stretch, where Marconi Beach is situated. Given the likely price of some of the property on the cape, sea rise caused by global warming should be of some concern to the locals.)

The transmitters were a high-voltage spark gap connected to a dipole and the receivers were dipole aerials connected to a “coherer”. This was apparently a tube of metal filings, which the incoming high-frequency current from the aerial would

cause to fuse at the contact point, thereby reducing the resistance to allow a DC current to operate a relay, which gave an audible click and tapped the tube to “de-cohere” (mechanically shake up the metal powder, restoring the higher resistance). Data rates were clearly slow by modern standards. I invite anybody who knows about these things to write an article on spark-gap transmitters and receivers.

In a second coincidence involving communications, we travelled to Boston in six hours on a 747. Clifton is also where Alcock and Brown landed, 500m from the Marconi Station. It took them 16 hours 27 minutes in a Vickers Vimy. There is now just the “nose cone” marking the spot.

John Bradshaw



John Bradshaw with the plaque for the first transatlantic station.



A 1995 plaque commemorates Marconi's work.



John Bradshaw surveys the view at Cape Cod.



The information shelter on Marconi Beach marks the site of the original transmitter masts.

Physics wows Cumbria public

The Institute of Physics has an outreach programme called Physics in the Field, which does just what it says – shows off science experiments outdoors for the public. This summer Liz Jeavans, Caitlin Watson and Alex Cheung (from Institute headquarters), plus branch volunteers, attended the Holker Garden Festival, Cumbria, on 29–31 May to demonstrate the wonders of physics to passers-by. The local volunteers were John Bradshaw, Chris Bowdery, Stewart Eyres, and Steve and Rita Bailey. They all came away with a bright-red Physics in the Field T-shirt.

Visitors were amazed at the strength of friction when two paperback books had their pages interleaved. They launched 35 mm film canisters loaded with rocket fuel (Alka-Seltzer and water) and raced to get water through a bottle neck (learning about vortices on the way). The Cartesian diver still surprised

everyone, as did the idea of pushing a skewer through an inflated balloon without bursting it. Other popular experiments included pumping air out of a bottle to watch marshmallows expand and turning glasses of water upside down over people's heads to demonstrate surface tension.

The weather was excellent and the location within the festival grounds was ideal. Our efforts were well received and we all had time to look around at what else was going on.

On 26 June, Steve Bailey and Chris Bowdery took Physics in the Field to Chetwynde School near Barrow-in-Furness. The sun blazed down as we worked around a large table in the school grounds. The pupils really enjoyed taking part and physics never seemed so fun.

I believe that the Physics in the Field activities will become a regular part of our outreach activities in summers to come.

Chris Bowdery



Steve Bailey shows the effects of low pressure on marshmallows.



From left: Liz Jeavans, Alex Cheung, Chris Bowdery, Caitlin Watson and John Bradshaw at the Holker Garden Festival in May.

Branch prepares Galileo show for anniversary

This time last year I wrote an article for *LANBRIA* outlining my plans to stage a comedy drama about the life of Galileo to celebrate the International Year Of Astronomy: “A dramatic lean to Galileo” (*LANBRIA*, September 2008). The main aim was to have the drama performed by, and for, secondary-school students. At that time I had only just begun to publicise the project with schools and other organisations, and no funding had been obtained.

Since then, I am happy to say, interest has been expressed by science and drama teachers in about 10 secondary schools, members of Lancaster University students' theatre group, members of drama departments and theatre companies, and many other individuals. In addition the branch was awarded £2000 in the last funding round to support the project. While this has all been

extremely gratifying, it has sometimes been tinged with disappointment. Busy schedules, and the need to give priority to regular productions, have led to some schools deciding to drop out or at least postpone their involvement. And all the while, the 400th anniversary of Galileo's first night under the stars with his new telescope in autumn 1609 was rapidly approaching.

Then, just a few weeks ago, there was an upsurge of interest at the two Lancaster grammar schools. I met the heads of drama at both schools and they began recruiting potential actors and other helpers. A meeting with about 10 of their students was hurriedly arranged before the summer break. We read through part of the script and the students all left with a copy, hopefully to read over the break and decide what part they would like to play. Rehearsals will begin in September and will lead, if all

goes well, to performances in the schools, and maybe even in a real theatre, before Christmas – just in time to catch the anniversary date.

There is a lot of work to be done before it can all become a reality. One of the teachers has started to look into costume hire. Dallam School, Milnthorpe, and members of the students' theatre group are still interested in being involved. Some schools may decide to stage the drama (or parts of it) independently. All of this involves extra work. Interesting technical challenges will be presented by the projected images (which provide the background scenery and other illustrations), the music clips, the lighting and the props, and the challenges will be different for different venues. Imagine trying to stage in a convincing way swinging chandeliers, weights dropped from a tower and scenes varying from broad daylight to a starry night.

Theatre hire, publicity and admission charges will have to be investigated. I am told that I will probably have to be director as well as playwright, and will be in charge of all rehearsals.

Fortunately I retire in the autumn and so will have all the time in the world for this fun. However, there will be many more demands on the time of students, teachers and helpers than on mine, and my main worry remains that people might decide to drop out at a later stage, making a 2009 production difficult. In that case I will not lose hope, but will work for a 2010 production on the grounds that some of Galileo's most significant astronomical discoveries were not made until 1610.

Meanwhile, all offers of help will be gratefully received. After all, this is an Institute of Physics branch project.

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Bob Jones, vice-chair