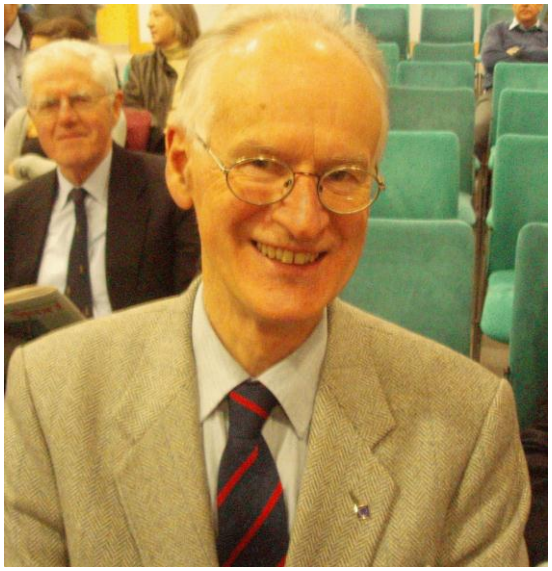
IOP | Institute of Physics
London and South East Branch

Online Newsletter **January 2013** **Issue no 24**

REMS At Home - An Environmental Miscellany

On 10 January 71 members and guests were educated and entertained by 5 invited speakers. The meeting was organised and orchestrated by George Freeman, who unfortunately could not attend during recuperation following an operation. Mike Quinton, (pictured below) introduced the speakers.



The Barometer and its early use in forecasting on land and on sea"

Anita McConnell Provided a very detailed story from the early days. It was Torricelli and Viviani who showed in 1643-4 that there is such a thing as a vacuum noting that the height of the column mercury varied daily with changes in the weather, but also with temperature. Pascal noted that a barometer recorded a lower pressure when taken up a mountain, the Puy de Dôme. In 1653 Henry Power of Halifax performed the first mountain experiment in England. Boyle, Hooke and experiments of Samuel Moreland were mentioned.

By 1689 Roger North was predicting the weather in East Anglia but discovered that barometers of the time didn't survive well at sea, because the glass was easily broken. His 200 page manuscript on meteorology was not published by the time he died in 1734, but the British Library has acquired a copy, which is fascinating reading. Ralph Bowen in 1671 had listened to many sailors returning from their travels and realised that cloud shape could predict storms a few hours ahead. He suggested that those living near the coast could also, with the help of a barometer, predict the weather. **Continued page 2**

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Above Anita McConnell

Captain Cooke was issued with a barometer using a simple constriction to reduce the oscillation just below the scale plate in 1772 in time for his second voyage.

Anita then described and illustrated the weather stations set up in between 15 and 33 monasteries in the Palatinate, centred on Mannheim, to take readings with barometers, thermometers, hygrometers and anemometers, together with observations of cloud cover, rainfall, wind direction, phase of the moon, magnetic declination etc and record the results taken regularly at 7am, 2pm, and 9pm at local time every day between 1781 and 1792 and published in Latin. Even the language was standardised! The Napoleon invaded in 1794 ending the project and this lecture.

"The Story of Navigation from 2000BC to 2020AD"

Jeremy Batch, (pictured below), in a very clear, gentle and superbly illustrated and amusing way surveyed the contributions of the world's civilisations for the tools needed for navigation.

He started by reminding us of Babylonian numerals and their base of 60, the problem of dividing up the circle (a bit more than 3 diameters!) and why they used 360 degrees, meaning that for us base ten users the right angle is an awkward number of degrees. Navigation at night then was strictly by the stars, which they noticed fall into a fixed pattern rotating about one that didn't move much (not Polaris in 2000BC). By 1500 BC lodestones were found to useful day or night.

The Polynesians were great navigators of the Pacific (1500BC – 1800AD) – at least those that arrived were! They had charts with shells marking positions of stars (or were they islands?) and canes marking ocean currents or swells. One of their number, Tupia, sailed with Captain Cooke. When he was brought up on deck and asked where Tahiti was, he was always pointed within a degree of the "correct" direction.

Meanwhile the Greeks were busy too. In 530BC Pythagoras and his followers proposed that the Earth was spherical and travelled round the sun. Lighthouses were essential to navigation and the granddaddy was built around 283BC on the island of Pharos off Alexandria. Hipparchus of Rhodes provided the grid of latitude, determined by measuring the angular altitude of a star. The Chinese pioneered the use of lodestones to indicate south, but the use of the compass only reached Europe in 1380.

Next we were introduced to the kamal, which consisted of a piece of wood and a length of string. By lining up a star with the top edge and the horizon with the bottom edge, it enabled the operator to measure latitude to ¼ degree or 15 miles on the earth's surface. In about 1460 sailors at Henry the Navigator's school in Portugal taught Arabic mathematics and introduced the students to the quadrant, which incorporated a plumb line so that sight of the horizon was not needed, although a calm sea to use it was!

Columbus (4 voyages between 1492 and 1504) had a compass it was divided into 32 points each of an inconvenient 11.250, whereas in China they still use a 24 point compass of 150 points. Archeologists found not only a gimbal mounted compass on the Mary Rose, which sank in 1549 but a log reel and hour glass for measuring speed. Francis Drake was so equipped for his circumnavigation (1577-80) and also had an astrolabe and cross staff.

1707 saw the worst English peacetime naval disaster, when Sir Cloudesley Shovell's fleet ran into rocks off the Scilly Isles. It highlighted the need for determination of not only longitude (they were 100 miles out), but also latitude (they were 120 miles out

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and only 3 of their 145 compasses were found later to be serviceable. Jeremy finished his talk by telling the story of Joshua Slocum who singlehandedly circumnavigated the world between 1895 and 1898 using the lunar distance method measuring the angle between the moon and a chosen star and astronomical tables.

"The RNLI and its Boats"

David Richmond-Coggan, (above), took us through the history of the Royal National Lifeboat Institution and showed some pretty hair-raising videos. He apologised for showing the latter straight after lunch, but they did illustrate just what he was talking about.

1824 was the official start of the Institution, although many formal arrangements for lifesaving had been made around the coast. The Liverpool Docks Trust, formed in 1776, was the first in the world. Soon after that there was a disaster in the mouth of the Tyne, where onlookers watched helplessly as sailors drowned. A competition resulted in Henry Greathead designing and building an open rowing boat in 1790. "The Original", as it was called, was manned by strong men and launched by strong women. In the next 100 years the only change to lifeboats was to add auxiliary sails.

In 1889 steam power was introduced. The boat was powered by a 170 hp compound steam engine, weighed 24 tons and was 50 feet long. The firebox had to be lit and stokers had to be in attendance continuously, so that the boat was always ready to go. Between 1889 and 1923, when it was sold, it embarked on 175 sorties, and rescued 295 people. Petrol engines were used from early 1900s. Being unreliable then and dangerous in a tossing boat, they were restricted to auxiliary use. 1936 saw the first diesel powered lifeboat at Yarmouth on the Isle of Wight. 2013, will see the introduction of the Shannon class, which at 13.6 metres long is designed to cope with 16 metre waves and will be capable of 25 knots even in 60 knot winds. Its range is 250 miles and so can go more than 100 miles out to sea.

Most of the talk concerned the all-weather fleet, but the inshore fleet of smaller, faster (up to 40 knots) vessels built to cope with mud flats, river estuaries and floods on land were also mentioned. The RNLI even uses hovercraft.

Radiosondes: their history and importance.

Keri Nicoll, (above), from the Department of Meteorology at Reading University spoke about thousands of radiosondes, containing a variety of sensors, that are released around the world every day at midday and midnight into the upper atmosphere to aid weather forecasting and research by recording a vertical profile of temperature, pressure, humidity, cloud height.

In 1749 an advance was made from climbing a hill to take readings to flying a kite. Alexander Wilson flew kites to 1 km with 3 or 4 thermometers tied at intervals to the line. He had to reel it in quickly to take the readings. High winds were a problem!

In the 1900s WH Dines made a great advance with his meteorograph. In a package weighing only 63g hanging under a balloon he had an aneroid device to measure pressure, a bi-metallic strip for temperature and a hair hygrometer for humidity, all of which had a point at the physical end of the sensor to scratch the reading on a silver film, which could be examined under a microscope when the balloon was recovered.

Only 10 days after the Montgolfier Brothers first manned flight in a hot air balloon, Jaques Charles and Nicolas Robert flew their hydrogen balloon on

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1 December 1783 carrying a thermometer and a barometer and so they could record measurements while aloft and also describe what they saw. Professor Charles reached 3km on his own before feeling unwell and releasing the gas valve to descend safely. Henry Coxwell and James Gaisher made 27 flights in hydrogen balloons from 1862 measuring pressure temperature and humidity up to 10km in altitude. However, after they nearly passed out due to lack of oxygen and others had had explosions on board. It was realised that unmanned balloons, which needed less of the expensively produced gas, and automatic data recording was the way to go. In 1898 de Bort discovered that at 16km altitude the temperature no longer fell with increasing height. He had discovered the stratosphere. In 1927 Idrac and Bureau first flew a radio transmitter into the stratosphere. By 1929 Robert Bureau had received meteorological data back by radio and had coined the word “radiosonde”, sonde being French for probe.

Keri showed pictures of different radiosondes designs now available. They still measure the same quantities, but electrically: pressure is still detected with an aneroid capsule with the change turned into an electrical signal; temperature by change in resistance of a platinum wire, and humidity by using a porous dielectric in a capacitor. GPS is used to determine position. Data is transmitted at 1Hz and so as the balloons ascend at about $5ms^{-1}$ readings are taken at 5m intervals. The latex balloons are filled with helium and expand from 1m diameter to 10 or 15m as they rise and then burst. The parachute below the balloon returns the radiosonde gently to earth, which is actually disposable. Specialist radiosondes have been developed. Cells to detect ozone by allowing it to react with potassium iodide to release iodine and an electric current were introduced in the 1960s. Particles can be counted and sized when they pass in front of a beam of light. Electric fields up to 10^9 Vm-1 in thunderstorms have been measured. Victor Hess discovered cosmic rays in 1912, while on a balloon flight.

Keri then described her own work, developing sensors that are light enough to piggyback on radiosondes, keeping costs to a minimum. Examples are for: ozone concentration; cloud tops and bases by optical rather than thermodynamic means giving a much more precise; cloud droplet size; turbulence by changes in a magnetometer output, which is constant when not swung around; the charge on Saharan dust to see if it is the reason for alignment of particles, which interfere with satellite retrieval. Investigating why the Icelandic volcanic plume of a few years ago managed to remain electrically charged by the time it reached Scotland. Keri finished by showing a video of Reading University’s venture into Unmanned Ariel Vehicles, electrically powered model aeroplanes, 50cm wingspan but capable of carrying sensors up to 2km altitude.

Vegetation patterns in meadows are explained by patterns in hydrology

Professor David Gowing, (above), began by showing some beautiful pictures of wild flowers in a flood plain meadow lying between the River Thames and the River Churn. The question was, “Why did the various species clump together and sort themselves into particular areas of the meadow, when the ground appeared to be the same everywhere?” Flood plains were well managed in medieval times and were common land so that no one owner was able to change it. The one chosen here is owned by National England and the medieval regime has been maintained. Hay is cut every June. Then cattle feed on the stubble for a time. Otherwise it is left to do its job of coping with floods from the rivers with a little help from surface drainage channels. David described how he and his team from the Open University looked into the hydrology of the area and how the water table varied through the seasons.

He showed diagrammatically the degree of water logging and the degree of soil drying on a sum exceedence value (SEV) plot of depth of the water table against month of the year. Water logging excludes oxygen above a certain threshold and soil will be too dry below the soil drying threshold. This information has been fed into a computer model to try and predict which species will favour which conditions. With the buttercup family, it became clear that meadow buttercups favour a constant water table, creeping buttercup favours wet soil and bulbous buttercup favours dry soil.

Each year’s hydrology is different and so no one species becomes dominant. This dynamism explains the high diversity of species – up to 40 different species in 1 square metre.

This record of the REMS At Home has been produced from Kate Quinton’s notes via an 8 page article written by Mike Quinton which was reduced in size by the newsletter editor.

2012 EEESTA Seminar 'Discovering the Hidden Universe'

EEESTA's fourteenth annual prestige seminar - took place on the evening of Wednesday 14th November 2012, at the University of Hertfordshire. The Seminar was an outstanding success. The venue was fully booked days before the event, indicating the immense popularity of astronomy. There were over 400 delegates, including many students from schools and two Universities in the region. The University of Hertfordshire provided a splendid finger buffet in the Atrium for all the delegates to enjoy. The newly refurbished Atrium adjacent to the Weston Auditorium was warmer than in previous years, and that made networking with other delegates much more enjoyable.

The Seminar was opened by Prof John Senior, Pro Vice-Chancellor (Research), University of Hertfordshire who gave a short welcome address which included a brief description of some of the important astrophysics research being carried out in University of Hertfordshire.

Before the formal business of the evening, the Chairman, Professor Michael Rowan-Robinson, (below)

carried out a couple of pleasant tasks for EEESTA. First he presented the 2012 EEESTA Innovation Award to Oscar Gill of Redborne Upper School and Community College, Ampthill. The award to celebrate the achievements of young people in science and engineering goes to an outstanding Arkwright Scholar from the region.

EEESTA likes to acknowledge as Friends of EEESTA individuals who have helped in their various ways to make these seminars the success they have been over these last 12 years. So the Chairman welcomed John and Carol Christopher as Friends of EEESTA,

but was only able to present the Certificate to John Christopher as Carol was ill. John has served EEESTA for most of its existence: he has been Chairman of the Seminar Committee, and Chairman of the parent body, and has worked tirelessly to help EEESTA achieve its objectives.

Professor Rowan-Robinson set the scene for the Seminar with a historical overview of infrared astronomy, starting with the detection of infrared radiation from the sun by Herschel in 1800 and continuing with a brief history of far-infrared astronomy from space. In particular, by focussing on the science drivers, he described how the early missions of the 1980s and 1990s led to the Herschel project. He then moved to the future, telling us what we can expect post-Herschel.

Above: Professor Matt Griffin. **Continued page 6**

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Professor Matt Griffin described the UK-led design, development and delivery of the highly successful SPIRE instrument on-board Herschel. He described the design and construction of SPIRE and the Herschel satellite, including a couple of videos, one showing the launch of Herschel. His talk gave a flavour of the spectacular science results obtained with this instrument over the last 2 years.

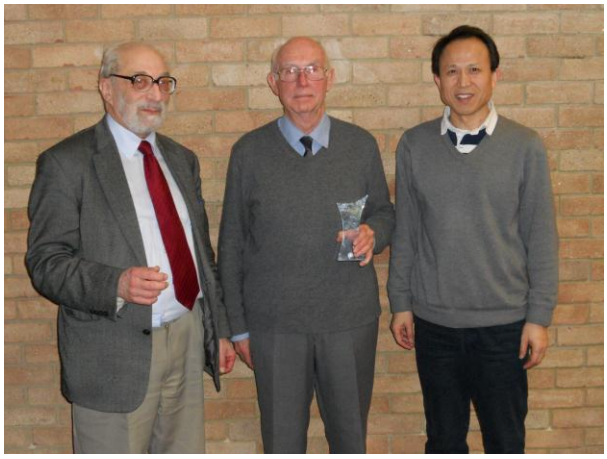
Professor Mike Barlow, (above left), described the fascinating results of the Herschel Space Observatory on highly evolved stars and their nebulae, and its discovery of large amounts of newly synthesised cold dust particles ejected from recent supernovae, such as the Crab Nebula the Cassiopeia A remnant and Supernova 1987A in the Large Magellanic Cloud. His presentation included a number of technical terms that he did not always explain.

After a lively Question and Answer session (photo below) the Vote of Thanks was given by Des Prouse, (above right), Leader at Goonhilly New Ventures. His interesting talk described Goonhilly New Ventures, a voluntary action group comprising various parties interested in forging a sustainable future for the former Satellite Earth Station at Goonhilly Downs, Cornwall, including astronomical research.

Photographs by Will Dennehy Photography.

Text by Ian Williamson.

Why do social networks perform so well?
Answer: correcting errors in digital information.



Following his lecture at the University of Kent on 22 January 2013, Professor Paddy Farrell, former professor of communications at Manchester and Lancaster Universities Centre received a memento of the occasion from Professor J. Wang, professor of communications at the University of Kent.

Prof. Farrell explained that there are now more mobile phones (cell phones, smart phones, iPads, etc) in the world than fixed phones; the plain old telephone system (POTS) is being replaced by the still rapidly growing mobile-radio system (MOBS). Since users can now transmit and receive not just audio, but also video and data signals, which in turn has led to the creation of a large number of social networks: Facebook, YouTube, Twitter, LinkedIn, etc.

Amazingly this huge complex system performs very well most of the time. One crucial reason is that the information transmitted and stored in the system is protected against mistakes by powerful error-correcting codes. The talk described how these codes work, and highlighted their error-correcting power with a practical demonstration.

Dr Cyril Isenberg

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Institute of Physics London and South East Branch – Questionnaire
Some Q and A.

On the Recent member survey carried out by the London and South East Branch via Survey Monkey, of those responding 53% were members and 23% were students (fellows and associates make up the rest). A number of comments were made. This is a selection of those comments with some answers.

The Editor replies:-

I'm not really aware of branch activity, but the IOP in general does cater for me as a physics teacher.
I did not think the branches services we're available or applicable to a 16-19 Student member.

As an ex teacher I always found lectures I attended as giving useful background or new stories to tell, often I took some of my pupils with me. Teachers and students are welcome at branch lectures, but if coming to our lectures at the IOP or Hatfield please register in advance as events at both are often full.

It would be insightful if some school visits were organised.

School visits are normally organised via STEMNETS. The branch supports events in Junior and infant schools via Science Oxford and Hertfordshire SETPOINT. We also support the WOOFYT project run by Jeremy Sampson. WOOFYT is expected to be at St John's Church Boxmoor Hemel Hampstead, for invited local schools, public and school events at Hitchin Parish Church, The Union Chapel Islington and on 10 April 2013 at Science Oxford as well as events in individual schools. The branch also provides Physics Prizes at local region Big Bangs. IOP Education Department organises a schools lecture, suitable for secondary pupils, every year with a prominent speaker and provides much support for secondary schools.

Workshop, social event, exhibitions: I would like to see more events of any sort from social right through to more seminars: Half/full day seminars Visits Exhibitions.

Non REMS members are welcome to the REMS at Home events (2 per year). Enquire of the REMS secretary to see if there are spare places on other REMS events, these are a wide variety of scientific and other visits. A few years ago the branch ran a members and family visit to the Greenwich Observatory but this requires an organiser. VOLUNTEERS ARE REQUIRED to run these sorts of events. Seminars are normally run by the IOP subject specific groups.

Most talks are London based. Few in Oxford area: this is countered *by I don't make use of your facilities, but work at RAL and Oxford so there's plenty here: It is difficult for you to compete with the seminars etc held in Oxford: Meetings are too far away.*

The committee took the view that there were plenty of Physics events in the Oxford area. We are aware that some parts of the branch are poorly covered and would be happy to open more suitably placed centres. However this requires a local centre organiser, VOLUNTEERS PLEASE. Current centres are at AWE, University of Hertfordshire in Hatfield, University of Kent at Canterbury, OU at Milton Keynes and the IOP in London. If members are near a branch boundary they can belong to more than one branch, do this via MyIOP or member services. Please note Guildford is in South Central branch and lectures are held by them there, Manchester has its own Branch who organise lectures there. Essex is now in East Anglia Branch.

I feel that information is poorly disseminated - I do not know when I last received a 'timetable of events', so I could not say what events have been available to me.

Following the demise of the printed newsletter, (a central IOP decision, not one made by the branch), we have produced an events leaflet. This leaflet is sent out with Physics World twice a year. (If you do not receive a leaflet contact member services, leaflets are normally issued in January or February and September or October). As the leaflet covers a six month period there are always some late arrangements. The January - June 2013 was in the January 2013 Physics World. In addition the Branch Officer emails a list of forthcoming events and highlights the newsfeed of past events. The full branch calendar is at http://www.iop.org/activity/branches/south_east/lse/calendar/index.html and includes some REMS events. The branch leaflet is on the noticeboard at http://www.iop.org/activity/branches/south_east/lse/index.html as is some branch news. REMS news is at http://www.iop.org/activity/branches/south_east/lse/retired/page_56640.html details of all REMS events are available from the REMS secretary John Belling john.a.belling.secrems@gmail.com .

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An attempt to break the world record for the 'biggest simultaneous physics experiment in multiple venues'

Success!

On 13 November, London and South East branch committee members, Alex McDowell, David Parkes, Lee Crouch & Mark Telling were invited to South Hampstead High School (SHHS), London, to witness, and help steward, an attempt to break the world record for the 'biggest simultaneous physics experiment in multiple venues'.

SHHS was just one of over 25 schools and academies within the GDST network simultaneously performing measurements to determine the Earth gravity; namely by performing 'pendulum' and 'dropping a ball' experiments. Approximately 170 Year 6 and Year 7 pupils at SHHS took part in a makeshift gymnasium-based physics laboratory.

Dr M Telling

Peter Kalmus' 80th Birthday

The Particle Physics Research Centre will hold a half day meeting at Queen Mary University of London on the afternoon of Wednesday 20 March 2013 to celebrate Peter Kalmus's 80th Birthday. The format of the meeting will be a series of talks by Peter's colleagues over the years, followed by a reception.

Above: Peter Kalmus at an IOP meeting. Photo Courtesy Mike Quinton.

Speakers will include:

Steve Watts (University of Manchester)

John Dowell (University of Birmingham)

Alan Astbury (University of Victoria)

Eric Eisenhandler (Queen Mary, University of London)

Phillip Diamond (Institute of Physics)

Please contact Kathy Boydon 020 7882 6956 if you wish to attend.

Further details, times etc. will be shown nearer the time at: -

http://pprc.qmul.ac.uk/research/peter-kalmus-80th-birthday

New REMS Secretary Required!

Dear Member

As many of you will already know, I shall be standing down as REMS Secretary after quarter 3 of this year 2013, owing to family commitments. A new secretary needs to be appointed to take over from quarter 4.

I have written a brief guide to the work of the REMS secretary, which can be accessed via the home page of my website http://www.johnabelling.webspace.virginmedia.com/ : the guide should be taken as advisory, certainly not prescriptive.

If you, or anyone you know, is interested in becoming REMS secretary, please reply by email, john.a.belling.secrems@gmail.com or contact me on my mobile 07986 379935.

I have enjoyed being secretary for the last 2½ years, and have got to know many of you. I have certainly learned a lot more about computer packages!

Best Wishes,
John

The magic of bubbles

This Lecture by Dr Cyril Isenberg was held at the IOP on 5 December 2012

Giant films and bubbles that are not spherical were demonstrated, vibrational behaviour and minimization properties investigated.

Photographs courtesy of Mike Quinton

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REMS RIVER WALK – THAMESHEAD

There are several guides to the Thames Path walks. The official National Trail Guide has been divided into two parts. “Thames Path in the Country” by David Harp and Tony Gowers and covers the Thames from the source to Hampton Court. Another useful guide is the Globetrotter “Walks along the Thames Path” by Ron Emmons. The whole route is clearly waymarked. Sections near the source can be subject to flooding and become impassable. The other consideration is public transport, which is fairly infrequent or non-existent. Hence the earlier “in the Country” walks will cover sections of the Thames Path, either as circular walks or linear walks up or down stream.

The first “in the Country” Thames walk was on the 27 October 2012 and seven well insulated members set out from Kemble Station. The day started cold with snow flurries in Bracknell, frozen rain drops in Newbury and -2C in Reading. On the walk it was beautifully sunny but with a keen north wind. Gill and David Pick took us on a circular walk which included the Thames Head. From Kemble Station we walked to the Thames Head sign. Even with all the rain we have had no water was flowing but in the next field it was marshy and the juvenile river was flowing.

Within ½ mile it was a fast flowing stream with lots of tributaries helping.

At Ewen (Anglo Saxon for source) we were forced to leave the Thames path and walk along a quiet country road to reach Somerford Keynes for lunch in a country pub the Baker’s Arms.

We then headed back to Kemble along a quiet country lane (with the obligatory grass growing in the centre of the road) to Poole Keynes. (One bus to Cirencester on Tuesday at 8.30.)

Hence by a footpath to Kemble. It was surprising to see how much land was growing canes for organic fuels. Unfortunately the path, although clearly way marked, disappeared into ploughed fields, where the path had not been reinstated and we had to make our own. The ground was very sticky and one member lost his boot to the mud. The area has been wealthy for centuries as shown by the number of good Elizabethan buildings. Overall it was a very good day.

Text by David Pick and George Freeman,

Photos by George Freeman