Institute *of* **Physics**

LONDON AND SOUTH EASTERN BRANCH REMS SECTION

AT HOME
THURSDAY 10 JANUARY 2008

This At Home has been organised by Roger Vole & David Pick

The At Home is being held in the Rutherford Room on the ground floor of the IOP HQ at 76 Portland Place, London W1B 1NT. Refreshments and lunch are on the floor below.

10.30	Arrival and Coffee
11.00	Welcome REMS Notices and Introduction
11.10	Reconstruction of the Antikythera Mechanism, Michael Wright
12.10	Hiding information in music, Derrick Grover
12.40 - 14.00	Lunch
1400	The bionic bat; evolution and wave physics, David Pye
1510	Experiments with digital cameras, Lionel Baker
1540	60 Years of Physics, Arthur J Brown
1610	Tea and disperse

The meeting will be at the IOP HQ, 76 Portland Place. The cost per person including lunch and refreshments is £20.

Abstracts and Biographical Details

Reconstruction of the Antikythera Mechanism: Michael Wright

Recovered from a shipwreck that is dateable to the 1st Century B.C., close to the island of Antikythera, this fragmentary mechanism is one of the treasures of The National Archaeological Museum, Athens. There it stands alone as evidence of the high level of attainment of the Hellenistic mechanic; it is a remarkably accomplished work, on a small scale, and is justly celebrated as the earliest artefactual evidence for the use of toothed gearing.

The Antikythera Mechanism first became widely known through the work of the late Professor Derek Price; but Price’s treatment of the instrument itself was inadequate, and it remained but poorly understood. Michael Wright’s reconstruction of the Antikythera Mechanism is based mainly on his own detailed study of the original; but it incorporates, as a small but important modification, a feature revealed by other researchers who have had access to a further, newly-discovered fragment. Wright argues that the instrument was a portable planetarium, and he will demonstrate a working model of this reconstruction which, unlike all other attempts, accords with, and accounts for, very nearly all of the mechanical detail observed in the original fragments.

Michael Wright studied Physics at Oxford, and worked for thirty-four years at The Science Museum, London, latterly as Curator of Mechanical Engineering. He studies tools and their use, and the design of instruments and mechanism, especially instruments of precision, of all historical periods. He has further interests in the history of mathematics and of astronomy. He aims to incorporate practical insight into an academic approach. The complete publication of his study of the Antikythera Mechanism is in progress, and other current work includes studies of circular and linear dividing engines, a catalogue of the contents of James Watt's private workshop, and horological topics.

Hiding information in music: Derrick Grover

After my previous talk on steganography to REMS in 1985 a member of the audience asked about the rumour that the BBC had hidden information in music to communicate with the underground during world war 2. Elgar, also, is reputed to have hidden messages in his compositions.

This talk looks into the possibilities and considers various ways in which it could be done. It is applicable to forensic evidence for copyright protection and introduces the possibility of people developing a signature tune based on their name.

Derrick Grover became interested in steganography for the protection of copyright while licensing computer software at the National Research Development Corporation. He founded the Technology of Software Protection Specialist Group for the British Computer Society and was its chairman for many years. He is editor and contributor to "The Protection of Computer Software". Pub. CUP. Previously he was engaged in Research and Development of electronic systems and IT in the UK and USA. He graduated at University College London and is a Fellow of the Institute.

The bionic bat: evolution and wave physics: David Pye

There can be no more striking example of the relationship between physics and biology than the echolocation systems of bats. Bats are guided in their flight by short wavelength ultrasounds used in a manner similar to the microwaves of radar. In order to do this they must exploit many of the basic properties of waves. The lecture demonstrates these properties by performing several classical experiments. The results are then used to refine an initially simple air-sonar to achieve very striking sensitivity and performance in a `Bionic Bat'.

The different design options are shown to resemble rather closely a variety of real bats, both in appearance and in mode of operation. But the beautiful adaptations of bats have arisen entirely through competitive evolution and they face severe biological as well as physical constraints. For example the acoustic countermeasures used by their prey further increase the diversity of bats themselves. Biodiversity and classical physics here go hand in hand.

Professor David Pye: born in 1932, he was educated at Queen Elizabeth's Grammar School, Mansfield, University College of Wales, Aberystwyth and Bedford College for Women (sic), London. He was Lecturer then Reader at King's College and has been Professor of Zoology at Queen Mary College, University of London since 1973. He developed an early fascination for bat `radar' and the instrumentation necessary for the study of animal ultrasound. He was a Founder Director in 1976 of QMC Instruments Ltd which produced large numbers of commercial ultrasound detectors, mainly for biological studies. He has travelled widely in order to study tropical bats and latterly has developed an interest in ultraviolet and polarisation in the visual world of animals (author of Polarised Light in Science and Nature: Institute of Physics Publishing, now Taylor & Francis). He is a Fellow of the Institute of Physics and an Honorary Fellow of the Royal Institution. A strong supporter of demonstration lectures, he gave the Royal Institution Christmas Lectures in 1985, and shares the Dodo's opinion that "the best way to explain it is to do it".

Experiments with digital cameras: Lionel Baker

Have you sometimes wondered whether your camera is performing as well as it did or as well as it should? Experiments involving 8 different makes of camera will be described. Simple methods for measuring image information content and veiling glare will be discussed, as these are the main parameters influencing image quality.

Hints will be given, with examples, of how to optimize camera settings, improve images and even extend camera specifications.

We hope you will be able to follow the attached instructions for measuring the Optimum Print Width of your camera so that a survey of results can be undertaken in good time for presentation at the talk. There will also be an opportunity on the day to measure your own eye performance, as this will enable you to relate print size to your visual correction.

Lionel Baker graduated in physics from Imperial College in 1953 and completed his PhD there in 1955. After completing a Research Fellowship at the Royal Aircraft Establishment he joined Sira Ltd in 1958 and retired in 1990. His main interest has been in the design and testing of optical instrumentation. He is currently Chair of a BSI committee dealing with optics and photonics. His website is www.geocities.com/baker_lionel

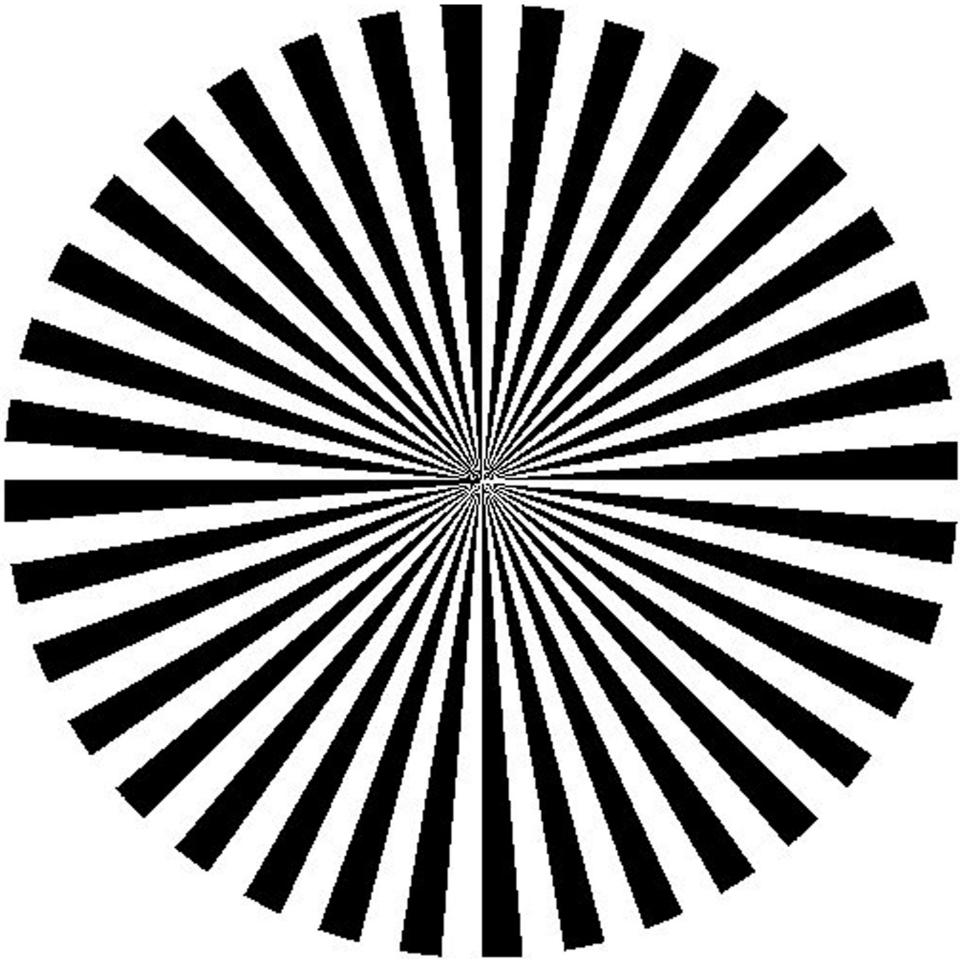
60 Years of Physics: Arthur J Brown

Professor-emeritus Arthur Brown was born and went to school in South-west Scotland and thence to the University of Edinburgh from which he graduated in 1942 with the degree of MA with honours in Mathematics and Natural Philosophy. This degree, though long accepted by IOP as a Physics degree, in fact contained very little Physics but proved ideal for his war-time work on *Separation of the Uranium isotopes by diffusion through a porous barrier.* This was carried out under the direction of Professor F E Simon of Oxford University mainly at out-stations in North Wales and at Birmingham University. It became the title of his thesis for which was awarded the degree of PhD by Birmingham in 1947 and led to A Inst P in the same year. F Inst P followed around 1960 by which time he had spent several years at Cambridge working on mechanical properties of metals and then returned to Edinburgh to join the staff of his old Department of Natural Philosophy, firstly as lecturer and later as reader. He was appointed to a chair at the City University, London in 1967, leading a group working on ultrasonics, mainly applied to non-destructive testing. He retired in 1982.

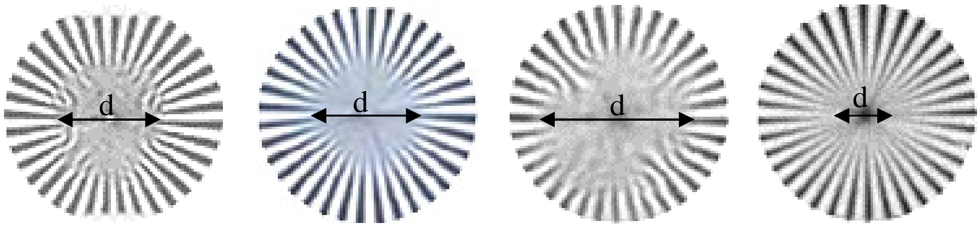
Digital Camera Testing Group

The aim of this group is to assess support for use of a new camera quality metric called **Optimum Print Width (OPW)** that could be measured by most camera users. This will help in optimizing your camera controls and when comparing the performance of different models. Please refer to the instructions for measuring this parameter on the next page. No responsibility is accepted for the accuracy of measurements given in confidence to Members.

Welcome to our group!



Sector star pattern



Leica Nikon Pentax Canon (film)

The four sample images of sector star test pattern, shown above, illustrate resolution characteristics, quantified by the grey area (camera footprint) of diameter d, achieved with 3 digital and 1 film camera. The image width divided by d is a measure of the information recorded by the cameras.

Instructions Version 4

1. Print the test chart, preferably on matt white photographic paper, and record an image with the pattern at the centre and the camera set to its highest quality rating. The range is not critical but the bars near the edge of the pattern image should be clearly visible. Use a tripod and self-timer if available, start with the wide-field zoom setting and avoid reflections from the paper surface. If the image near the centre is clear move further back.

2 Load the recorded image into a computer using Photoshop or equivalent software or prepare to measure your printed image, at A4 size or larger.

3. Measure the full width, W, of the image you have recorded of which the test pattern forms a very small part, using the scale in Photoshop. If measuring a print, W is the largest picture dimension, width or height.

4. Zoom up the image on your computer so that the test pattern occupies 3/4 of the screen and measure the diameter, d, of the central unresolved circular grey area (camera footprint), using the same Photoshop scale or employ a magnifier if a print is used. As in the 4 small sample images shown above this area should include all signs of aliasing, where some partially visible lines may not be straight. If a printer is used its performance is included in the measure of OPW.

5. The optimum print width (OPW), where the camera resolution is matched to that of the eye (5 c/mm) when the print is viewed at arm's length, is given by:

OPW = 2.3W/d mm.

6 The OPW, in numerical form, is a useful parameter when adjusting camera settings and comparing the performance of different cameras, since it takes into account lens and sensor quality as well as the number of pixels. The larger the OPW the better is the camera performance in terms of the information content provided.

7. Please email camera details to the address given below including, make, model, No.of pixels, zoom setting and complete digital image recorded (of which the test pattern is but a small part) and I will return to you your OPW value and the latest data available on other cameras. If you are using a print (A4 size), send it with a stamped addressed envelope to 21, Long Acre, Orpington, Kent BR6 7RD and I will do the calculation of OPW and send the results of other tests to you.

8. If you wish to apply the same test to a film camera, as in the far right hand small image above, you may need a microscope or eyepiece to examine the negative to determine d. A higher resolution sector star with 72 bars, when OPW=4.6W/d, is available on request to help judge the uncertainty of measurement and to see more clearly pixel characteristics.

Have fun!

Lionel Baker 15/07/07

Contact details:
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