

Gnomon

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Going to the Zoo 2 - you can come too

Following a rather understated count-down on Twitter, the long awaited Galaxy Zoo 2 has been launched by the team that links the Sloan Sky Digital Survey with the universities of Oxford, Nottingham, Portsmouth, Yale and John Hopkins.

The original Galaxy Zoo was launched in July 2007, with a data set made up of a million galaxies imaged with the robotic telescope of the Sloan Digital Sky Survey. The task of sorting these out and beginning to make any sense of the enormous variety of shapes and sizes was daunting indeed, then in a flash of inspiration, it was decided to try to utilise the enormous resource of the people connected to the internet, and, more especially, the ingenuity of the human eye and brain.

The Galaxy Zoo was established to allow everyone to help to classify galaxies according to their shapes, a task for which the human observer is better than even the fastest computer. The original Zoo gave all participants the


relatively simple task of sorting images of galaxies into either elliptical or spiral. If you had a spiral then you had the further task of deciding if it was a tight, loose or barred spiral.

Using the data that the first Zoo project has provided has proved that the resulting classifications are as good as those compiled by professional astronomers! With so many galaxies, it was originally estimated that it could take at least two years for visitors to the site to work through them all. Within 24 hours of launch, the site was receiving 70,000 classifications an hour, and more than 50 million classifications were received by the project during its first year, from almost 150,000 people.

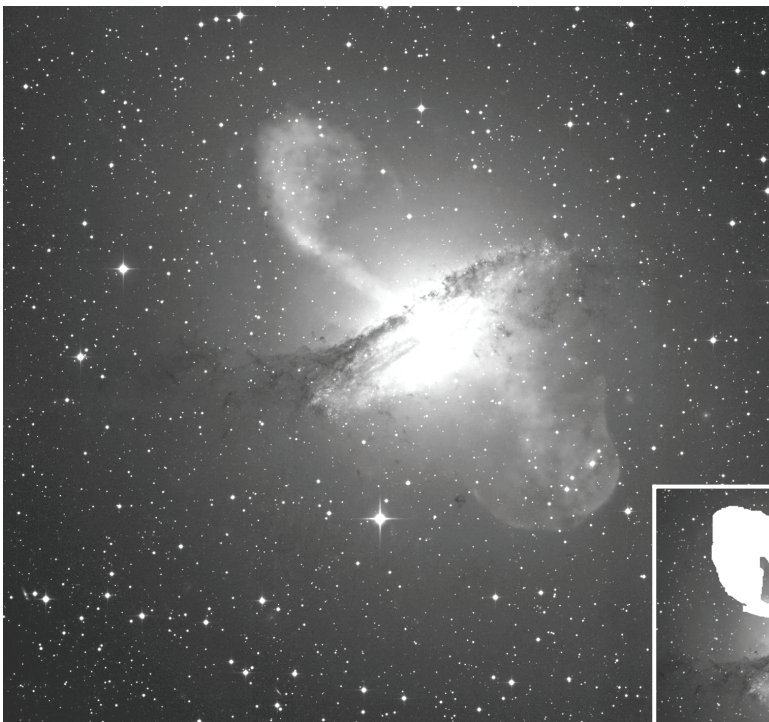
Having multiple classifications of the same object is important, as it allows the Zoo team to assess how reliable each one is. For some projects, only a few thousand galaxies may be needed, but they must all be, for example, spirals say. With this programme, just

those with 100% agreement of the classification could be used. For other projects, larger numbers of galaxies might be needed, so in this case an agreed majority level defining objects as spiral could be used. As a result, Galaxy Zoo participants have so far produced a wealth of valuable data and have sent telescopes on Earth and in space chasing after their discoveries.

Zoo 2 focuses on the nearest, brightest and most beautiful galaxies. The questions classifiers have to ponder have got much more detailed. There are questions that determine the smoothness of galaxies, their ellipticity, properties of the spiral arms and even the central bulges. In fact, it looks as though everyone taking part in Zoo 2 will quickly become experts in recreating Hubble's famous tuning fork diagram.

As in the first incarnation of the Zoo, it is the unexpected that can prove the most interesting. The Zoo Keepers have added in options to report 

Showing the black hole at Centaurus A centre




This image of Centaurus A shows a spectacular new view of a supermassive black hole's power. Jets and lobes powered by the central black hole in this nearby galaxy are shown by submillimetre data (coloured orange in the original) from the Atacama Pathfinder Experiment (APEX) telescope in Chile and X-ray data (coloured blue) from the Chandra X-ray Observatory. Visible light data from the Wide Field Imager on the Max-Planck/ESO 2.2 m telescope, also located in Chile, shows the dust lane in the galaxy and background stars. The x-ray jet in the upper left extends for about 13,000 light years away from the black hole. The APEX data shows that material in the jet is travelling at about half the speed of light.

(Inset) The same photograph, but with the lobes blanked out in white to show their position in the galaxy which is much more obvious in the full colour original on the NASA website.

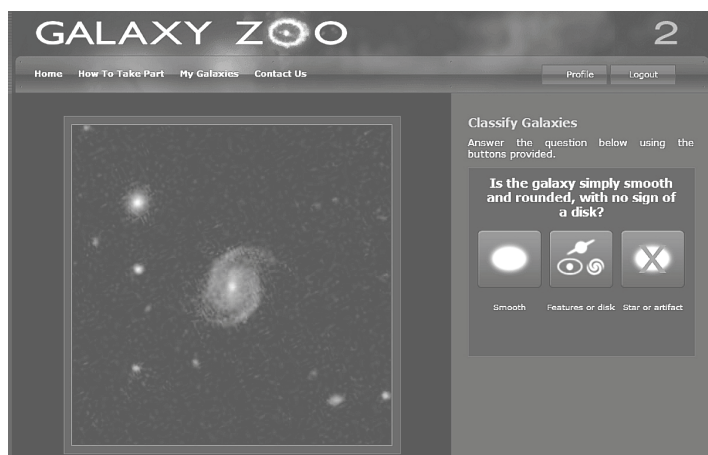


Image Credit: X-ray: NASA/CXC/CfA/R.Kraft et al.; Sub millimetre: MPIfR/ESO/APEX/A.Weiss et al.; Optical: ESO/WFI

 www.nasa.gov/multimedia/imagegallery/image_feature_1276.html

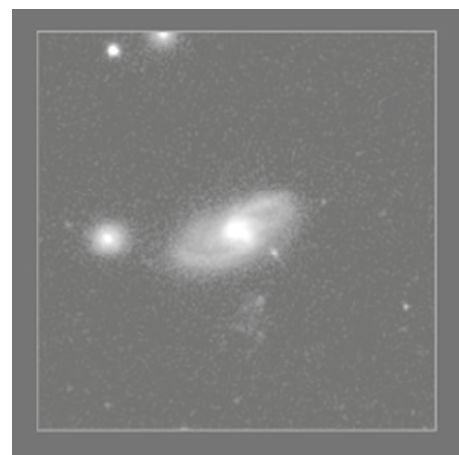
different types of unexpected shapes to help spot galaxy mergers, rings, gravitational lenses, and other interesting objects or effects.

The story is told in detail on the Zoo website, from which anyone can start observing for themselves and participate



in a very lively Twittering and Blogging. Most important of all, anyone can now do a little bit, or a whole lot, depending on their whim, of real work in astronomy.

One of the most exciting discoveries from the original Galaxy Zoo was something completely unexpected. Hanny Van Arkel, a Dutch schoolteacher and Galaxy Zoo volunteer, posted an image to the Galaxy Zoo forum and asked "What's the blue stuff below?" No one knew. The object became known as the "Voorwerp" (Dutch for "object"). The original images from the Sloan Digital Sky Survey could not make out what it was, so follow-up telescope observations, in optical and ultra-violet light, as well as measurements from the Swift satellite were made.



The Voorwerp is shown here (left, but the blue object (s) below the galaxy is hard to see in greyscale) but you can read more about it and see additional examples on the Galaxy Zoo

blog article: The Mystery of the Voorwerp Deepens!.

Computers will slowly get better at classifying galaxies, but looking at an image and asking "what's that odd thing?" remains uniquely human. Register for your contribution to astronomical research today! www.galaxyzoo.org/

Richard Knox

It's all change north of the border

Scottish education is undergoing an unprecedented root and branch review. Launched by the Scottish Government in 2004, the scope of the review covers the entire school curriculum. The guiding documentation to steer the whole process is known as a "Curriculum for Excellence" (CFE), the details and principles of which can be found on the Learning and Teaching Scotland website www.LTScotland.org.uk

The purposes of the school curriculum have been captured through a set of four capacities. The aspiration is to enable all learners to become successful learners, confident individuals, responsible citizens and effective contributors. Within the supporting documentation to guide the curriculum review is a set of principles for curriculum design. These principles are: challenge and enjoyment, breadth, progression, depth, personalisation and choice, coherence and relevance.

There are implications here for teachers, teacher educators, for parents and schools, for employers and the education system as a whole. It is impossible to hide from CFE. The past four years have seen the gradual rewriting of curriculum syllabuses and guidelines, consultation and engagement with the profession and the emergence of draft sets of experiences and outcomes for different subject areas.

Schools have been watching developments closely and keeping management and teachers updated as to the nature and implications of change. However, we are still to be presented with a definitive set of outcomes against which we can plan learning and teaching with confidence. By the time you read this article the science outcomes and experiences should be in the public domain. You can look at the draft outcomes on the website mentioned above.

Some of the outcomes will be looked at later in this article but the suite of national qualifications for which Scotland is justly proud is also being reviewed as part of the same review process. Standard grade courses, for many years the GCSE equivalent in Scotland, are likely to look very different and most likely will no longer be called "Standard" grade.

So what does the emerging science curriculum look like and how is it going to differ from the current model? One guiding principle of the review process has been that of seeking to reduce the content in the school curriculum. This has been referred to as "decluttering". The idea is to offer a set of outcomes and experiences to teachers but to allow and indeed encourage creative thinking to find routes through the outcomes.

Such thinking will probably be undertaken in different ways by local authorities and even by individual schools. This places an unprecedented responsibility on the shoulders of teachers to create routes for learning within the framework of outcomes and against the guiding principles mentioned earlier.

There is going to be a huge need for Continuing Professional Development for the profession across all subjects. ☞

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All communications (except those to the Editor) should be addressed to:

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Publication Dates:

These are at the equinoxes and the solstices, that is four times a year. Copy deadlines are six weeks before these dates.

☞ The science curriculum has a new shape. For all learners from the “early” pre-school stage through to level 4 (age 15) science is shaped into seven key themes:

- Planet Earth: sustainability; biodiversity; climate and Earth science; astronomy
- Energy in the environment: energy transfer; energy sources; energy in food; electricity; electronics.
- Forces and motion.
- Life and cells: keeping my body healthy; cells; biotechnology; reproduction; genetics; using my senses.
- Communications: communication systems; light; using the electromagnetic spectrum; sound.
- Materials: properties and uses; elements; chemical reactions; forensic science.
- Topical science.

There are six astronomy experiences and outcomes. They start with the “early stages” outcome which is:

I have experienced the wonder of looking at the vastness of the sky, and can recognise the Sun, Moon and stars and link them to daily patterns of life.

At first level it is: *I have observed and recorded the position of the Sun and Moon at various times. I can make connections between the shape, position and size of shadows and the Sun at different times of the day.*

At second level: *I can use simple models to communicate my understanding of size, scale and relative motion in our Solar System. I can observe or research a feature of space that I find fascinating and describe this to others*

Reading the above statements will give you the flavour of how outcomes and experiences will be presented to teachers. The remaining three statements can be found on the Learning and Teaching Scotland website.

Bob Kibble

Observations

My article on these two pages reviews the development of the curriculum in science and other subjects in Scottish schools.

I must share with *Gnomon* readers my disappointment in the nature and quality of the outcomes as currently published in draft form. I am not alone in being critical. Indeed a number of high profile bodies, including the Royal Society Edinburgh, have expressed grave misgivings about the style and shape of the emerging curriculum during the consultation phase. However it appears that we will be offered something not very different to these draft statements.

Our task will be to make the best job we can. There will no doubt be engagement with teachers through Continuing Professional Development events and via the design and writing of support materials.

There is plenty of good teaching and educational expertise in Scotland to ensure that young people are presented with an innovative and valuable learning experience supported by, or in spite of, the emerging fruits of the Curriculum for Excellence.

Bob Kibble.

**Senior Lecturer in Science Education
University of Edinburgh**

OBSERVATIONS ON “OBSERVATIONS”

Thank you Bob. We miss your famous contributions to “Curriculum Corner” in Gnomon, but welcome your critical look at the new approach to the curricula in Scotland. The newsletter is a perfect medium for AAE members’ opinions on all matters concerning our area of teaching. So do not fume in impotence when you can air your views right here!

Editor

The 8th centenary celebration of the discoveries of Galileo is being marked by IYA 2409. This year (2009, in case you have become totally disoriented) is the International Year of Astronomy and although we are only 400 years along that path, we can speculate what newspapers may then be saying about the Universe.

The Royal Astronomical Society Schools Newspaper competition has become a well-established event in the UK. To mark this year’s IYA, schools are invited to produce a newspaper or a feature article commemorating the 800 years of astronomical discovery since Galileo for IYA of 2409. There are four categories for entries, and the prize in each category is a telescope for the winning school. So who knows, may be one of the winners will themselves appear in the history of famous astronomical discoveries of the future? In addition, there are prizes for the winning pupils.

The competition categories cover four age groups; the newspaper competition is open to pupils of ages 7 – 11 years and 11 – 14 years, and the feature article competition is for groups 14 – 16 years and 16 – 19 years.

The entries must arrive at the RAS by Monday July 27.

The Newspaper Competition entrants should publish a small newspaper which explains some of the latest discoveries for the year 2409. The paper will need illustrations, perhaps of the new instruments that have led to recent discoveries, and even some of the sensational pictures produced. For IYA 2409, the newspaper will undoubtedly also need to cover in some way the milestones in astronomy over the 800 years since Galileo.

It’s IYA 2409 for the RAS News-

The finished entry must be prepared and laid out in the style of a modern newspaper, covering at least four sides of A4 pages. Things to look out for are good, relevant, witty headlines and lead stories. Articles must be clearly written for members of the general public, with high quality diagrams, photographs or artists’ impressions. It may also treat a particular issue such as how scientists now study the Sun, for example. The entry could also contain a cartoon, or a poem, and other such items as might appear in newspapers in the 25th century.

The feature article is to be published in a 2409 issue of a scientific magazine which reviews the major discoveries in astronomy over the 800 years before IYA 2409. The article

might describe how instruments have developed since the telescopes that Galileo himself would recognise, and how observing techniques have evolved, from simple refracting telescopes, to telescopes in orbit around the Earth, and by the 25th century there was the? The article should discuss the most important developments in greater detail, and

review the latest techniques for studying the Universe. It should detail some of the main problems with which astronomers are still grappling in 2409, and give a list of references in true science feature fashion.

All prospective entrants must register in advance by emailing news@ras.org.uk as soon as possible. Registrants will get full instructions and competition rules or these can also be found on the RAS website.

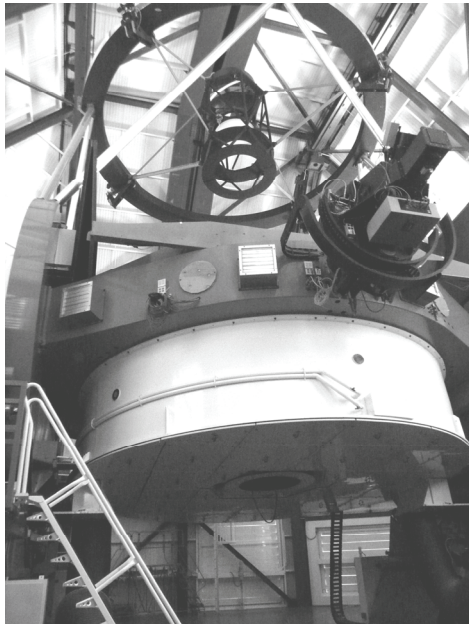
www.ras.org.uk



Letter from Japan UMOD

Although Coonabarabran may be the astronomy capital of Australia, Chile is the southern hemisphere superpower when it comes to telescopes. No fewer than four of the world's major optical observatories are located within two hours drive of the picturesque coastal town of La Serena, some 500km north of Santiago.

Heading inland from La Serena up the Elqui Valley, where the world-famous Pisco liquor is produced, one arrives at the Cerro Tololo Inter-American Observatory which is home to the Blanco 4-metre telescope, a 1.5-metre telescope, and several smaller telescopes. On the adjacent mountain Cerro Pachon sits the Gemini South 8.1-metre



View from underneath of the Clay 6.5-metre telescope. Note the instrument at right of centre, located at one of the bent Gregorian ports.

telescope together with the Southern Observatory for Astrophysical Research (SOAR) 4.1-metre telescope. Further north, but just visible from Cerro Tololo in the right lighting is the European Southern Observatory's La Silla site, home to two 3.5-metre class telescopes and nearly a dozen smaller instruments. A gravel road leading off the road to La Silla brings you to perhaps the least well-known of the major Chilean observatories: the Las Campanas Observatory (LCO), which I visited recently.

Part of the reason for this is that while most of the aforementioned observatories are operated as national facilities funded by various nations, LCO is privately owned and operated. The Observatories of the Carnegie Institution of Washington established LCO as their southern hemisphere observing station, installing the Henrietta Swope 1-metre telescope in 1971, and the Irénée du Pont 2.5-metre telescope in 1977. Carnegie then joined forces with the University of Arizona, Harvard University, the University of Michigan, and the Massachusetts Institute of Technology on the Magellan project, to build two 6.5m diameter telescopes at LCO. The first of these, named after astronomer Walter Baade, saw first light in 2000, while the second named for benefactor Landon Clay saw first light two years later.

The twin Magellan telescopes are located 60m apart and share a common services building and aluminising plant. Like most large modern telescopes, they have an alt-azimuth mount, with two Nasmyth foci each which enable large instruments to sit on a relatively stable platform. Each telescope also offers several "bent Gregorian" folded ports around the mirror cell to which more lightweight instruments can be attached and light directed by use of a flat tertiary mirror just above the primary mirror. The primary **4** mirror is thin enough to be manipulated in real time with

actuators to compensate for thermal and gravitational distortions, while the secondary mirror can be rapidly tipped and tilted to partly compensate for atmospheric seeing effects. All this enables the Magellan telescopes to capitalise on the exquisite seeing at LCO, which most nights is 0.6 arcseconds or better, universally recognised as among the best in Chile.

A telescope is only as good as its instrumentation of course, and here again is where Magellan excels. The "workhorse" optical camera and single or multi-object spectrograph on Baade is called IMACS, while LDSS3 on Clay serves a similar function. A high-resolution optical spectrograph called MIKE sits on Clay, while the "bright time" instrument on Baade is the (ominously-named) PANIC near-infrared camera. New instruments due to come on-line at Magellan in the next year or two include FourStar, a wide-field near infrared camera; FIRE, a near-infrared spectrograph; MMIRS, a near-infrared camera and multi-object spectrograph; PISCO, an optical camera that records images in 4 bands simultaneously; and PFS, a high-stability optical spectrograph for detecting extrasolar planets. Plans are also underway for a wide-field mode on the Clay telescope that would make it possible to image one square degree (an area the size of five Full Moons) in one hit!

Although each Magellan telescope has barely two thirds the light gathering capability of each of the Gemini telescopes (but nearly three times that of the AAT!), the instruments on Magellan nicely complement the existing capabilities of Gemini South. In recognition of this, the Australian astronomical community has purchased 30 nights of Magellan time each year since 2007 from the Carnegie Observatories.

The Australian Gemini Office which I manage is responsible for coordinating the usage of this time. We provide two Magellan Fellows, who spend two and a half years based in Chile providing observing support to visiting Magellan observers. They then spend the final year of their Fellowship at an Australian institution of their choice, carrying out research which builds upon their time spent at Magellan. Time on the Magellan telescopes is just as highly sought after as on Gemini. However, whereas most Gemini programs are executed in a queue mode, Magellan



The twin "domes" of the Magellan telescopes feature large louvres which are opened at night to help keep the air around the telescopes at the same temperature as the outside air and preserve the excellent seeing.

observing is more "classical" in that successful programmes are allocated specific nights, and an observer must travel all the way to Chile to carry out the observations. This is a great opportunity for students to experience "hands on" observing on an 8-metre class telescope. Watching condors soaring at sunset over the Andes while sipping a Pisco sour is not bad either.

Stuart Ryder

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Space scientist in physicists' mission to Wiltshire

A manned mission to Mars, described by prominent Russian space scientist Dr Alexander Martynov, was a highlight of a unique astronomy day organised by schools in Calne, near Chippenham, Wiltshire, in February.

Lectures by UK physicists and Dr. Martynov were enjoyed by more than 250 north Wiltshire students at this important event, organised by the Science Departments of St Mary's School, and the John Bentley School, of Calne. This was an initiative funded through the North Wiltshire Independent State Schools Partnership (ISSP).

Science, astronomy and physics students from schools including Malmesbury, Corsham, St John's and Hardenhuish heard from the space scientist and engineer about his 25 years at Russia's Mission Control. Dr Martynov is now Head of Foreign Affairs at the Mission Control Centre in Korolev near Moscow. His talk ranged from Sputnik, the world's first artificial satellite launched in 1957, to the prospects for manned missions to Mars, centred on the ongoing project for a six-year manned mission. He also spoke about the construction of the International Space Station, and discussed what the future might hold for the future of space travel.

Students also heard Helen Webber from Reaction Engines Ltd who spoke about the technological challenges of building a large space ship. Helen is working on a new

design of rocket engine that will enable engineers to build reusable space shuttles to ferry material for a space ship to an intermediate space station.

Dr Ruth Bamford, a plasma physicist at the Rutherford Appleton Laboratory, revealed the latest breakthrough of her own research group, an electromagnetic shield that will be essential for protecting astronauts from deadly solar radiation during a long voyage to Mars.

Finally, Bristol University's Dr. Dave Newbold took the audience on a whirlwind tour of particle physics and the recent discoveries made at CERN and spoke about his work on the Large Hadron Collider.

All the guest speakers urged pupils to consider becoming the next generation of scientists working in the international space industry, helping to move forward and develop current projects with new discoveries and techniques.

Commenting on the Astronomy Day, Dr Helen Wright, Head of St Mary's Calne, said "The Independent State Schools Partnership is a fantastic alliance which works across not only science subjects but English, maths and modern languages, enabling talented pupils from many different schools in the state and independent sectors to come together and hear from significant figures like Dr Martynov who we hope will inspire them in their future careers."

lizivens@hotmail.com

Liz Ivens

The Coke-can Sundial

The illustration shows an innovative horizontal-gnomon sundial made by one of my GCSE students a couple of years ago as one of her pieces of coursework. The construction is very simple, being literally a coke can with a hole drilled straight through the side, as near to the top as possible. This hole should go right out the other side and be the correct diameter for a piece of wood dowelling or even a length of pencil (as shown in the picture). If you use dowel rod you may wish to "sharpen" it to give a good point for the end of the shadow. The length protruding from the side of the can should be adjusted, depending on the height of the can, to give shadows that fall onto the side

even when the sun is at its highest at midday in Summer. We used 5cm but the maximum length can be calculated by:

$$\text{length} = \text{height of can} \times \tan(90^\circ - \text{max altitude of Sun})$$

The paper wrapped around the can is then used to plot the path of the tip of the shadow of the gnomon. This could show the movement during one day or the position at noon on every sunny day throughout the seasons, giving a smooth curve round the year. To do the latter experiment, Lydia had to make sure that the coke can was set up at exactly the same spot, with the gnomon pointing due South for every measurement. She also had to calculate the

exact time of local noon by applying a correction to UT for her longitude (West of Greenwich) and apply the Equation of Time for the variation of speed in the Sun's apparent movement across the sky. These last two corrections are not necessary if you only want to do a day's observations – the moment that local noon occurs will be apparent from the peak of the curve.

A further exercise for the mathematically minded is to calculate the length of the shadow for noon right round the year. One calculation for every six or seven days is sufficient to get a good curve. In the illustration Lydia has also plotted a separate curve for other times of day, 8am 10 am 12 noon, 2 pm and 3pm. The picture shows the sundial working at "nearly" 10 am on a lovely day in early November. The shadow just touches the 10 am line.

Equations for calculating the length of the shadow for such a sundial can be resourced from "Practical Astronomy: A User-friendly Handbook for Skywatchers" by H Robert Mills (ISBN 978 1898563020). Robert was a staunch supporter of the AAE and he would have been very pleased to see this sundial working so well, especially because it was inspired by his book.



Coke-can sundial. Photo courtesy of Lydia Rex

Anne Urquhart-Potts

For your Library

Introduction to astronomy and cosmology. Ian Morison. ISBN 978-0-470-03334-0. £80.00 (hard back); £32.50 (soft back). pp341; Full colour photographs and diagrams. John Wiley & Sons.

The author explains at once that this is a textbook but he did not see why it should not be easy to read because of that! He achieved his target. Because the book combines lots of practical basic physics, it will help enormously those students, for example, who dread remembering whose constant/laws were whose and what for (Planck's, Boltzmann's, Wien's and so on, and just what was Heisenberg's principle of absurdity?) To which all the new astronomical examples can be added for the physics students who did not intend to "do" Astronomy, since Professor Morison's book is aimed at *all* first year physics as well as astronomy undergraduates.

This is in textbook format though, complete with paragraph numbering, worked examples and sample questions that range from solving simple triangles - but you have to work out which triangles you have to solve - to some fairly detailed astronomical posers.

Right at the beginning the author conveys his enthusiasm for the subject. He relates how he made a telescope at the age of 12 out of lenses he was given at the time, and how that experience resulted in his being hooked for ever. How many of the astronomical fraternity can relate similar stories! Why can we not provide the same inspiration, or the equivalent, for all youngsters in this or other branches of science?

The book follows a familiar path for astronomy texts, starting with a brief historical review highlighting Ptolemy, Tycho, Kepler, Galileo, Newton Herschel, and at the appropriate areas, Hubble, Einstein, Hawking, and many others. The book deals with some practical considerations (measuring time, the celestial sphere, and so on) before following a familiar course outward through the Solar System, the stars and galaxies and the recent evolution of cosmology. The text is virtually up to date in all major areas, the only major development in the news that was missing from the book was reported almost exclusively in the last issue of *Gnomon* (the first extra-solar planet to be caught on a photograph). At each stage the necessary diversions into the related science are cheerfully made, and by the index, a great deal of space has been covered in the 341 pages.

The science of astronomy involves much mathematics, of course, but here nothing too indigestible for even a distracted first year student is involved. Professor Morison, as required, gets into any of the wide range of sciences that astronomy demands, even some biology (well how can life in this Universe be tackled without it?). There is also a polite reference to the (*possible*) role of a Creator in the final analyses of the ultimate question to life the universe and everything. The book ends by highlighting some of the many shortcomings of our understanding of cosmology, cosmogony, unified theories, and so on, although not quite as humbly as, for example, Jeans was. (Dark energy still seems to me to be a repeat of Einstein's famous "blunder" and I am waiting fairly confidently for someone to suggest one day that c is constant only locally, or in fact has been reducing ever since the Big Bang, or both!) But that is an example of how reading this book stimulates the imagination.

There are a few contentious items. Professor Morison's explanation of sidereal time is rather obscure, and would have been much assisted by pointing out simply that because the Earth orbits the Sun, the starry background

(if we could see it with the Sun in the sky) would appear to move westwards behind the Sun.

The explanation of the "well known Moon illusion" is unconvincing. Mind you, I have yet to hear of one that seems to settle it once and for all. I prefer the suggestion that the Moon when close to the horizon has houses or trees etc, to provide a reference for the eye. This is missing when the Moon is high in the vault of the sky (or indeed a constellation or the Sun, all of which cause the same illusion). The illusion can be simulated with two photographs of the Moon, one taken when it is near the horizon and the other when high in the sky on the same date. This works, though not as well since the edges of the photograph itself provide a frame of reference. It works best with a projected slide. This is a marvellous opportunity for some research and experiment by our readers.

The explanation of how to steer and maintain a ship's course close alongside another while both are in motion on a swell in an otherwise calm location seems to be completely the opposite of what one would expect. Why?

Finally the sub-editor has not done a very good job. There are too many spelling errors (mostly misprints, I suspect) a few grammatical errors, and some inconsistencies. Why should mars and moon (*sic*) appear like that from time to time, for example?

This is an important book, and is well thought out, well written, and entertaining. It should be a great aid for teaching science in general, physics especially, and for astronomy in particular. Please hurry with correcting the details that let it down a bit. So many new astronomy books these days need a new section in *Gnomon*, "for your coffee table". Your library is much more important, and this book should be there - as soon as the cover prices come down.

Richard Knox

Observing the Night Sky With Binoculars: A Simple Guide to the Heavens. Stephen James O'Meara. Cambridge University Press. Paperback £19.90. ISBN 978-0-521-89554-5 370pp.

This is a detailed journey around the night sky (Northern Hemisphere) accompanied by the author who shows us the treasures to be seen in the constellations but also gives much background knowledge.

The introductory chapter starts with the Big Dipper, orienting the beginner to the North and setting out to do some naked eye observing. Key concepts such as altitude, latitude, circumpolar, magnitudes, light years and stellar nomenclature are clearly explained at a level which would be appropriate for GCSE Astronomy students. However this is not designed as a textbook for the GCSE syllabus as the explanations are too brief and there is no opportunity to review and practise the knowledge. It would be very useful as a companion for those starting out on certain categories of GCSE Astronomy coursework as the star charts show a binocular view and lead one easily to a variable star (R Ursae Majoris) and a seventh magnitude galaxy (M81), to estimating magnitudes and looking for colour. The need for really dark skies for this work is emphasised and the technique of averted vision for the faintest objects is explained.

The remainder of the book covers the Spring, Summer, Autumn and Winter constellations, exploring each with the aid of clear diagrams and star charts, drawn by the author. Large views of the sky assist in picking out a whole constellation and then more detailed charts help to home in on double stars, variable stars, clusters and other delectable objects. Beware of the fact that the larger views are drawn for a latitude of about 40° so that some of the star patterns shown will be below the horizon for British latitudes. The ☞

text also leads you carefully through the star-hopping required and it is as if the author were there at your elbow guiding you. Some of the objects are easy targets but many are challenging for binoculars especially in the light-polluted skies of much of Britain. Most of the observing here is designed for handheld binoculars, but the book could also be used with a small amateur telescope using a low power eyepiece. Binoculars are the best instrument for the beginner in this field as they are easy to use and inexpensive compared to even very modest telescopes. However this book does not offer advice on purchasing a pair of binoculars nor does it go into technical details of the optics.

Interest is kept high even on cloudy nights by the wealth of astronomical information about each area and also the stories of the mythology of various cultures. Some snippets are purely poetic and a few descriptions are likewise: the Orion Nebula is described as "a puff of fairy dust" or a cluster as "a glistening diamond brooch, a treasure displayed under glass in a museum of stellar wonders"! For me this did not detract from the breathtaking vistas of the night sky as I toured with my trusty 10x50's.

Two minor niggles: the American spellings; and the illustrations do not have captions, so that you have to read the text through to find out what the picture shows. Much more problematic was the way the binding is made so tight that the book closed quickly every time I put it down, making the routine of referring to a chart and then sweeping the sky to find recommended objects very difficult. A photocopy of the page would get around this awkwardness, but it is a shame that the design of the book means it cannot be used ☹

Friends of the RAS

You may have noticed that, following the successful launch of the RAS public lecture series, they have started a new membership scheme, 'Friends of the RAS'. "Friends enjoy:

- free priority seat reservation at RAS lunch-time lectures
- invitations to social events and meetings in Burlington House (and eventually in other parts of the country)
- use of the Society's library
- escorted visits to observatories and other places of interest
- discounted subscription to *Astronomy and Geophysics* magazine

In addition every Friend receives a copy of the RAS 2009 Diary and other RAS publications as well as discounted admission to Herschel House Museum Bath.

To become a 'Friend' for 2009 all that people need to do is send their name, address, email address and telephone number with a cheque (made out to 'The Royal Astronomical Society') for £35.00 to the Membership Secretary, Royal Astronomical Society, Burlington House, Piccadilly, London W1J 0BQ

For further information visit [//friends.ras.org.uk](http://friends.ras.org.uk) and ☹

Sky Diary Spring 2009

As the evenings get brighter and the clocks change to BST, observing astronomical objects becomes a little more tricky. April is all about Mercury and it is at its best during the evening twilight.

During the last couple of weeks in April you will be able to observe this bright planet shining at -0.7mag. Just look slightly north of west about half an hour after sunset. As the Sun sets you need to look for the bright red Aldebaran in Taurus which is even less north of west. Mercury can be found just to the right. As we approach the end of the

without a brick on it. Despite these reservations I would highly recommend the book as a thorough grounding in visual observing and in the basic concepts of astronomy. It is well worth the money and my copy will get well used.

Anne Urquhart-Potts

Stargazing Basics. Paul E Kinzer. 2008. Cambridge University Press. ISBN-13: 978-0-521-72859-1. £11.99

This book is nicely designed so as not to intimidate the beginner. It has three parts: observing with the naked eye or instruments, what's up there and lastly a glossary with some simple star charts.

The first section starts with a nice personal account of how the author got going in observing. There is good coverage of binoculars, spotting telescopes, Dobsonian and Goto telescopes and the author avoids discussion of large or expensive equipment and explains how to avoid poor and over-sold telescopes. He also covers camera mounts and web-cams. There is a nice section on star parties and astronomy clubs.

In the second section he covers the Solar System and deep sky objects, concentrating on objects that can be seen through modest equipment. The third section has a comprehensive glossary, a nice section on names and their pronunciation and a selection of simple star charts.

Throughout the text there are sections in bold type to direct the reader to glossary entries. The book's subtitle "Getting Started in Recreational Astronomy" is a very fair summary of this very sound book – recommended.

Alan C Pickwick.

if you would like multiple copies of the 'Friends' leaflet (possibly for distribution at public events), the RAS would be delighted to let you have them. Please contact Ron Wiltshire at the RAS. ☹ ronw#ras.org.uk

Free DVD for AAE Members

Enclosed with the March *Gnomon* is a free copy of the latest "Eyes on the Skies" DVD, produced by ESA, the IAU and ESO. We have a considerable stock of these DVDs and they are available to members as follows:

The cost of each DVD is 36p. Postage for up to three discs is 42p, other quantities postage is 90p for ten, £2.49 for 25, £5.70 for 50, or £8.22 for 100 discs. These are cost prices to the AAE. For small numbers, please send first or second class stamps to cover the cost of the DVDs and the postage. For large numbers please email me at:

☹ Alan_C_Pickwick#btinternet.com

There are also still a few copies of the ESA "Hubble 15 years of Discovery" DVD reviewed in the last issue of *Gnomon*. You can get copies of these from Anne Urquhart-Potts if you send a suitably sized stamped self-addressed envelope to Anne at *Gwel'an Vala*, Philleigh, Truro, Cornwall TR2 5NB.

Alan C Pickwick.

month, Mercury will venture nearer and nearer to the Pleiades until it is in conjunction with the cluster (which will be hard to see in the twilight) and the Moon on the 26th. Soon after this the Sun will catch up in the sky and Mercury will disappear once more.

Later on in the month Venus will be a very bright morning star. At -4.4mag this bright object can be observed an hour before sunrise. Look low in the east. On the 22nd April there is an interesting conjunction of Venus with the Moon and Mars at 15:00 (all times in these notes are in BST).

If your school was lucky enough to get a free Schools' Telescope from the Society of Popular Astronomy then this is a possible target. Be careful though as the ☹ **7**

☞ Sun is nearby and you must never look directly at the Sun through an unfiltered telescope.

From around halfway through the month Jupiter will be a good early morning object. Rising after 03:30 it moves through Capricornus. Use large binoculars or a telescope to show the four Galilean satellites. On the 19th the Moon passes 1.5° to the north of Jupiter.

Saturn is the best this month if you like to have a go at imaging planets. Although the rings are almost side on and much harder to see, the planet is high enough in the sky and visible at a reasonable hour in the evening. Near the south and about 45° altitude at 21:00 this planet is easy to find, although not very bright at 0.7mag. The planet heads towards the west, setting around 02:00. Saturn is found in the constellation of Leo.

Leo also houses many interesting galaxies, six of which you can see with large binoculars. You will need a clear sky as they are all 9th magnitude. M65 and M66 lie just under the rear leg. NGC2903 lies at the end of the “sickle” shape of Leo’s head. M95, M96 and M105 lie under the lion’s body.

Meteor spotters this month have the Lyrids. These are swift and brilliant meteors. Visible from the 20th to the 23rd

Moon phases for the fourth quarter of 2008				
	New Moon	First Quarter	Full Moon	Last Quarter
April	25	2	9	17
May	24	1 & 31	9	17
June	22	29	7	15

April they peak on the morning of the 21st. A typical rate is around 10 per hour.

As we venture into May, Mercury heads towards the Sun, Venus gets slightly brighter still and Mars pokes its head out from the glare. At 1.1mag Mars will become an obvious early morning sky object. Jupiter, as it travels through Capricornus, is seen lower in the sky. But this comparatively large disk with its continuously charging cloud belts is still a winner through a nice pair of binoculars.

Rising and setting times (UT): lat.52°N; long.3°W						
	April 15		May 15		June 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	05:15 ☾	19:09	04:18 ♉	19:59	03:51 ♉	20:33
Mercury	05:36 ♀	20:47	04:32 ♉	20:18	02:59 ♉	18:14
Venus	04:03 ☾	16:50	02:58 ☾	15:43	02:00 ♀	16:13
Mars	04:32 ♂	16:05	03:11 ☾	16:19	01:52 ♀	16:31
Jupiter	03:30 ♃	12:58	01:41 ♃	11:22	23:39 ♃	09:28
Saturn	15:03 ♄	04:32	13:01 ♄	02:32	11:03 ♄	00:31
Uranus	04:29 ☾	16:05	02:34 ☾	14:15	00:33 ☾	12:17
Neptune	03:37 ♃	13:24	01:40 ♃	11:28	23:34 ♃	09:26
Moon	01:08 ♂	08:05	00:42 ♂	09:15	— ♂	11:48

Data for other venues and dates can be estimated from this (and Moon phase) table. Symbols after rise times show constellations where body is, at rising. ☾ is a symbol “borrowed” for Ophiuchus, the 13th zodiacal constellation.

During May Jupiter’s apparent size grows from 38” to 42” across and on the 28th Jupiter meets Neptune. Such conjunctions are rare as Jupiter’s orbital period around the Sun is 12 years. There will not be any further such conjunctions until 2022. Saturn again sits in Leo at 0.8mag. Look out for Titan its largest moon.

May does come with a nice meteor shower. The Eta Aquarids can be seen between the 1st and 8th. Radiating from the constellation of Aquarius, these are fast moving bright meteors. A peak rate of 35 per hour could give a lovely show, although the Moon’s light will interfere on the 5th.

As I write these notes I dream of June and cross my fingers for some lovely relaxing and lazy summer evenings after school. The summer solstice occurs on the 21st at 05:46. At this time the Sun will be in Gemini and will stop its northerly motion. This will be the longest day of the year and the start of summer in the northern hemisphere.

Venus will still be an easterly beacon at -4.2mag in the pre-dawn sky. Jupiter in the south eastern sky can be seen before midnight. On the 13th and 17th Jupiter and the Moon lie 2.5° apart. Saturn becomes more unfavourable during June as it fades into the evening sky.

James O’Neill

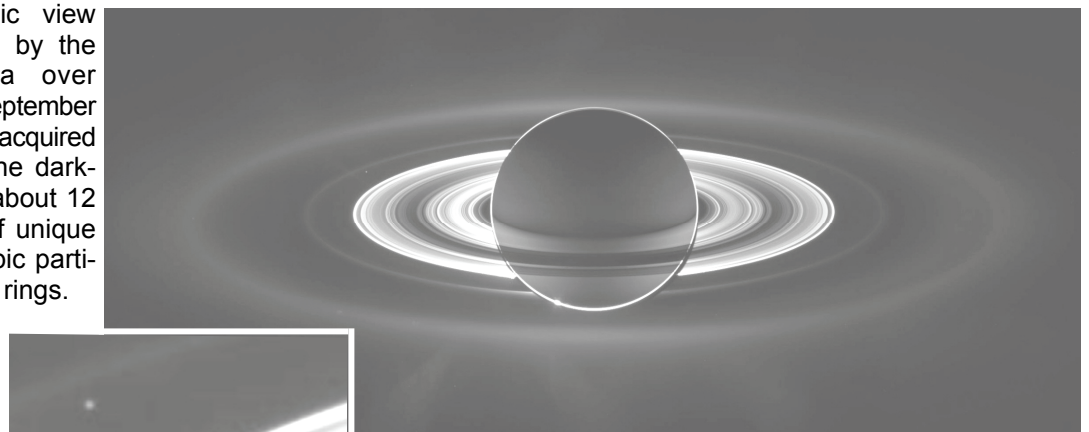
Different perspective on Saturn

Saturn hangs in the blackness sheltering the Cassini spacecraft from the Sun’s blinding glare, showing the ringed planet as never seen before.

This marvellous panoramic view combined 165 images taken by the Cassini wide-angle camera over nearly three hours on 2006 September 15. The mosaic images were acquired as the spacecraft drifted in the darkness of Saturn’s shadow for about 12 hours, allowing a multitude of unique observations of the microscopic particles that comprise the faintest rings.

The narrowly confined G ring is easily seen here, outside the bright main rings. Encircling the entire system is the much more extended E ring. The icy plumes of Enceladus, whose eruptions supply the E ring particles, betray the moon’s position

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in the E ring’s left side edge (as shown below). Engulfed in the G ring and above the brighter main rings is the pale dot of Earth (with any luck, just visible in the inset).

Cassini views its home planet from about a billion miles away in the icy depths of the outer Solar System.

The disc of the planet as seen from within Saturn’s shadow gives a dramatic view of the ring system, and, if you look very carefully, you may see the dot of the distant Earth embedded in the rings (shown enhanced in the inset) Image Credit: NASA/JPL/Space Science Institute