AAE

Gnomon

Newsletter of the Association of Astronomy Education

Vol. 28 No.4 ISSN 0952 326X SUMMER 2009

GCSE Astronomy — the new syllabus for 2010

Many readers of *Gnomon* are involved with delivering Edexcel's GCSE Astronomy qualification, which continues to grow in popularity with over 2000 candidates sitting this summer's examination.

The syllabus for this qualification has recently undergone a revision. The new syllabus will be available from this September, with the first examination taking place in the summer of 2011. The new GCSE in Astronomy will still be assessed by a written examination paper accounting for 75% of the final grade with controlled assessment tasks (i.e. 'coursework') still making up the other 25%.

A summary of the material in the new syllabus is shown below. Given the popularity of the previous, long-standing syllabus there have not been a large number of changes to the content of the syllabus.

Following consultation with both teachers and professional astronomers, the following additions to the syllabus were made to reflect recent developments in astronomy:

- Eratosthenes' measurement of the Earth's circumference.
- a knowledge of a number of principal lunar features
- origins of the Moon (giant impact hypothesis)
- likely origins of planetary moons
- potentially hazardous objects
- exoplanets
- origins of water on the Earth
- life in the Universe: SETI, the Drake Equation and Goldilocks Zones
- Hubble's Law
- existence of dark energy and dark matter
- active galactic nuclei

To sharpen the focus of the qualification upon practical observational astronomy, leaving some of the more detailed astrophysical or mathematical topics to other courses such as GCSE Science or A-level Physics, the following items were removed:

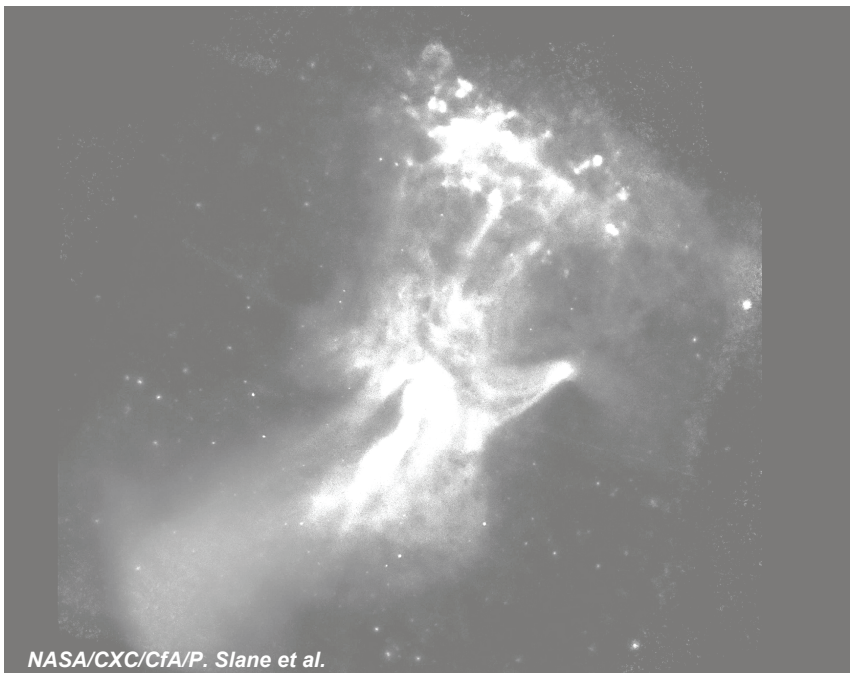
- seasons
- tides
- rockets and satellites
- origins of lunar features
- temperature distributions in the Sun
- telescope ray diagrams
- extended calculations with Kepler's Third Law of Planetary Motion and Newton's Law of Universal Gravitation

details of techniques in radio astronomy

☞ *(cont. on page2)*

Giving this pulsar a big hand

A small, dense object only 12 miles diameter is responsible for this beautiful X-ray nebula that spans 150 light years. At the centre of this image made by NASA's Chandra X-ray Observatory is a very young and powerful pulsar, known as PSR B1509-58, or B1509 for short. The pulsar is a rapidly spinning neutron star which is spewing energy out into the space around it to create complex and intriguing structures, including one that resembles a large cosmic hand. Astronomers think that B1509 is about 1,700 years old and it is located about 17,000 light years away. Neutron stars are created when massive stars run out of fuel and collapse. B1509 is spinning completely around almost seven times every second and is releasing energy into its environment at a prodigious rate - presumably because it has an intense magnetic field at its surface, estimated to be 15 trillion times stronger than the Earth's magnetic field. The combination of rapid rotation and ultra-strong magnetic field makes B1509 one of the most powerful electromagnetic generators in the galaxy. This generator drives an energetic wind of electrons and ions away from the neutron star. As the electrons move through the magnetized nebula, they radiate away their energy and create the elaborate nebula seen by Chandra.



NASA/CXC/CfA/P. Slane et al.

☞ (cont. from p.1) *GCSE Astronomy — the new syllabus for 2010*

Overview of new syllabus content

TOPIC 1: EARTH, MOON AND SUN

- Size and shape of the Earth
- Earth's atmosphere
- Earth as a site for astronomical observation
- The Moon and its principal features
- Possible origins of the Moon
- Lunar orbit and phases
- Size and shape of the Earth
- Earth as a site for astronomical observation
- Reflecting and refracting telescopes
- The Moon and its principal features
- Possible origins of Moon
- The Solar surface and atmospheric features
- Energy production in the Sun
- Solar EM radiation
- Sunspots
- Solar wind and aurorae
- Solar observation
- Solar and sidereal day
- Equation of Time

TOPIC 2: PLANETARY SYSTEMS

- Solar System bodies, including planets, dwarf planets, asteroids, comets, Centaurs and Trans-Neptunian Objects.
- The ecliptic and zodiac
- Meteors
- Kepler's Laws
- Space exploration
- History of discoveries
- Exoplanets—difficulties and techniques for their discovery
- Life in the Universe

TOPIC 3: STARS

- Naked-eye objects in the night sky, e.g. constellations, clusters, nebulae
- Seasonal variations in our view of some objects in the night sky
- Circumpolar and non-circumpolar stars
- Star charts and planispheres
- Messier catalogue
- Spectroscopy and the study of stars
- Magnitude scale and spectral classes
- Hertzsprung-Russell diagram
- Stellar distance determination
- Cepheid variables
- Stellar evolution

TOPIC 4: GRAVITY AND COSMOLOGY

- Shape and structure of our Galaxy and their discovery
- The Local Group
- Distance scales
- Other galaxies and clusters
- Redshift and Hubble's Law
- Quasars and Cosmic Microwave Background radiation
- Large scale structure and evolution of the Universe
- Cosmological models
- Big Bang
- Dark matter and energy

Controlled assessment

This is the area where the most significant changes have taken place to increase the level of control over the work submitted by candidates, following guidelines from the Qualifications and Curriculum Authority (QCA). The intention has been to retain the individual observational work which students completed as part of their coursework in the previous qualification whilst ensuring that all work submitted was the student's own.

Students complete their own astronomical observations, now choosing two tasks from the list shown in the following lists. One task is an unaided eye activity from List A and the other involves some form of optical aid (List B). Students may *not* complete a pair of tasks with the same number in both lists, thus ensuring that their controlled assessment covers a range of astronomical areas. They then complete a written report on each task, under controlled conditions. These reports are marked by teachers, with a sample being moderated by Edexcel.

CONTROLLED ASSESSMENT TASKS

Choose one task from each of Lists A and B.

List A*: *Unaided observations

1.*Lunar Features* Produce a series of naked-eye drawings of three lunar surface features. Use them to show their changing appearance at different lunar phases.

2.*Meteor Shower* Observe a meteor shower. Record meteor trails on a drawing of the stellar background from sketches and estimate magnitudes of the meteors. Locate and show the position of the radiant.

3.Drawings of lunar or solar eclipse: using a suitable method of observation (lunar – direct, solar – pinhole projection), produce a series of drawings showing the progress of a lunar or solar eclipse.

4.Constellation drawings: observe and make detailed drawings of three different constellations, recording dates, times, seeing and weather conditions, noting star colours (if possible) and estimating magnitudes by comparison with reference stars.

5. Drawings of a celestial event: with the unaided eye, produce a series of drawings to record the passage of a suitable celestial event, e.g. a transit, occultation or comet.

6.Shadow stick: use a shadow stick to record the direction of the Sun at different times on at least two days and hence determine (a) the time of local noon and (b) the observer's longitude.

7. Levels of light pollution: use repeated observations of the faintest stars observable to quantify the effect of light pollution at two different sites. ☞

Subscription Rates:
Individual Members..... £14.00
Retired Members £12.00
Corporate Members
(e.g. schools, colleges etc.) £28.00
Members receive yearly four issues of *Gnomon*. Corporate Members will receive three copies of each issue.
A £2 discount is made on all annual subscriptions paid by direct debit.
Extra Copies:
0 - 10..... £1.00 per copy
11 - 50..... £0.75 per copy
51 +..... £0.50 per copy
(Back numbers, not less than one year old, half these prices.)

There will generally be a 10% discount to AAE members on all publications and advertising rates.
Practising teachers may claim their subscriptions as an allowance against income tax, effectively reducing their contributions.

All communications (except those to the Editor) should be addressed to:
Association for Astronomy Education
The Royal Astronomical Society
Burlington House, Piccadilly
LONDON W1J 0BQ
www.aae.org.uk

For all enquiries concerning the newsletter, contact the Editor:
Richard Knox
3 Alexandra Terrace
Penzance, Cornwall, TR18 4NX
gnomon_editor@talktalk.net
Telephone: 01736 362947
Any photographs sent to the Editor by email (preferred) should be sent in a common format (TIF or JPEG) with resolution not less than 300 dpi

Advertising Charges:
Whole page..... £120
Half page £60
Quarter page..... £30
Inserts £75
(Inserts may be of any size which may conveniently be inserted in the newsletter. Heavy items may incur an additional charge for postage.)
A 25% reduction is made for advertising in all four issues.
Publication Dates:
These are at the equinoxes and the solstices, that is four times a year. Copy deadlines are six weeks before these dates.

☞ 8. Sunspots: use a pinhole to project an image of the Sun onto a suitable background and observe and record sunspots over a sufficiently long period of time to determine the Sun's rotation period. WARNING: The Sun must NOT be viewed directly, even without optical aids.

9. Light curve of a variable star: use a series of naked-eye estimates of the magnitude of a suitable variable star over a sufficient period of time to determine the period of the star.

10. Estimating stellar density: by counting the numbers of visible stars within a certain area of sky, estimate and compare the density of stars in the sky, parallel with and perpendicular to the plane of the Milky Way.

List B: Aided observations

1.*Lunar features:* produce a series of telescopic drawings and/or photographs of three lunar surface features. Use them to show their changing appearance at different lunar phases.

2. *Meteor shower photography*: use long-exposure photography to obtain photographs of a meteor shower. Estimate magnitudes of the meteors. Locate and show the position of the radiant.

3. *Photographs of lunar or solar eclipse:* using a suitable method of observation (Lunar – direct, Solar – projection), produce a series of photographs showing the progress of a lunar or solar eclipse.

4.*Constellation photography: p*roduce photographs of three different constellations, recording dates, times, seeing and weather conditions. Use the photographs to identify colours and magnitudes by comparison with reference stars.

5.*Telescopic drawings or photographs of celestial event*: produce a series of detailed telescopic drawings or photographs to record the passage of a suitable celestial event, e.g. a transit, occultation or comet.

6.*Sundial:* on at least three widely spaced dates, compare the time shown on a correctly aligned sundial with local mean time. Use these data to determine the accuracy of the sundial used.

7.*Photographic measurement of light pollution:* use the magnitudes of the faintest stars visible in long exposure photographs to quantify the effect of light pollution at two different sites.

8.Sunspots: use a small telescope to project an image of the Sun onto a suitable background and observe and record sunspots over a sufficiently long period of time to determine the Sun's rotation period. WARNING: The Sun must NOT be viewed directly, especially with optical aids.

9. Light curve of a variable star: use a series of telescopic estimates of the magnitude of a suitable variable star over a sufficient period of time to determine the period of the star.

10. Measuring stellar density: Use binocular/telescopic observations or original photographs to measure and compare the density of stars in the sky, parallel with and perpendicular to the plane of the Milky Way.

11.Drawing of Messier Objects: Use binoculars/telescope/ robotic telescope to produce detailed drawings and/or photographs of at least three Messier/NGC objects.

12.Measuring the sidereal day: take long-exposure photographs of the circumpolar stars around Polaris or the South celestial pole and use them to determine the length of the sidereal day.

The consultation which took place before the revision of this qualification uncovered a strong feeling amongst both teachers and professional astronomers that there should be a firm focus on astronomical observation. Hence all the task titles involve students taking some form of astronomical observation, one aided and the other unaided.

Once completed, all tasks are awarded marks for the quality of the design, observations, analysis and evaluation demonstrated.

GCSE Astronomy continues to provide an excellent way for schools and colleges, particularly those with Specialist Science status, to tailor and extend their range of scientific courses. The fascinating but accessible material and engaging controlled assessment of this qualification have ensured that its popularity has risen every year for the past decade.

Copies of the new specification and support material for delivering the new course can be downloaded from the Edexcel website at:

www.edexcel.com/quals/gcse/gcse09/Astronomy/Pages

Julie King
Principal Moderator for GCSE Astronomy, Edexcel
jking#ermysteds.n-yorks.sch.uk

AGM at Mill Hill, September 26

The preliminary announcement for this was a loose insert into the March issue of *Gnomon*. However it does not matter at all if you lost it - just let the secretary know if you intend to come. (Teresa Grafton is our current secretary and she can be contacted via our postal address or via e-mail: **aae#erwwen.co.uk**).

Mill Hill is the University of London's Observatory and is a hands-on teaching department, part of the Astrophysics Group at UCL. Five telescopes are currently in use and there will be an opportunity during the day to tour the domes and hear about the observing programmes. There will also be short talks by attending members, hands-on classroom activities and an opportunity to swap classroom resources.

Members and friends are cordially invited to attend this day out at the University of London Observatory, Mill Hill. . The preliminary programme for the day is:

10.30 Registration and coffee
11.00 Annual Business Meeting and elections
12.00 Astronomy presentations by attending members, and presentation of hands-on activities
13.00 Lunch
14.00 Viewing of the observatory
14.30 Keynote talk—speaker to be announced
15.15 Further teachers' sessions
16.00 Brief meeting of the new Council. All are welcome to attend this, but only Council members are entitled to vote.

Elections are for the following Council positions: President, two or three Vice-presidents, Treasurer, Secretary, Assistant Secretary and at least three Council members. Nominations should be sent to the secretary, Teresa Grafton, to reach her several days before the meeting. Also let her know if you yourself are interested in standing for any of the above positions—new faces are always welcome!

There will be a small registration fee for the day to cover the costs of coffee, tea and lunch.

The University of London Mill Hill Observatory, address is 553 Watford Way, Mill Hill Park, London NW7 2QS. This is a ten-minute walk from Mill Hill Broadway Station which is on the line north from the new St Pancras Station. If you are coming by car, there is limited parking at the Observatory.

Hope to see you all there.

Letter from Down Under

The past month has been quite a momentous time for the Anglo-Australian Observatory. The night of 27 April marked the 35th anniversary of "First Light" on the 3.9-m Anglo-Australian Telescope. The very first photographic plate exposure was taken by commissioning astronomer (and fellow New Zealander) Ben Gascoigne and is shown in the attached figure. The purpose of this exposure was to test the polar alignment of the telescope. It is a little-known fact that this image was taken before the primary mirror had received its first coating of aluminium, as the coating plant assembly was delayed in England, and did not arrive until mid-1975. Even with just 4% reflectivity, a 4-m glass mirror collects quite a bit of light! HRH Prince Charles officially inaugurated the AAT at a ceremony 6 months later.

The AAT grew out of discussions between British and Australian astronomers in the early 1960s about the possibility of locating a 150-inch telescope in the southern hemisphere, after the United Kingdom rejected an invitation to be a founding member of the European Southern Observatory (ESO). Negotiations between the UK and Australian governments got underway in 1967, and culminated in the signing of the Anglo-Australian Telescope Agreement on 25 September 1969. A Project Office was established on the grounds of the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Division of Radiophysics in the Sydney suburb of Epping, and work began on the 50 metre high building and dome at the chosen site on the Australian National University's Siding Spring Observatory in the central west of New South Wales.

The American form of Owens-Illinois was contracted to provide the mirror blank, made from a low-expansion glass-ceramic material called Cervit. A Ritchey-Chrétien optical design was selected to deliver the wide field of view required for photography, and the contract to polish the mirror to specification and fabricate the tube joining the primary and secondary mirrors was awarded to Sir Howard Grubb, Parsons and Company of Newcastle-upon-Tyne. Mitsubishi Electric Corporation of Japan won the contract to build the equatorial horseshoe mounting. In a leap of faith, an Interdata Model 70 computer with a whopping 64MB memory was selected to provide real-time control of telescope tracking, guiding, and instrument communication. This platform proved so versatile and robust that it was only retired late last year, making it probably the world's longest-running computer system in continual operation. It has now been donated to Sydney's Powerhouse Museum!

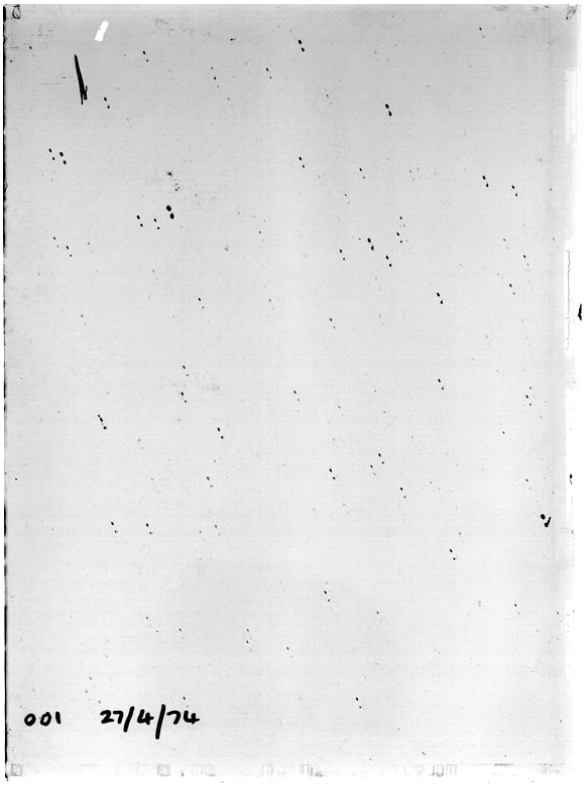
The final cost of the observatory when completed was A$16 million. Just before the AAT was commissioned, the UK installed a 1.2-m Schmidt telescope adjacent to the AAT which could survey the entire southern sky, and pick out thousands of intriguing new sources for the AAT to investigate. In 1988, the AAO assumed full responsibility for the UK Schmidt as well as the AAT, and both facilities have served the UK and Australian astronomy communities well, achieving capabilities their designers never even dreamed of.

Alas, by the start of the 21st century the UK was reconsidering its decision not to join ESO, as well as looking at ways to increase UK access to larger telescopes including Gemini. To pay for all this, the Particle Physics and Astronomy Research Council (now the Science and Technology Facilities Council) made the difficult decision to withdraw from the AAT Agreement. Under the terms of this bi-national treaty, either party is required to give 5 years' notice of their intention to terminate the agreement. The UK issued this notification in 2005, ramping down their interest only 11% of the AAT time, and from 1 July 2010 their funding of the AAO will end altogether.

For some years now, the future funding and governance arrangements for the AAO have been a source of much concern to AAO staff, users, and the wider community. It was with great relief therefore that we received the news this week that the Australian federal government signaled in its 2009/10 Budget that it will make up in full the shortfall in funding brought about by the UK's withdrawal. This is all the more remarkable in a year which has seen government revenues take a dramatic hit, and reflects the fact that government sees investment in research and technology as a legitimate form of economic stimulus that can pay dividends now and into the future. In fact this government has singled out space science and astronomy as one of three "Super Science" areas (the others being marine and climate science, and "future science", i.e. biotechnology and nanotechnology) which will have their own special funding for research fellowships and infrastructure. This is a major vote of confidence by the government in all areas of astronomy, including the AAO and Australia's bid to host the Square Kilometre Array radio telescope.

It will be a sad day indeed when we sever formal links with our British colleagues after 36 years of outstanding science cooperation (and mutual teasing of each other) at the Anglo-Australian Observatory. We fully expect the many productive collaborations between British and Australian astronomers to continue on the AAT, even though British astronomers will no longer have a guaranteed share of time, and will now have to fight for whatever time the Australian-dominated time assignment committee feels is warranted on the basis of scientific merit. The AAT may be about to become the "All Australian Telescope", but we expect to be hearing British accents around the dome and Epping headquarters for a long time yet.

Stuart Ryder
sdr#aao.gov.au



First photographic plate ever exposed with the AAT. It is likely that two exposures were recorded on the same star field near the south celestial pole, with a slight offset between them, to save on (what was then quite expensive) photographic plates.

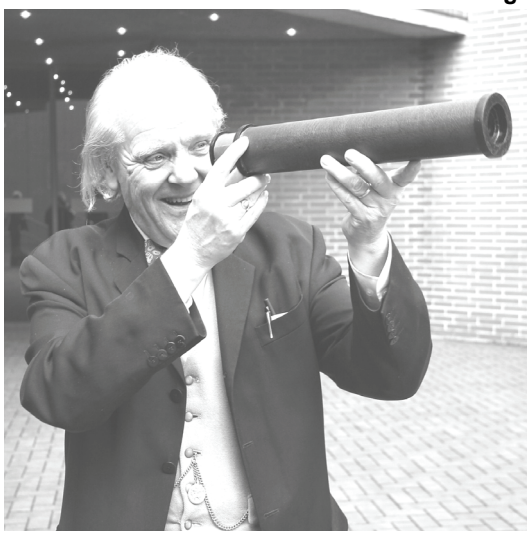
Thomas Harriot lecture and reception

Tickets are now on sale for Harriot Day at Syon Park, Middlesex. The lecture and reception will be on Sunday July 26.

Celebrating 400 years of the astronomical use of the telescope, the lecture, *Thomas Harriot: the Englishman who beat Galileo,* will be given by Dr Allan Chapman (of the University of Oxford) in the Garden Room Marquee at Syon Park at 5.30pm. It will follow the unveiling of a memorial to Harriot by Lord Egremont of Petworth. The lecture will then be followed by a buffet reception with live music of Harriot's time. This event is the culmination of Thomas Harriot Day at Syon Park and is part of the International Year of Astronomy 2009. Go to the website for full details of the day and evening event and how to purchase tickets, which are £20 each. 💻 **telescope400.org.uk**

Teresa Grafton

Ann Mills has produced a short account of Harriot's life and achievements. This illustrated booklet with a foreword by Sir Patrick Moore can be obtained from The South Downs Planetarium. The price is £3.50 +p&p:
☎ 01243 774400 💻 **www.southdowns.org.uk** *Ed.*

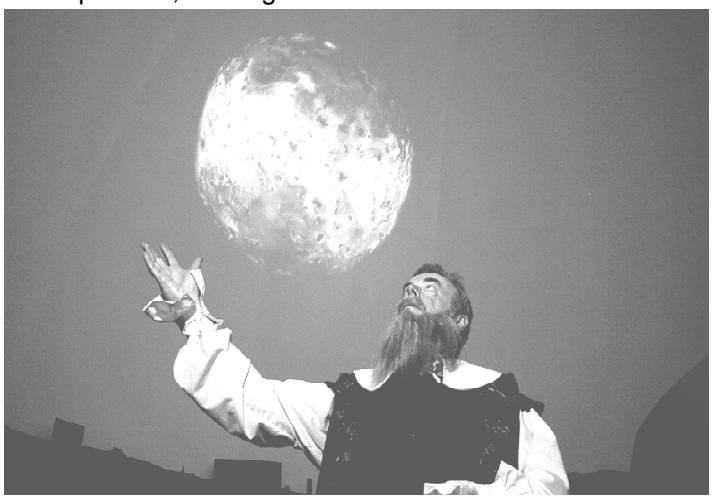


Dr Allan Chapman with his replica of the telescope that Thomas Harriot would have used to observe the Moon in July 1609. ***(Photograph: Brendan Blake)***

Galileo Galilei ALIVE in your school !!

UNSECO has designated 2009 as International Year of Astronomy in recognition of Galileo Galilei's development of the telescope and subsequent observations of the Moon at the end of 1609.

1610 was, however, an even more exciting year in the history of Astronomy as Galileo turned his attention to Jupiter and Venus as well as observing sunspots convincing himself that Copernicus had been right about the universe and, in the process, earning himself fame and admiration across Europe. That this fame would later change to notoriety and bring him into fateful confrontation with the Church authorities makes the Galileo story one of the most compulsive and illuminating in the history of Science.



Galileo, aka Peter Casey, discovers Io in the planetarium, while recounting the trials of Galileo.

Peter Casey, an actor, writer and retired teacher, has been touring "*The Trials of Galileo*", his vivid portrayal of the great Tuscan mathematician and astronomer, around UK schools for the last year. Galileo tells the students about his life and achievements, including his challenges to the accepted wisdom of Aristotle and his observations of the heavens, putting his life and work into a clear historical context.

This is more than a one-off show, it is a whole-school experience. With his replica Galilean telescope, Peter will spend a full day in character in a school offering presentations across the age range, as well as plenty of opportunity for informal interaction on corridors and even taking lunch with students. Described by Heathside School, Weybridge as "…an original and inspiring day", "*The Trials of Galileo*" can be used as a Science/Astronomy resource or shared with RE, History and Drama. The whole day costs just £250 plus £50 where an overnight stay is required outside the Merseyside area. Further details can be found on the website: 💻 **www.blindseerproductions.com**

For your Library

The Cambridge Double Star Atlas. James Mullaney and Wil Tirion. ISBN 978-0-521-49343-7. £27.50 (pbk, spiral bound). pp148; Cambridge University Press.

This is a significant addition to Wil Tirion's spectacular star atlases, having all the benefits of complete sky coverage, showing stars down to a visual magnitude of 7.5. It also plots nearly 2400 double and multiple stars on the maps, labelled in green which shows up well under the red light you need at the telescope to maintain your dark adaptation. The atlas can also be used as a general guide to the night sky as it shows the positions of constellations, star clusters, variable stars, nebulae and galaxies. These are colour coded for easy identification

It is estimated that at least 80% of stars are in pairs or multiple systems, very many of these being resolvable through binoculars or a small telescope (between 2" and 14" in aperture). This atlas comprises 30 maps, drawn in Wil Tirion's famous style and printed with stunning clarity. They will get you started in finding these double gems. There is a full listing in an Appendix, giving RA, Dec, designation, magnitudes and separations. The designations used are the ones by which star pairs are officially and/or best known by observers and the system of designation is fully explained.

The text and the vivid descriptions of the double stars are by James Mullaney who is an experienced observer. He describes how to train the eye to record faint detail and how to perceive the subtle colour combinations in the stars. Other important factors such as seeing, resolution and collimation are also considered. The text is readable and clear and could be accessible to the strongest GCSE candidates, with some help from a tutor. A "Starter list" of 133 of the finest and easily observable doubles follows. This sent me scurrying outside with my binoculars and I was soon locating the more widely spaced ones. The maps were user-friendly and the book is spirally bound and lies flat in the garden. Descriptions accompanying each double star listing encourage you to look for the colour contrasts. It is as if the author were at your shoulder guiding you.

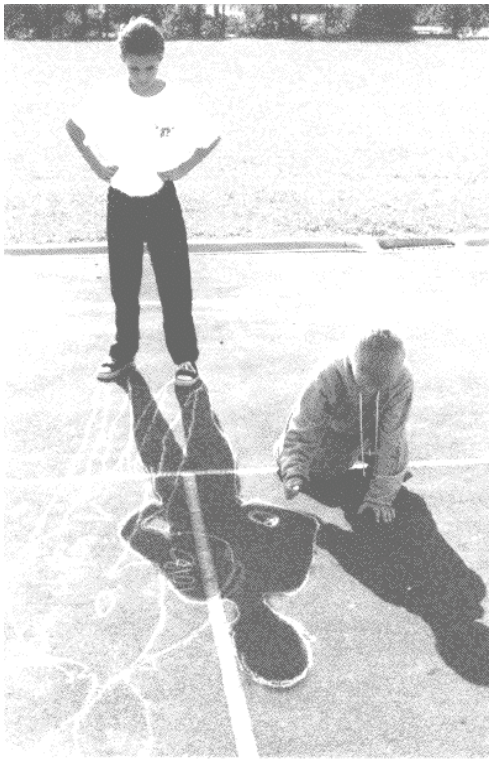
This book could be used as a starting point for GCSE Astronomy coursework (see page 1) but it is also an outstanding reference work which all amateurs will want to own and use regularly. **Anne Urquhart-Potts**

Curriculum Corner

Daytime Astronomy: Draw my shadow

This is the first of a series of exercises from Eric introducing students to a series of practical astronomical observations and activities during the day. This then leads to students doing their own night-time observations at home.

Materials and facilities required: chalk, sunny day, clock or watch; paved area outside.



Vocabulary: shadows; North Pole; solar noon

There are two noons every day. 'Clock' noon (12 o'clock) and Solar noon when the sun is half way in time between sunrise and sunset at your location. Identifying solar noon and shadow direction (true north) are critical for most of the following activities in this and subsequent exercises. Discovering that there is such a daily event as solar noon and that only at this time do shadows point to the North Pole will be new to most students.

At 9.30 a.m. on a day that is likely to remain sunny, take the group outside to an open paved area clear of any trees and buildings that may cast shadows in that area later. Working in pairs, the students draw with chalk around each other's shadows and their shoes (so they can stand in the same position later). The students should print their names and the time on their shadows.

At 10 a.m. the students should stand back in their shoe outlines, draw around their shadows again and record the time. Repeat this activity at 10.30 and discuss possible reasons why the shadows change.

Get each student to draw a circle on the ground where they guess the shadow of their head would be at 11.00. At 11.00 the students should stand in their shoe outlines again to see how close the shadow of their heads were to their guesses. Draw around their shadows again.

It is likely that the students will want to keep recording their shadows until later in the day. When they have completed a day's observations, ask them to draw a line connecting the top of the shadows of their heads.

The point along the line where the shadow would have been shortest was when the sun was halfway between sunrise and sunset and was on the meridian for your place. This was the time of solar noon. All shadows cast at solar noon point to the true North Pole.

Alternatively an 11.00 a.m. to 1 p.m. series of observations may be done as a separate activity on a later occasion by starting the observations at, say 11 a.m. and doing them every half hour until 1 p.m. Draw a line across the top of the heads (as above) and determine solar noon.

(During summer time make all observations one hour later to cover the solar noon).

Eric Jackson

EAAE Course on Astronomy Education

This year, the EAAE is organising a specific course for teachers to offer them access to new educational materials and methods and the chance to exchange experiences.

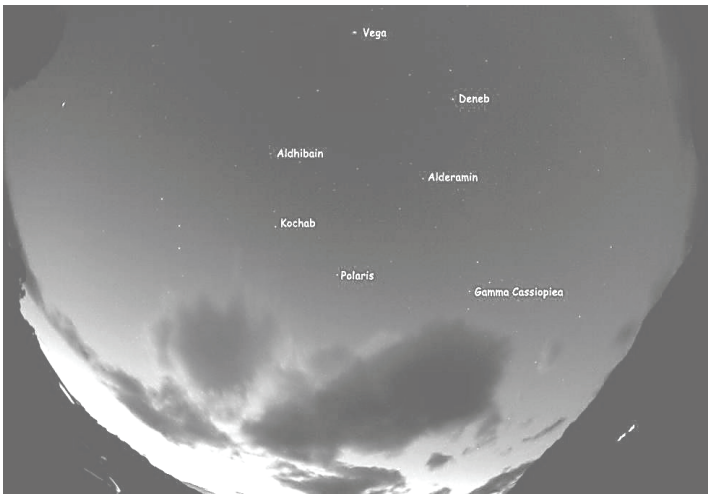
Entitled "*Mathematics and Astronomy, a Joint Long Journey",* the course will be run in Madrid, from 2009 November 26 till December 1. This course is open to all secondary school teachers who work in European countries. Details from the EAAE website: **www.eaae-astro.org**

Planetarium operators stretch the imagination

This year members of the British Association of Planetaria (BAP) held their Annual Meeting at the National Maritime Museum in Greenwich. On several occasions in the past, AAE and BAP have held joint events. In 2003, memorably, the two associations went to Orkney together at the time of an annular eclipse. The two associations have members in common as well as a number of interests and concerns. With this in mind, I thought a report of the recent BAP meeting might interest *Gnomon* readers.

This well-attended occasion was a good opportunity to take a look at the Greenwich facilities, particularly the new Peter Harrison Planetarium. This was the venue for some fascinating displays of creativity on the part of member facilities, for example, the planetarium at Thinktank, Birmingham. Mario di Maggio has been developing an informative and very attractive presenter-led show based on ancient Chinese constellation art. Called "*Written in the Stars - Chinese art in the sky*", it is a beautiful display of original artwork.

We also saw material from Centre 4 Life in Newcastle's interesting and topical show, "Voyage of the Beagle". While this was at the other end of the technological continuum, a Dutch designer, Robin Sip of Mirage3D, gave a breathtaking display of full-dome technology with sequences from their new show "Natural Selection", also about the Darwin Beagle voyage. In addition, we were treated to demonstrations of the growing power of the immersive dome experience from Global Immersion, and the event's major sponsors - Evans



The stars the pupils used to make a new constellation.
(Picture courtesy Highland Constellation Project)

and Sutherland and Sky-Skan. These showed just how far dome technology has come since the world first saw full-dome digital projection in action at the London Planetarium during IPS'98.

I think most of us would agree that a planetarium presentation, whether in a mobile or fixed facility, is an unbeatable way to introduce children (and adults too) to the universe. The BAP web site has details of facilities throughout the UK, so check up what is on your doorstep, if you do not already know! This website is due for substantial redevelopment in the near future.

In a sparkling programme, if I had to pick two items that really stood out I would go firstly for the Ghana Science Project which has resulted in the first planetarium to be built in that country and the first digital projector in sub-Saharan Africa.

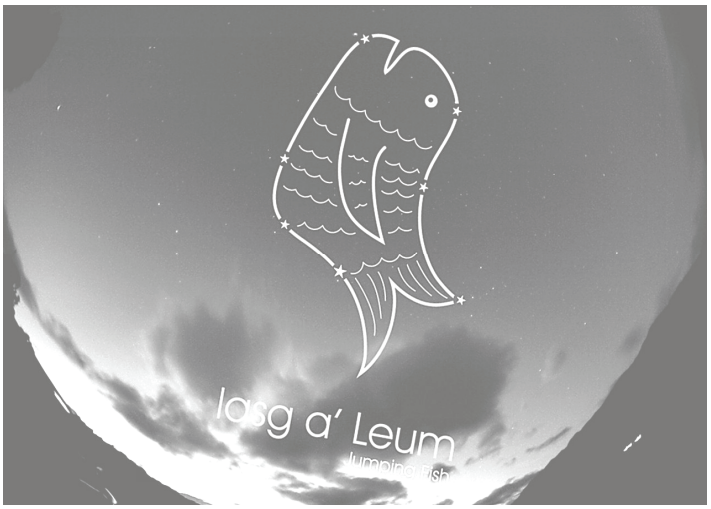
The project is the result of the enthusiasm of one man, Jacob Ashong, aided by his wife, Jane, and son. It has been achieved on the proverbial shoestring, collecting cardboard from local shops to provide a skin to cover the wire frame of the dome which was then covered by pieces of waterproof sheeting sewn together by a posse of local tailors. Look at the pictures and follow the link on the website (see bottom of column 1) to hear Jacob tell the story of this new addition to the world's planetaria.

It is salutary to contrast the technology enjoyed by science education facilities in the West and countries like China and India, with what is available in countries like Ghana. Incidentally, if any AAE member or school in the UK has materials or equipment to share or going begging, do contact Jacob Ashong. This project is very keen to strike up relationships and interactive partnerships with people and facilities over here.

Another "wow" moment in the meeting came when Dr Gill Russell (CosmicSky/artist) and Professor John Brown (Scotland's Astronomer Royal/magician!) gave a presentation about their IYA-funded Constellation Project in which seven Scottish primary schools from all over the country have taken part in a competition to make a new constellation from stars they have chosen. John Brown and Gillian Russell visited the schools and ran several exciting and inspiring workshops for years 5-7. These involved choosing the "school star", a mobile planetarium show, a cosmic art workshop and magic demonstrations of cosmic phenomena.

The chosen stars relate to a series of historic astronomical landmarks all over Scotland. These include the Mills Observatory, built in 1935. which was linked to Aldebaran, and the wonderful 3000 BC Maeshowe Tomb on Orkney, linked with the spectacular Double Cluster in Perseus. The children have used these stars to make a constellation for IYA 2009.

The new constellation will create a legacy for IYA 2009 and also connect schools participating in the project with each other and with the powerful heritage of astronomy in Scotland which enjoys some of the UK's darkest skies.



Jumping Fish—the winning design
(Picture courtesy the Highland Constellation Project)

The competition is still in progress but you can see above the winning "Jumping Fish" constellation that a pupil from Ullapool created for the Highland Constellation Project in 2007. This year's competition looks like producing something every bit as exciting. The enjoyment of all involved was obvious from the presentation and BAP members were extremely enthusiastic about this highly imaginative and well-executed initiative. AAE members can learn more about the project from Gillian Russell on the CosmicSky link in the list of useful websites.

All in all, the BAP Annual Meeting in IYA2009 was a great success and leaves one feeling optimistic about the efforts being made to bring astronomy to life within and beyond the classroom.

Teresa Grafton
Secretary, AAE

Useful Websites:
www.planetarium.org.uk (*-BAP site)* **www.thinktank.ac/**
www.life.org.uk **www.mirage3D.nl**
www.ghanascienceproject.net/
www.cosmicsky.co.uk/pdf/primary-schools- constellation-project.pdf

Sky Diary Spring 2009

Summer skies suffer the natural light pollution of the midnight twilight at British latitudes. Readers like Eric Jackson and Stuart Ryder (see respective pages) get their dark nights now, but in the north, where the permanently twilit sky is not quite what the doctor ordered for astronomical pursuits, there are some memorable events that take place. It's also warm out there (usually, although I am told it is the fault of global warming that we are suffering almost freezing temperatures at night as we write our late copy now in early June!).

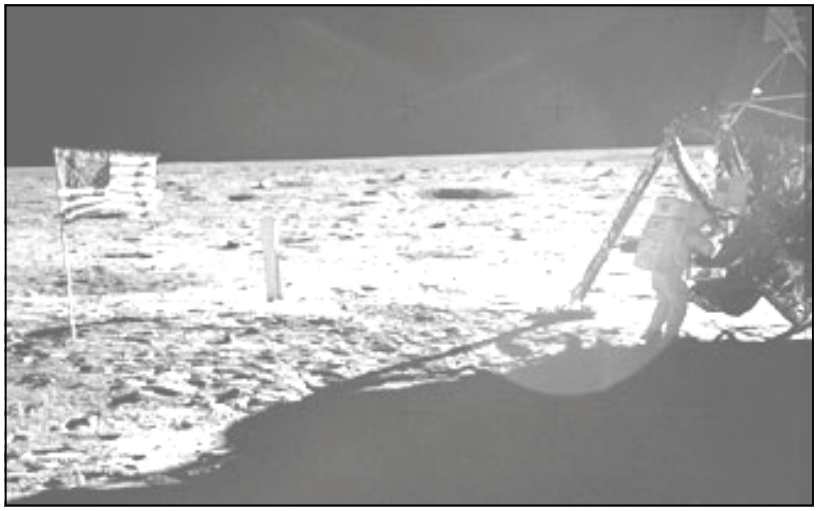
The midnight Sun needs a trip to the Arctic Circle, and that is an interesting aspect of the far North at this time, but one can watch the Sun pass right round the northern horizon through the night by following the nimbus of the twilight glow. This is an ideal activity for campers! Of course, it depends upon how you define "twilight". For the purposes of our civil environment, Civil twilight lasts from sunset to a depression of the Sun (the negative altitude of the Sun below the horizon) of 6º. Sailors defined twilight by when they lost sight of the horizon at sea after sunset, and that led to Nautical twilight being defined as lasting till the depression of the Sun reaches 12º. Finally, astronomers wanted the sky to be really, really dark, and so Astronomical twilight ends when the Sun is more than 18º below the horizon. Even when due north (close to midnight local mean time) the summer solstice Sun with a declination of about 23½º is only about 12º below the horizon from mid-British latitudes, so Astronomical twilight and even Nautical twilight lasts all night.

This issue of *Gnomon* comes out just in time for an all-night celebration (watching the twilight, if you like) to bring back memories of 40 years ago. Just like the questions "Where were you when you heard of the death of Kennedy/ Princess Diana?", one usually can remember the ☞

☞ answer to "Where were you on the night of July 20th 1969?". It was the night Neil Armstrong took "One small step for (a) Man (man), one giant leap for Mankind."

Apollo 11 was launched atop a Saturn V rocket from the Kennedy Space Center on July 16th 1969. It carried Mission Commander Neil Armstrong, Command Module Pilot Michael Collins and Lunar Module Pilot Buzz Aldrin. On July 20, Armstrong and Aldrin became the first humans to land on another world, while Collins was being forgotten by nearly everyone. (Can you imagine a worse job: standing by while history is being made by your colleagues?) The landing site chosen was in the Mare Tranquilitatis because it was expected to be a relatively smooth and level area. Neil Armstrong became the first human to set foot on the surface of another world. Aldrin joined him shortly afterwards, and offered a simple but powerful description of the lunar surface: "magnificent desolation."

The image (from NASA) shows Armstrong working at an equipment storage area on the lunar module. This is one of the few photos that show Armstrong during the most famous excursion on the surface of another planet, because he was the one with the camera most of the time! Armstrong and Aldrin explored for only two and a half hours, collecting rock and soil samples and taking photographs.



"Now where did I put the script for that dratted historic speech for posterity. It was here when the Eagle landed"

They left behind an American flag, a patch honouring the fallen Apollo 1 crew, and a plaque on one of Eagle's legs. It reads, "*Here men from the planet Earth first set foot upon the moon. July 1969 A.D. We came in peace for all mankind.*" That night I waited well into the wee small hours, using the time to observe Saturn (the Moon, of course was fairly young, with the Sun just rising on "Tranquillity Base", and in the UK it had set long before the great moment). Saturn was well placed in Aries and rose just before midnight. So we had three hours to kill quite happily immersed in studying the sky. But back to 2009!

Saturn is now near the intriguing rings edge-on position on the eastern borders of Leo, and we will not see Saturn's bottom again high in the northern skies for some 20 years - when it will have got back into Taurus, for example. This observer will not be so spry by then. Come to think of it, lucky to still be observing anything!

By the middle of the coming quarter (August 15th) the so-called "Summer Triangle" will be high, in fact at midnight almost pointing to the south point of the horizon through Altair. Saturn and Mercury will have set, fairly close together, soon after sunset and be a challenge to spot, whilst Jupiter will be getting ever more prominent in Capricornus. It is an intriguing fact about Jupiter that, since the planet takes about 12 years to make its orbit round the Sun, from the Earth it appears to move eastwards across the background stars by about one zodiacal "house" each year. This is *very* roughly one constellation along the ecliptic each year. So, whilst being in Capricornus is noticeably further north than the planet has been for several years, by next year, when it passes through Aquarius it will be returning to a useful height for northern observers.

Rising and setting times (UT): lat.52°N; long.3°W

	July 15		August 15		September 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	04:10 ♊	20:25	04:54 ♌	19:37	05:46 ♌	18:26
Mercury	04:09 ♊	20:41	07:27 ♌	20:15	06:58 ♍	18:15
Venus	01:24 ♉	17:12	01:41 ♊	17:54	02:58 ♌	17:38
Mars	00:44 ♉	16:36	23:49 ♉	16:25	23:10 ♊	15:47
Jupiter	21:39 ♑	07:21	19:34 ♑	05:03	17:21 ♑	02:26
Saturn	09:18 ♌	22:32	07:34 ♌	20:35	05:54 ♍	18:40
Uranus	22:35 ♓	10:23	20:32 ♓	08:18	18:25 ♓	06:05
Neptune	21:30 ♑	07:25	19:32 ♑	05:19	17:29 ♑	03:12
Moon	22:52 ♊	13:19	22:25 ♉	15:03	01:02 ♋	16:53

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.

However, Jupiter will act as a useful pointer during a chance to see distant and faint Neptune this summer. Jupiter passes south of Neptune, the distance between the two planets being only half a degree apart around July 10, when they are both within 3º of the near full waning Moon. Neptune at about magnitude 8 and an angular diameter 2arcsec is an object for telescopic observation under normal circumstances, but, for a few days around July 10, the outermost planet and Jupiter will line up in the southeast with the magnitude 5 star μCap about halfway between them. Jupiter will be the lowest of the three in the sky towards the southeast. The planets remain close together throughout the middle of the month.

In the dawn light of July 18, low in the east the Moon will head a line with Mars and Venus while passing through the Pleiades. This photo opportunity is not to be missed. Also a grazing occultation of Alcyone will take place for some observers.

There are several eclipses: no part of the longest total solar eclipse of the 21st century on July 22 will be visible from the UK, but you still have time (just) to get to Shanghai. Two associated lunar eclipses (July 7 and August 6) are both penumbral, alas, and only on August 6 visible from the UK.

UK meteor fans can watch the Perseids. Expect the base rates on August 12-13, but the waning Moon rises just after 23:00. Then it is the Equinox again, so check that your sidereal clock reads UT at September 22 at 21:19 UT.

Richard Knox

Moon phases for the third quarter of 2009

	New Moon	First Quarter	Full Moon	Last Quarter
July	**22**	**28**	**7**	**15**
August	**20**	**27**	**6**	**13**
September	**18**	**26**	**4**	**12**

Sorry that the heading on this table in the last issue was so obviously incorrect! Ed.