Gnomon

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The AAE Annual General meeting in Liverpool

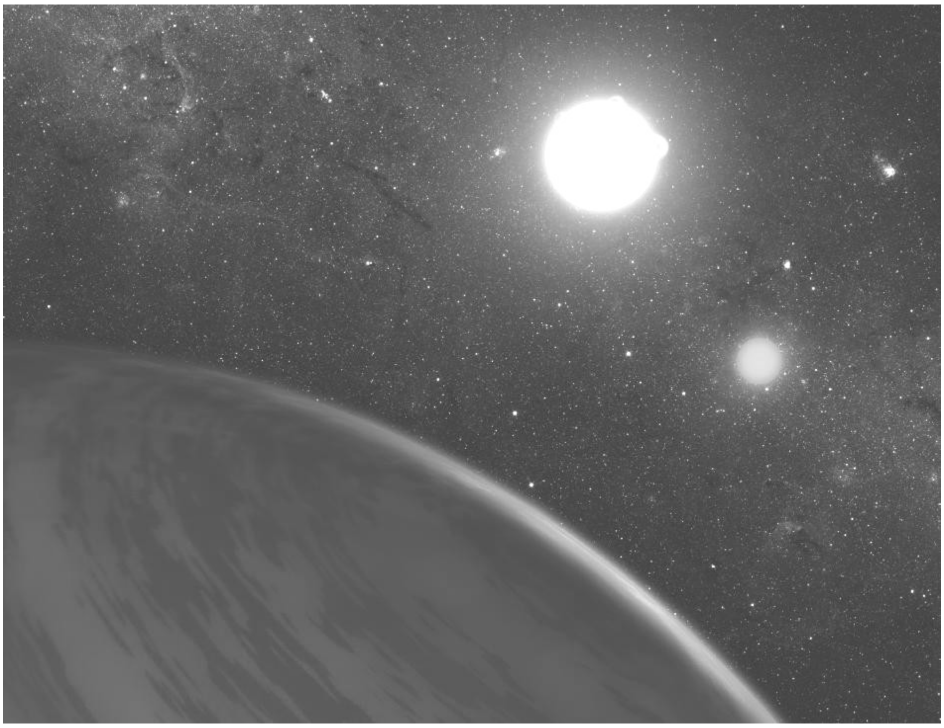
On Saturday 10th September we met at the World Museum in Liverpool for our Annual Business Meeting.This was part of the British Association of Planetaria's Annual Meeting and we shared their two days and facilities. We also presented an AAE Teacher Training Day - this also took place in the World Museum. 18 teachers from around the UK attended and enjoyed sessions on practical activities in the classroom run by Andy Newsam, Director of the National Schools Observatory, Francisco Diego (UCL / Your Universe), Mike Dworetsky (UCL), Garry Mayes (British Association of Planetaria) and Olivia Johnson (Royal Observatory Greenwich).
The participants also took the opportunity to attend a show in the Museum planetarium.

The Annual Business meeting was short and to the point. The Council elections were held and the President, Vice-Presidents, Treasurer and ordinary

☞ *(cont. on p2)*

Participants in the AAE Teacher Training Session on 10th September. Photo courtesy Mike Dworetsky

In The Light of Two Suns - Kepler 16b



The existence of a world with a double sunset, as portrayed in the film Star Wars more than 30 years ago, is now a scientific fact. Nasa's Kepler mission has made the first unambiguous detection of a circumbinary planet - a planet orbiting two stars - 200 light years from Earth. Unlike Star Wars' Tatooine, the planet is cold, gaseous and not thought to harbour life. Previous research has hinted at the existence of circumbinary planets, but clear confirmation has until now proved elusive. Kepler detected this planet, known as Kepler-16b, by observing transits where the brightness of a parent star dims because the planet crosses in front of it. The Kepler-16 system has a pair of orbiting stars that eclipse each other from our vantage point on Earth. When the smaller star partially blocks the larger star, a primary eclipse occurs. A secondary eclipse occurs when the smaller star is occulted (or completely blocked) by the larger star.
"The discovery confirms a new class of planetary systems that could harbour life" Kepler principal invstigator William Borucki said. " Given that most stars in our Galaxy are part of a binary system, this means the opportunities for life are much broader than if planets form around only single stars. This milestone discovery confirms a theory that scientists have had for decades but could not prove until now.
The image shows an artist's impression of the Kepler-16 system. The planet can be seen in the foreground. A movie can be found on the NASA website.
Image credit: NASA/JPL-Caltech/T. Pyle

☞ *(cont. from p1)* Council members were re-elected.

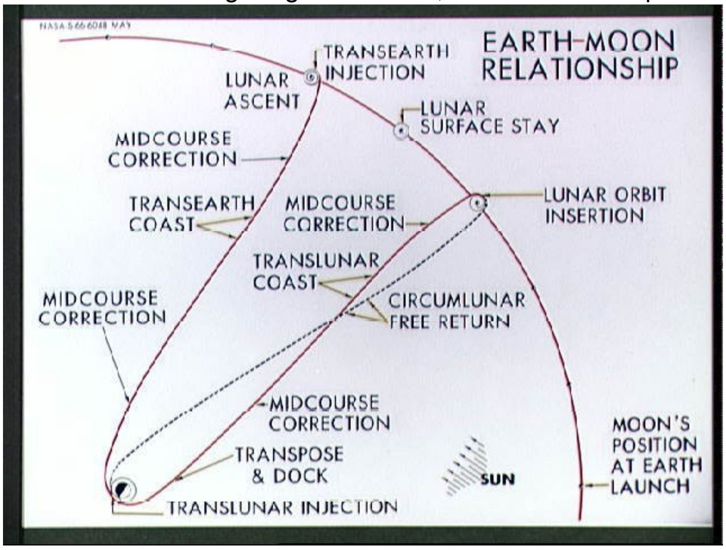
Resignations were tendered by the Secretary and by the Editor. The Secretary's Report appears on p7. So the AAE will be asking for nominations or volunteers for these posts. Council meetings are generally held two or three times a year, so the work is not onerous. Just send us an e-mail if you are interested.

Nearest The Sun

Last Issue we considered whether the Apollo astronauts hold the record for travelling closest to the Sun. We continue this train of thought:

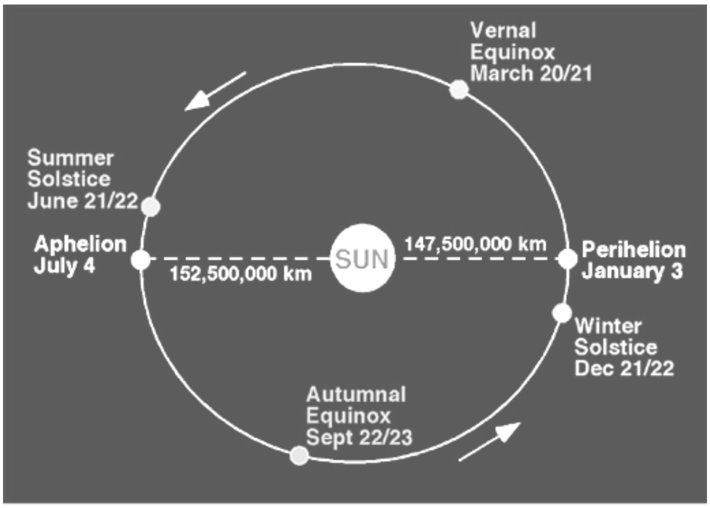
If the Apollo astronauts had travelled to the Moon when its near side was wholly illuminated at Full Moon, then they'd have been travelling further away from the Sun, not towards it, during their missions. But in fact, the Apollo astronauts needed to reach the Moon when their intended landing site was appropriately illuminated (i.e. relatively soon after sunrise on the Moon, so that they could clearly see the craters via their shadows on the surface below). This trajectory is illustrated in the NASA graphic below.

To meet this lighting constraint, most of the Apollo missions launched a few days after New Moon and arrived about 3 days later, when the Moon was still inside the Earth's orbital path, and hence nearer to the Sun. A rough calculation puts most of the Apollo missions some 150,000 km closer to the Sun than the Earth when they arrived at the Moon.



Now, those Apollo missions that flew in the (Northern Hemisphere) winter months are the ones most likely to hold the "nearest the Sun" record since the Earth is at perihelion, it's closest point to the Sun, on around January 4th each year. (See footnote, page 4).

Although the average distance from the Earth to the Sun is 149.6 million km, the orbital eccentricity of the Earth, (currently 0.017), means that we're only 147.5 million km away from the Sun in the winter, and 152.5 million km away in the summer.



This 5 million km variation in the distance to the Sun tends to dominate over the 384,000 km distance between the Earth and the Moon, and also the shorter term oscillation of about +/- 4,000 km in the Earth's position relative to the Sun which is described in the footnote on page 4.

If we were just considering missions that landed on the Moon, it would be a close-run thing. Apollo 14 flew on 31 January, 27 days after the perihelion, while Apollo 17 lifted off on 7 December, 28 days before perihelion. These two missions went to locations on the East of the lunar disk, so they were heading "inwards" towards the Sun to a slightly greater extent than the other missions, arriving a little earlier in the lunar illumination cycle. Allowing for the three-day travel time, Apollo 17 would probably just have had the edge.

But there is one Apollo mission that surpasses both Apollo 14 and Apollo 17. Apollo 8, the first mission to travel to the Moon, was launched on 21 December 1968, and arrived at the Moon on 24, December, roughly 11 days from the Earth's closest passage to the Sun. And since it flew just two days after New Moon, it was heading closer to the Sun than any of the missions which landed.

Now you might be thinking, "Ah but, if the Earth swings closer to the Sun between December 24th and Jan 4th, would the entire planet still come closer to the Sun at the perihelion point than the mark achieved by the Apollo 8 astronauts?". Another rough calculation suggests that although the Earth travels roughly 10 degrees around the Sun in this time, it only gets about 50,000 km closer to our local star in these 11 days, so the Apollo 8 astronauts would still hold the record by roughly 100,000 km. So in recent history Jim Lovell, Bill Anders and Frank Borman are the human beings who have been closest ☞ *(cont. on p3)*

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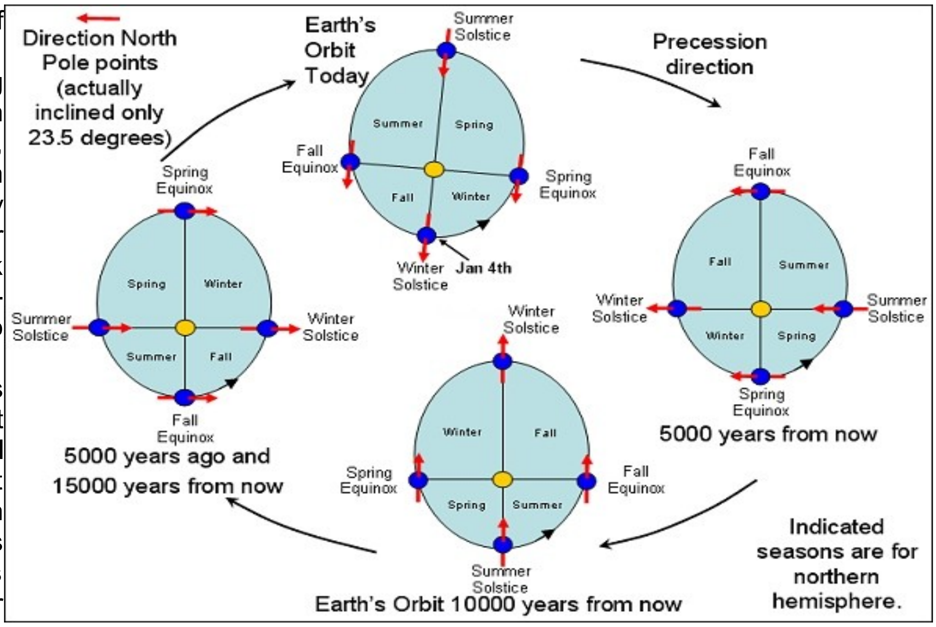
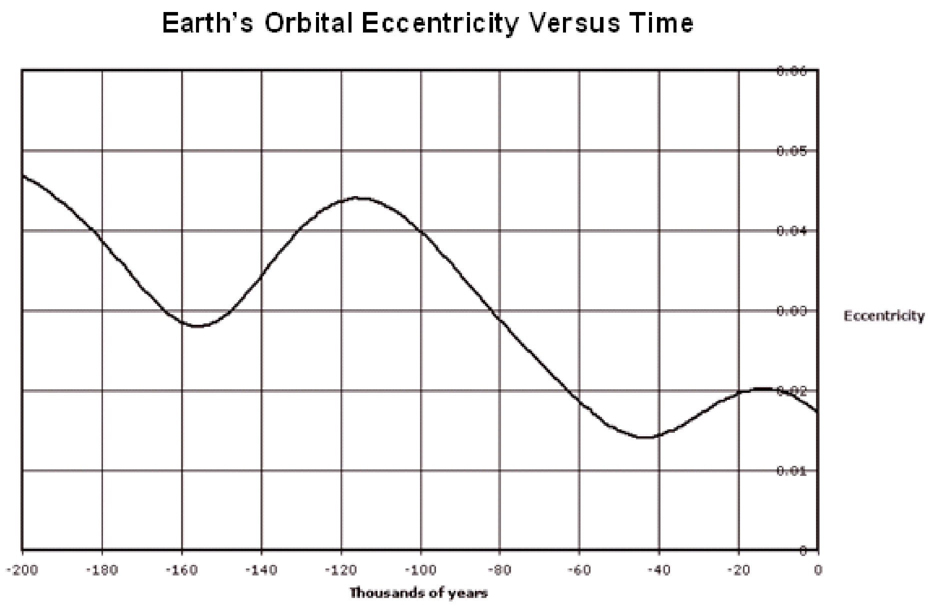
to the Sun, at an approximate distance of 147.4 million km, on 24 December 1968.

(Just for completeness, it is worth noting that the "unconventional" trajectory taken by the Apollo 13 crew, (which, incidentally, also included Jim Lovell), carried them slightly further from the Earth than any other human beings, a distance just over 400,000 km. But since this mission took place in April 1970, it was too far from perihelion for this small additional distance to affect the "nearest the Sun" record.)



The "nearest the Sun" problem now gets more subtle because the Earth's orbit round the Sun gets perturbed by gravitational effects in regular ways that were first calculated by a Serbian mathematician called Milutin Milankovitch about 100 years ago. (Milankovitch discovered various cycles, but the two that are of particular interest here are the variations in Earth's orbital eccentricity (shown below) and the way in which the orientation of the orbit rotates in space over a 21,000 year period (shown above right).

The current value of 0.017 for the eccentricity is relatively low, and is decreasing, so the Earth's orbit is getting more circular over time. But that means the eccentricity was higher in the past, and so the perihelion distance historically was smaller than it is today.



So let's hop in a time-machine and travel back about 5,000 years. At that time, the eccentricity of the Earth's orbit was around 0.018, and the perihelion position was a little closer to the Sun than the mark set by the Apollo 8 crew. So the holder of the "nearest the Sun" record would have been a person living somewhere on Earth.

At that time the perihelion date wasn't 4 January but, due to another Milankovitch cycle, was close to the Equinox, due to the rotation of the Earth's orbit plane, as illustrated in the next diagram. So back then, the sub-solar point at perihelion was close to the Equator. Hence, to find the human closest to the Sun 5,000 years ago, we need to look for a high, accessible point on the Earth's surface, close to 0° latitude.

Intriguingly, due to the Earth's oblateness, the point on the Earth's surface that is furthest from its centre is the top of a volcano called Chimborazo in Ecuador, just south of the Equator. Now it isn't clear that any of the pre-Incan settlers in Ecuador ever made it all the way to the summit of their local volcano, (which is thought to have been active periodically at the time), but even on the slopes of the mountain at the Autumn equinox 5,000 years ago, they'd probably have been the closest living humans to the Sun. However, the record may well have switched hands from time to time, since the exact time of perihelion can occur at different points in the Earth's rotation, and hence Kilimanjaro in Africa could also stake a claim if the perihelion occurred close to local noon in Africa rather than South America.

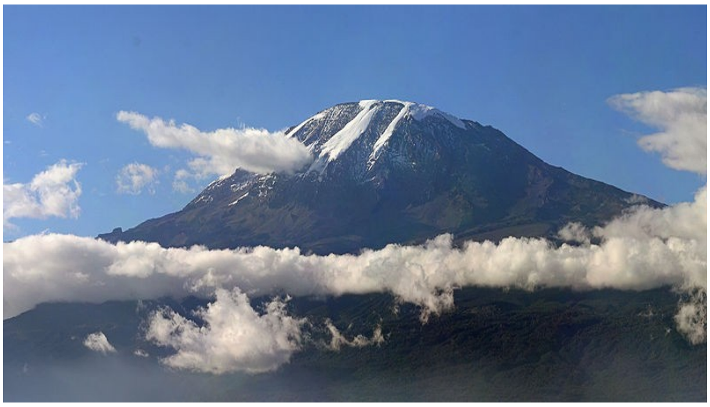
As you'll see from the plot of the Earth's eccentricity, it continues to rise back to roughly 15,000 years ago. At that time the perihelion position was close to the Spring Equinox, so again we'd be looking for a high point on the equator, but this time we shouldn't include any locations in the Americas, because human beings probably hadn't reached the continent at this date, (although recent discoveries call this assumption into question). So Kilimanjaro now presents itself as a most likely candidate location, and although history records a first ascent to the summit, in 1889, it is probable that an early African mountain explorer who was climbing the mountain near the Spring equinox held the record for being closest to the Sun 20,000 years ago.

Further examination of the eccentricity plot shows that the Earth's eccentricity then decreases for a while, and then increases to an even higher value about 70,000 years ago. There are ongoing debates about when "truly modern humans" evolved, and also about when they "emerged" from Africa, but at around this date, it is almost certain that some of our earliest ancestors unknowingly claimed the record for the human beings nearest the Sun. They were almost certainly Africans living in the Tropics, and their record of about 145.9 million km, set close to noon on the date of an ancient perihelion, has never been surpassed. It might also have occurred to you whilst reading the above that there is a closely analogous question which also requires an answer. "Which human has been furthest from the Sun ?"

☞ *(cont. on p4)*

☞ *(cont. from p3)* If we take our time-machine back again, far into history, the question has a comparable answer. As the perihelion point of the Earth's orbit moves closer to the Sun, the increasing eccentricity moves the aphelion point further away. So the furthest ever human being from the Sun is probably another unsuspecting ancient ancestor close to the top of Kilimanjaro, although on this occasion, close to local midnight.

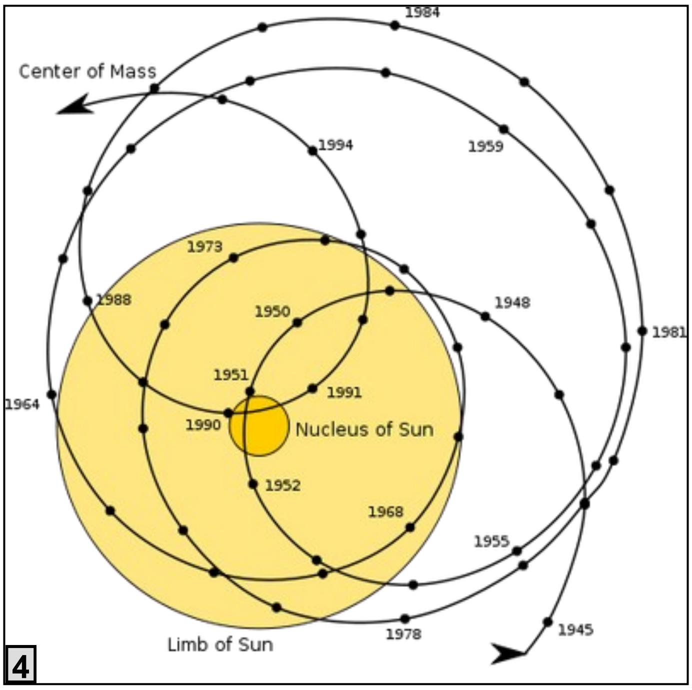
But the answer to the more specific question, "Which currently living person has been furthest from the Sun?", is much, much trickier to answer. As previously discussed, the Apollo astronauts travelled inside Earth's orbit, so they voyaged no further from the Sun than people on the Earth's



surface. But astronauts in low Earth orbit could still potentially be further away, and the challenge is then to determine which ones might hold this record.

And this is where it gets really difficult. Space station crews on Salyut, Mir, and the ISS have a greater statistical chance of holding the record, since they were definitely in orbit at the aphelion date, which is typically 4th July. To be further from the Sun on that date than the population of the Earth itself, they would have to be in an orbit that has regressed to the point where the orbit path travels roughly over the local midnight location on Earth at the moment of aphelion. Since the Sun is close to the Tropic of Cancer on 4th July, the furthest point of this orbit trace from the Sun would need to be roughly over the Tropic of Capricorn.

And whilst these space stations have the greatest statistical chance of meeting these criteria, it is also possible that one of the shorter-duration exploratory flights by the US, Russia, or China actually set the "furthest from the Sun" record. So there are lots of candidate missions to investigate; initially to establish whether they were in orbit around aphelion, and then to evaluate the orientation and ground trace of the mission during that period.



Since the orbit height of all these manned stations is of the order of 400 km, there isn't much to choose between them and it is also necessary to take into account some of the other detailed perturbations on the Earth's position relative to the Sun. One of these, the fluctuation of the Earth-Moon system about the barycentre location, is described in the footnote. Another is the fact that the gravitational attractions of Jupiter and the other outer planets also cause variations in the position of the Sun relative to the barycentre of the solar system as a whole.

Plots such as the one shown below are potentially somewhat misleading, since the "wobble" in the Sun's position cannot be simply added and subtracted from the Earth's orbital distance. (Since the perturbations from Jupiter and the other planets apply to the Earth as well as the Sun, our "orbital dance" around the barycentre is similar to that of our parent star). From the point of view of Jupiter, the Sun and the Earth are in a similar direction and are at a similar distance. But clearly these parameters are not exactly the same so the perturbations caused by Jupiter are a little different for the Earth and the Sun.

Hence there is some relative motion between the Earth and the Sun and this variation is large enough that it also needs to be taken into account in the calculation of who has been furthest from the Sun.

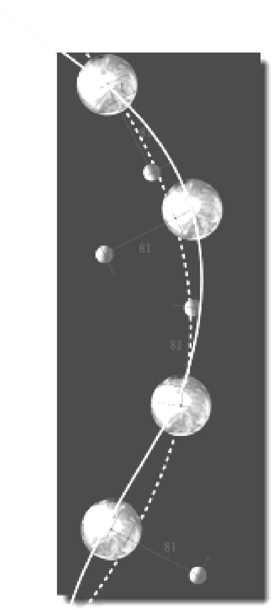
In conclusion, somewhere out there is an astronaut who has been further from the Sun than anyone else alive. But they'll need a PhD in orbital dynamics to prove it!

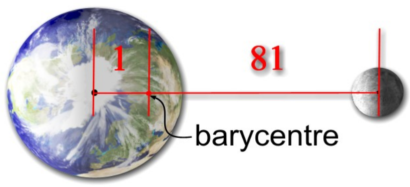
Stuart Eves

Acknowledgement: The author would like to acknowledge the assistance of John Laycock in preparing this article.

Footnote:

The exact date of perihelion, (and aphelion), varies from year to year because the Earth itself doesn't follow a smooth elliptical path around the Sun. The presence of the Moon, and its associated gravity, means that the Earth-Moon system rotates around a point, the barycentre, which is actually about two-thirds of the radius of the Earth, (about 4,000 km) from its centre. As a consequence, the Earth follows an oscillating path around the Sun, and the date of perihelion depends on when the Earth reaches a "minimum" on this path. Since the Moon does not complete an integer number of orbits in a calendar year, the "phase" of this oscillation changes, and causes the perihelion date to vary. A fact that makes the calculations even more difficult is that the Moon's orbit around the Earth is also elliptical, so the barycentre distance, and thus the amplitude of the oscillation, also varies with time.





Letter from Down Under

In the previous Letter from Down Under I reported on three new instrument concepts that had been put through their paces recently on the Anglo-Australian Telescope (AAT). Not long afterwards, the Instrumentation Science Group at the Australian Astronomical Observatory (AAO) together with colleagues from Sydney University commissioned a 4th new instrument called SAMI (Sydney-AAO Multi-object IFU) which also promises to revolutionise how astronomers gather data in the future.

The AAT's 2 degree Field optical fibre positioner is still one of the world's most powerful facilities for conducting large surveys of stars and galaxies. Each of up to 392 fibres can be positioned in the telescope's focal plane to collect the light within the fibre's 2 arcsecond diameter and relay it to the AAOmega spectrograph located in its own room beneath the telescope. While the spectra obtained can tell us a lot about the galaxy in question such as its redshift (and thus its distance from the Hubble relation), the predominant stellar population, any nuclear activity, etc. it tells us very little about how the galaxy itself rotates, how the chemical abundances change with radius, whether the galaxy is interacting with a nearby companion, etc. To extract a separate spectrum from every part of a galaxy is the job of an integral field spectrograph, but these can only study one galaxy at a time. To avoid the risk of damaging fibres, the 2dF robot can position fibres no closer together than 30 arcseconds, leaving a lot of space (and missing information) between fibres.

What is needed therefore is a way to pack optical fibres more closely, or indeed even fuse them into a bundle, but without the light entering any one fibre spilling over into an adjacent fibre. A team from the AAO and Sydney University has worked out how to fuse multiple fibres together with just enough cladding remaining between them to prevent contamination. Their "hexabundle" consists of a single central fibre surrounded by concentric rings of 6, then 12, then 18, and finally 24 fibres for a total of 61 fibres, each of which samples 1.6 arcseconds and collectively cover a field of 14 arcseconds. Two separate fibres sample blank sky well away from the target. The AAOmega spectrograph can accommodate 13 of these hexabundle feeds, but each hexabundle is physically too large to be handled or positioned by the existing 2dF robot. So how can one place these hexabundles where they are needed?

Figure 1: SAMI team member Sam Richards prepares for a long winter's night riding in the prime focus cage of the AAT monitoring the instrument alignment and plugging hexabundles into the pre-drilled plates. (Image credit: AAO, U. Sydney)

Before the advent of the 2dF robot in the mid-1990s, astronomers would drill holes in brass plates at the locations where their targets would fall, bring these plates to the telescope, then on the night would manually plug individual optical fibres into these holes before mounting the plates at the telescope focus. For the purpose of quickly demonstrating the potential of SAMI, this old manual positioning system was resurrected inside the Prime Focus Camera of the AAT with its 1 degree field of view. This facility has not been used in over a decade, and provided a rare opportunity for team member Sam Richards to join the illustrious ranks of astronomers like David Malin by riding in the prime focus cage of the AAT! (Figure 1).

Over 4 nights in early July 2011 the SAMI team put this new facility to the test. Each plate was pre-drilled with holes for 26 galaxies, plus their sky fibres. Thirteen of these were plugged with a hexabundle; the telescope slewed to the field position; the alignment of the plate on the sky checked visually using additional holes at the locations of bright stars, then refined by looking at the signal coming down each of the hexabundles; then the galaxies were integrated on for the next 2 hours. Then Sam would quickly but carefully unplug the 13 hexabundles and insert them into the other 13 galaxy holes, recheck the alignment, and begin another 2 hours of integration.

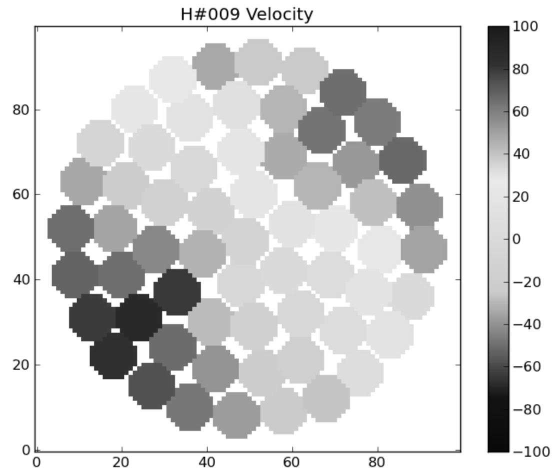


Figure 2: This velocity map shows the pattern of rotation across a galaxy observed with a SAMI hexabundle, with the colour at each fibre position representing the shift in wavelength caused by Doppler motion. The box is 15 arcseconds on a side. (Image: AAO, U. Sydney)

The early results shown in Figure 2 are extremely promising. This shows the change in line-of-sight velocity across a spiral galaxy as measured from the Doppler shift of a hydrogen emission line. These "spider diagrams" are characteristic of a rotating disk and data like these enable us to work out how much dark matter a galaxy has. The ability to make these measurements in a dozen galaxies at once adds a whole new dimension to galaxy surveys. No longer will galaxies merely be tracers of large scale structure and dark energy in the Universe, reduced to a single number like a redshift or a galaxy sub-class. Integral field spectroscopy surveys will allow us to get to know galaxies as individuals, and to piece together how they have evolved with time. Descendants of SAMI now being envisioned on 8m-class telescopes, and ultimately on the 30m-class telescopes of the coming decade will make this a reality.

Stuart Ryder
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New Deadline for EAAE Competition "Catch a Star"

Catch a Star is a contest that has been held as a result of the collaboration between the European Association for Astronomy Education (EAAE) and European Southern Observatory (ESO)."Catch a Star!" includes more than one competition, so there is something for everyone. idea of the program is to encourage students to work together, to learn about astronomy and discover things for themselves by researching information.
The contest includes developing and presenting astronomy projects online.
The deadline is now Sunday, 30th October, 2011, at 17:00 Central European Time. After the deadline all projects will be publicized on the project's webpage.

Curriculum Corner

WHAT IS IN THE SKY TONIGHT?

Required: A north/south line at home

Have the students stand astride their "home line" (see the Autumn 2010 issue of Gnomon on how to find this line), just after dusk.

Facing south: they should raise their hands out sideways and bringing their outstretched left hand above their face to touch their outstretched right hand they will make the path of the Moon, planets and constellations of the zodiac.

Bright objects along this path, besides the Moon, could be planets. The constellation of the zodiac for the season will also be seen along the path. To find these, a sky map can be used (see footnote for good websites).

Facing north: they should make a circle around their eyes and nose by touching the tips of their thumbs and middle fingers together. The Little Dipper will be inside the circle and the pole star, Polaris, will be in the centre.

All the stars inside the circle are circumpolar; they move around the North Celestial Pole and Polaris.

Around the outside of the circle will be seen the Big Dipper (The Plough) and Cassiopeia.

.**Note:** When students discover that a north/south line can be made at solar noon, can use it for compass bearings and for introducing a simple method of finding their way around the heavens, they are well on the way to doing some practical astronomy.

You can find positions of the constellations of the zodiac for any location or time in Astronomical Yearbooks or at websites such as:

💻www.skymaps.com or 💻www.skyandtelescope.com.

Vocabulary: astride, circumpolar, North Celestial Pole, Little Dipper, Big Dipper, Cassiopeia

Eric Jackson

For your Library

The Secret Deep by Stephen James O'Meara. ISBN 978-0-521-19876-9, £29.00 (US$48.) Cambridge University Press. Hardback, pp483.

Stephen James O'Meara will be familiar to many as a great populariser of astronomy and an unfailingly engaging and informative writer on the subject, first in *Sky and Telescope* and *Astronomy* magazines, and later through his books in the Cambridge Deep-Sky Companions series.

The Secret Deep is the latest in that series, and the first thing that strikes the reader poring over its pages is the freshness of the material. Yes, it is another list of things to look at in the deep sky; but the 109 objects presented here are often not found in existing lists, and many lifelong star-hunters may well not yet have come across a good number of them. What assiduous deep-sky observer can resist hunting down the Loch Ness Monster cluster, the Fossil Footprint, the 'flattest galaxy of them all' and the Peek-A-Boo nebula? Is there really a globular cluster in our skies cannibalised from another galaxy? Which quasar, 2 billion light years away, can be found with a medium-sized telescope?

Each object is profusely described, with sky coordinates, history, size, magnitude, cross-referencing to other lists and easy-to-use charts and photographs (by Mario Motta). Most of them are visible from northern temperate latitudes. A very few will be difficult or invisible from the British Isles, the lowest in declination being the globular cluster NGC 2298 in Puppis, 36 degrees south of the Celestial Equator.

The author's style is uncluttered and highly readable. It is conversational rather than didactic, but so full of facts that it would probably be difficult to find out much more about the objects discussed. The book might appeal rather more to astronomers with larger telescopes and darker skies: most of the 'deep-sky secrets' listed would not be accessible to urban observers with binoculars or modest instruments, but many of them do represent a challenge for such observers; for when skies are particularly transparent and still (a situation often occurring on winter evenings), it is surprising what can be 'fished up' even from moderately light-polluted areas.

Particularly pleasing are the many sketches of nebulae, clusters and galaxies that adorn the book, showing that CCDs and the high-tech approach have not yet completely supplanted the eye and the pencil. The art of astronomy lives on in this work.

Data lists and a selection of twenty further deep-sky targets complete the book. It will be a valuable addition to the bookshelf of serious observers, extending their vision and offering 'targets for tonight' that they may never have encountered before, but will be intrigued to read about and find for themselves. Full marks to Stephen James O'Meara for a really *new* book.

Bob Mizon

(Mizar Travelling Planetarium and the BAA Campaign for Dark Skies)

The Living Cosmos by Chris Impey. ISBN 978-0-521-173841. £15.99 (US$24.99). Cambridge University Press. Paperback, pp393

In this popular level romp through astrobiology we are taken on a path that starts with the ancient Greeks and an astronomy primer, via how life originated and evolved on Earth, to prospects for life elsewhere in the solar system, and out to exoplanets and habitable zones.

☞ ***(cont. on p7)***

☞ (cont. from p6) The journey ends by asking whether we are alone, which deals with the usual suspects; the Drake equation, the Fermi paradox and SETI. The path has numerous side branches in which Impey, a Professor of Astronomy at the University of Arizona, tell us about the characters of the scientists involved, or mythology, or has a swipe at Intelligent Design, or other fun diversions. Much of the (slightly) more technical material is extracted into a comprehensive set (28 pages) of excellent short notes.

The Living Cosmos is an easy read and there is some lively writing; I enjoyed radioactive decay illustrated with popcorn and entropy with farts. But sometimes the language is misleading, as when we are told that the moon was 'gouged out by a giant impact', and there are several errors in the science; e.g. subducting slabs are not pushed, but pulled (by gravity). More problematic is that I didn't always get the sense of a focused narrative. Sometimes this is because of the ordering of topics, sometimes because we are presented with facts but without any idea how we know them, and occasionally because things didn't seem relevant (e.g. Milankovich cycles and the ice ages, Multiverses and M theory). In places I wanted Impey to be more critical. Thus the fractionation of carbon isotopes in ancient rocks can be abiotic as well as biogenic, and this means that we have to be much more circumspect about when life originated on Earth. And not everyone subscribes to the standard warm-wet early Mars story. Of course popular accounts aren't scientific reviews but they should convey something of the uncertainties as well as the passion.

Despite these reservations, you could get much from this book if you are starting out in astrobiology, and you won't feel that you've waded through a textbook by the end!

Dr. Alan Longstaff
Associate Lecturer in Astronomy and Earth Sciences
Open University

Advancing Variable Astronomy: The Centennial History of the American Association of Variable Star Observers by T.R.Williams & M.Saladyga .ISBN 978-0-521-51912-0. £65 (US$ 99.00) Hardback, pp xv + 432.

A foreword by Owen Gingerich precedes a mine of information about the World's largest non-profit organisation devoted to variable stars. The book offers an engaging and researched tale of how observational Astronomy has developed from the nineteenth to twenty-first centuries. This landmark tome describes many individuals in the amateur and professional scene during this interval mainly from the AAVSO's foundation in 1911.

Williams is a former two-time President and the current AAVSO Historian, Saladyga is the Archivist of its headquarters at 49 Bay State Road, Cambridge, Massachusetts and is a technical assistant. The book is very well produced with a host of illustrations, in particular photographs of groups and individuals. The cover is one that any variable star enthusiast would not miss – the light curve of SS Cygni superimposed against a background of the Pleiades.

The index comprises 20 pages, there is a detailed bibliography, and 58 pages of notes referring to the six main parts comprising 21 chapters. These parts cover scientific Pioneers, AAVSO Foundation, Records and Archive, and the Bureaus set by Mayall, Mattei and Henden. There is an epilogue and seven appendices of notable facts about officers, world groups, historic items, observational totals and awards. Thirty-three groups that contribute to the huge database are summarised in an appendix, for example in Belgium, Japan, Israel, Norway, New Zealand, Russia, Spain, Ukraine, Uruguay.

In a simple division of its history the first forty years are devoted to the Harvard Cambridge Observatory's connection with the association. The following years show how simple visual observations maintain a thread of continuity to a world-wide group. The authors offer personal insights about individuals both in the organisational network and those at the eyepiece but in several cases this is detailed to a degree of boredom. It is good to read of how personal contacts with observers, the core of AAVSO, are maintained. As an observer with a role in the Variable Star Section of the British Astronomical Association, I succumb to great admiration for the time, talent and energy exercised by friends and colleagues in this field. A genuine lack of research by the authors is evident in that the joint meeting in Cambridge, UK of the AAVSO and the BAA in 2008 Spring is not mentioned when, in contrast, several other international affairs are noted.

The efforts of many solitary individuals using small to large instruments, whether visual or instrumental is acknowledged and appreciated in relation to the inherent value of such 'work'. In particular the authors describe the role of women in the organisation either in a 'back-room' or more visible role. Mayall, Mattei, Hoffleit and Hazen are ladies of special stature in the AAVSO. Some years ago a specific publication was produced by Dorrit Hoffleit about American Women Astronomers before 1960, it portrayed more detail than encountered here.

Various AAVSO Sections created in the modern era comprise: Cataclysmic Variables, Data Mining, Eclipsing Binaries, Long Period Variables, Supernova and Nova Searching, a Solar Section, a High Energy (for example, Gamma Ray Bursters) department and another devoted to Short Period Pulsating variables. Each section has a leader and advisors, with mentoring and outreach individuals, and over recent years materials to aid science teachers have been made available. A specific area is concerned with the development and production of variable star charts – an ultimate information point for an observer. The AAVSO also leads a role in maintaining and fostering historical collections about variable stars. As of 2010 August the total number of single observations in the archive is 18,500,000 and steadily rising.

This is not the place for details on how to observe, record variable stars, archive them and liaise with others. That is the role of several other works both old and modern. This is also not a text book. An overall theme of community and sense of purpose appears to gel the book and Gingerich's concluding words in his preface are legitimate. "It is both fascinating and instructive".

Melvyn D Taylor

Melvyn is an active observer with astronomy records maintained from 1967 to present. He is a member of Leeds AS since 1965, the BAA (1969), the AAVSO (1973), Isle of Man AS (1993) and IOTA-ESOP (1996). He is active as secretary of the BAA Binocular Section and Observational Assistant to the Leeds AS.

Secretary's Report to the ABM

Teresa Grafton will be retiring as Secretary to the AAE after many years of involvement, working in various roles. She writes:

"This report is something of a valedictory note. The past year has not seen a great deal of activity from my point of view as Secretary and I feel it is probably time for me to take a back seat in AAE. I have been involved in the

☞ (cont. on p8)

(cont. from p7) Association since starting work at the London Planetarium in the 1980s. The faces have changed over the years and few from that era are still fighting the fight! In fact, the late Martin Suggett of Liverpool Museum was one of the originals – some of you may remember him.

The post of Secretary is probably more important than any other in terms of keeping tabs on what is happening and maintaining enthusiasm in an ever-shifting educational scene. I therefore hope that someone with day-to-day involvement in astronomy education will take my place and do what needs to be done to make sure that students at all stages of their educational experience achieve the best possible understanding and appreciation of this vital and wonder-filled field.

The issues are different now but some very important ones remain to be resolved. I wish my successor well and will continue to take an active interest in the future of the AAE and astronomy education in the UK".

We all wish you a good retirement, Teresa! **Ed**

Sky Diary Summer 2011

During the final quarter of 2011 we have the chance of seeing all the planets and much more. So cross your fingers for some clear skies and find the woolly hat (which is probably currently tucked away under the stairs).

Mercury, the closest planet to the Sun, is a difficult object to spot. You need the right conditions and some patience. December seems the best time for a look. In fact between the 17th and 22nd December Mercury is at its best. Find yourself a good south-easterly horizon at a time around 40 minutes before sunrise. Even though Mercury will have a magnitude of around -0.2 the Sun will quickly fade the planet from your sight.

Moon phases for the second quarter of 2011

	New Moon	First Quarter	Full Moon	Last Quarter
October	**26**	**4**	**12**	**20**
November	**25**	**2**	**10**	**18**
December	**24**	**2**	**10**	**18**

Venus is going to be an amazing evening object next year. But we can watch during November and December as it slowly it gets itself into a more favourable position. Look south-westerly a little after sunset. Venus's orbit will take it through Scorpius, Ophiuchus and Sagittarius before the year is out. With a magnitude of around -3.8 it appears bright, but like Mercury you are always battling against the bright twilight. By the end of December it will be dark enough for Venus to be a very obvious object in the evening sky.

Mars becomes observable by the end of October and also for the rest of the year. Look south-east just before the Sun rises in the faint stars of Cancer. Although Mars looks small during autumn (about 5 arcsec in diameter), over the next three months its apparent size will increase to 10 arcsec. In December it will therefore appear just a bit bigger and a little brighter and be around for several hours before sunrise. On 10th November Mars passes just over a degree north of the star Regulus, but this photo opportunity will be marred by the light of the full Moon. There will be more to see of Mars in 2012.

While Mars appears small in diameter and does not show much detail, Jupiter on the other hand is around a super-sized 50" and is the object of the season. Jupiter is visible most of the night rising in the east and setting in the west. During October look south around midnight for a bright star-like object. The planet reaches opposition on 29th October and is magnitude –2.9. You cannot miss it! In December it will be seen much earlier in the south at around 8pm. Jupiter has an amazing weather system. Look for the two main cloud bands and enjoy the dance of the four main Galilean moons. A simple free PC program to calculate the visibility and order of the moons is JupSat95:

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

	October 15		November 15		December 15	
	Rise	Set	Rise	Set	Rise	Set
Sun	06:24	17:08	07:18	16:12	07:59	15:51
Mercury	07:32	17:24	09:42	16:54	06:11	14:59
Venus	07:56	17:38	09:34	17:12	10:15	18:00
Mars	00:01	15:18	23:32	13:52	22:47	12:20
Jupiter	17:36	07:57	15:25	05:32	13:22	03:20
Saturn	06:11	17:17	04:30	15:22	02:49	13:30
Uranus	16:29	04:38	14:25	02:31	12:27	00:32
Neptune	15:30	01:27	13:28	23:30	11:30	21:25
Moon	18:24	10:03	20:01	11:14	21:31	10:41

Data for other venues and dates can be estimated from this (and the Moon phase) table.

http://indigo.ie/~gnugent/JupSat95/

Saturn is at solar conjunction on 13th October and it will not be until December until it is seen again. It is found in the morning sky travelling slowly through Virgo.

If you wish to observe Uranus and Neptune this quarter you need to look during October evenings. Uranus is in Pisces and Neptune in Aquarius. Neptune appears 6 degrees south of the Moon on Oct 8th. Later in the year these outer planets are past their best and become unfavourable for viewing.

This year there is a possibility of an unusual meteor "storm" on the night of 8th/9th October as the Earth passes through the dust from the comet 21P/Giacobini-Zinner. This "Draconid" shower has had very high rates in the past. While it is difficult to predict this year's rates because this comet has a number of narrow dust trails, there is a likelihood of enhanced rates, peaking on the evening of 8th Oct. Go out as soon as twilight fades. Also on 21st/22nd October we have the peak of the Orionids. This should be favourable this year as the waning crescent Moon should not reduce visibility too much. The radiant is to the East of Orion and rises just after midnight. The maximum rate of meteors is around 30 an hour on the night of the peak, but you can expect good rates on the dates either side of the maximum. During November we have the Leonids on the 17th/18th. Observe these after midnight as the Moon will be then low down in the West. December's Geminid shower, peaking on the 14th December, will be unfavourable this year. The possible 100 meteor an hour extravagance is hampered by the nearly Full Moon.

I wish you the best of luck with observing. Please send us any reports or photos of your observations.

James O'Neill