TRANSIT

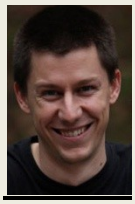
The May 2013 Newsletter of

FINAL MEETINGS OF THE SEASON at Wynyard Planetarium

Friday 10 May 2013

The ALMA telescope – a new window on the Universe

Dr Mark Swinbank, *Durham University*



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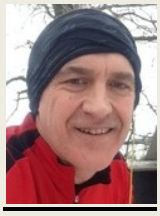
Friday 14 June 2013

An astronomer's view of the eye

Dr John Lockett, *York Astronomical Society*



Content

Editorial

Rod Cuff

A nicely mixed bag of items this month. In addition to the usual Skylights and quiz, there are Keith's excellent capture of Comet C/2011 L4 PanSTARRS, a report by Pat Duggan & Sue Barnes of the recent York meeting of the Society for the History of Astronomy (more such reports, please!), a survey by Michael Roe of just how far astronomical knowledge has been turned on its head in recent decades, and Andy Fleming's review of a 1999 book on how the elements were formed. Something for most people, I hope – if not, do please send me something else for June's issue, which will be the last before the summer break.

I'd like to offer a warm welcome to new members David, Aaron & Danuta Foster. We hope you enjoy what CaDAS has to offer!

Best wishes -- Rod

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Letter

[On 2 March I sent an email to the CaDAS distribution list to say that a lady in Nunthorpe had some Skywatcher and Celestron kit for sale. A few weeks later I received Alan's email below, which I'm reprinting here to encourage other members to let me know of astronomical kit they or their friends want to sell – the system works! – Ed.]

Hello Rod –

With reference to your email Telescope For Sale: I purchased this instrument on Saturday 13th March. It is a superb piece of kit (if I can figure out how to work the Goto). Thanks for the contact.

Best regards
Alan Mark (a fairly new CaDAS member)

Skylights – May 2013

Here are some suggestions for websites that will highlight some of the best of what you can see (clouds permitting!) in the night sky in the coming month.

- Universe Today's **short video** *Night Sky Observing for May Brings Spring Constellations*:

  www.universetoday.com/101900/night-sky-observing-for-may-brings-spring-constellations

- HubbleSite: a **7-minute video** of things to see in May, especially focusing on eclipses:

  http://hubblesite.org/explore_astronomy/tonights_sky

- **Night Sky Info's comprehensive coverage of the night sky this month**:

  www.nightskyinfo.com

- **Jodrell Bank Centre for Astrophysics** – **The night sky, May 2013**. Includes focuses on Saturn; Comets C/2011 L4 PanSTARRS and C/2012 F6 Lemmon; a megamoon (an even more convincing optical illusion than usual at Full Moon this month); the close grouping of Mercury, Venus and Jupiter just after sunset towards the end of the month; how to find out when you can see the International Space Station; the Hyginus Rille on the Moon; and objects in Gemini, Leo, Virgo and Ursa Major:

  www.jodrellbank.manchester.ac.uk/astronomy/nightsky

Comet PanSTARRS

Keith Johnson

The weather in March was pretty miserable, so I had no luck capturing L4 PanSTARRS until 3 April. On the next page is my attempt from that night.

Details are as follows:

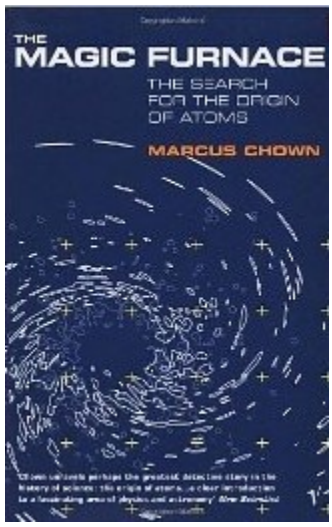
- 5 × 60-second light frames captured @ ISO 800, plus 5 dark frames, processed in DeepSkyStacker and Adobe Photoshop CS II.
- Hardware: 80mm ED refractor with type III William Optics flattener, Canon 1000D DSLR camera, HEQ5 Pro mount.

Book review: *The Magic Furnace*

Andy Fleming

[*Andy published this book review on his Andromeda Child blog a couple of years ago. It hasn't aged! — Ed.]*

'If the atoms that make up the world around us could tell their stories, each and every one of them would sing a tale to dwarf the greatest epics of literature', Chown proclaims in the prologue of this book. The work is his attempt to chronicle humankind's efforts, commencing with Democritus in Ancient Greece over two millennia ago, to discover what the smallest constituents of matter are, and from where they came.



It's an enthralling, comprehensive history lesson in the development of astronomy and atomic physics, encapsulating key moments and discoveries in the search to answer the question of why 98% of the mass of visible matter in the universe is composed of hydrogen and helium, and where the remaining 2% of 'metals' came from.

In one of the greatest all-time detective stories featuring an all-star cast, the research of such notable scientists as Lavoisier, Hooke, Boyle, Dalton, Mendeleev, Davy, Faraday, Avogadro, Thomson, Curie, Rutherford, Chadwick, Einstein and Hoyle is all beautifully woven together to arrive at one inescapable conclusion: that all of the chemical elements from beryllium and boron to iron in the Periodic Table were exothermically cooked up in the cores of dying red giant stars and vomited into the interstellar gas once those stars died. The jigsaw puzzle was finally completed when the endothermic origin of the elements heavier than iron was identified as supernovae, the result of the detonations of high-mass stars at the end of their short lives. It turns out that we, and everything we see, were literally 'made in heaven'.

From the synthesis of hydrogen and helium in the Big Bang to the discovery of such helium in the chromosphere of the Sun, from star-forming regions of interstellar gas to white dwarfs, neutron stars and black holes, from Newton's prism to the development of spectroscopy and spectrometry, from the discovery of electrons, protons and neutrons to electromagnetism and the nuclear forces, from Becquerel's discovery of radioactivity to the nuclear fusion of hydrogen into helium and beyond, each step towards our contemporary understanding of astrophysics and atomic synthesis is both logically conveyed and clearly explained.

Chown's writing style is both inspiring and captivating, and you will have difficulty putting this book down. Indeed, on a re-reading I found it just as captivating.

It is essential background reading for all those wanting to learn about the lives of stars, astrophysics and the reasons behind the abundances of the chemical elements.

Award-winning writer and broadcaster Marcus Chown. Formerly a radio astronomer at the California Institute of Technology, he is now cosmology consultant of the weekly science magazine *New Scientist*.

Publication Details
Chown, M., *The Magic Furnace: The Search for the Origin of Atoms*, Oxford University Press, (1999), 240 pages ISBN-10: 0099578018; 13: 978-0099578017.

Society for the History of Astronomy – Spring Meeting

[I'm most grateful to Sue & Pat for providing this account. May I please encourage anyone who has been or is planning to go to an astronomy-related meeting or location/building to drop me a few lines to put into Transit? Any such article may awaken others to interests or possibilities they didn't know they had! – Ed.]

Sue Barnes & Pat Duggan

The Society for the History of Astronomy (SHA) held its Spring Meeting this year in the lovely Quaker Meeting House in Friargate, York, on 20 April. There was a good mixture of topics, including some of the significant characters impacting on astronomy.

A welcome cup of tea or coffee was provided for everyone, as we assembled to find that some members had travelled from as far away as Scotland. The day began with an introduction given by Madeline Cox FRAS, chairman of the SHA.

Brian Donkin – industrialist, inventor and precision observer

The first talk was from Mike Leggett, publicity officer for the SHA and a member of Milton Keynes AS. Mike had chosen to talk about Bryan Donkin, a member of RAS, an engineer and industrialist and – astronomer, 1768–1855.

Donkin was firstly a land surveyor and land agent to the Duke of Dorset at Knowle Park. He became interested in a career in industry and, on the suggestion of his father's friend John

Smeaton, apprenticed himself to the Dartford Iron Works. Soon he was moving into the world of printing with his own design of precision machinery, and started his own company.

He looked at the drawbacks of current production and developed a polygonal composite ink roller, which by 1820 was responsible for producing Victorian stamps and banknotes. He was awarded a Gold Medal at the Great Exhibition of 1851 for his paper-mould making. He supplied the first steel-nib pen but sold the successful patent on to Joseph Bramah.

His advances in the field of tinning food were remarkable, not only for the ability to preserve food but also for his bold offer to the Prince Regent to personally taste the tins of meat – an offer that was accepted. Following this, he was commissioned to supply tinned food to the British Navy. It is said that the lead seals of his company's tins were safe under normal climatic conditions, but it was later reported that the reason for deaths on Franklin's expedition to northern Canada was that the lead degraded and became unstable in the intense cold and was absorbed into the food.

In astronomy, this gifted engineer invented a level for measuring the positions of stars to a fine precision. It was his company, now Bryan Donkin and Son, which supplied this equipment for the Greenwich Royal Observatory. He was acclaimed for upgrading the Nautical Almanac by providing accurate readings for 45 stars when ephemerides of only 28 were previously available and were causing problems to ships because of the long gaps to correct time-clock error at sea.

In 1838 he was elected a Fellow of the Royal Astronomical Society and was chairman by chance when that society received its Royal Charter. He had a small observatory in his own garden where he spent much time and where he was able to apply his perfectly engineered level as part of his own equipment.

A further contribution the innovative Bryan Donkin made was in the field of high-pressure gas equipment, where his forte for problem-solving again came to the fore by providing measurements of such accuracy that they were adopted as the national standard within that industry.

Russell W Porter – Arctic explorer, industrialist and astronomer

Richard Sargent of Chester AS gave a talk about Russell Porter, who was born in Vermont in 1871. As a very young man studying architecture, he was inspired by Robert Peary's lectures on Greenland and applied to go on his first Arctic expedition. Unknown to him, his mother had written to Peary pleading with him to not let him go. This proved effective at the time but only delayed him. He finally got to go in 1894 on an expedition to the west coast of Greenland, which had a number of disasters including hitting first an iceberg and later a reef. However, this clearly did not put him off, as on his return he said he had been bitten by the Arctic fever bug and was keen to go back.

Porter returned to the Arctic in 1896 with Peary. This expedition, on which Porter's role was that of artist and surveyor, was looking for a large iron meteorite. Even though the trip failed to find the meteorite, Porter provided useful surveying work of the area and painted some

beautiful artworks using watercolours and pastels (*see below*) , which must have been a challenge given the temperature.

Porter kept returning to the Arctic, including as part of attempts to get to the North Pole. He had some very close calls, particularly an encounter with a polar bear. His role had expanded to that of artist and scientist, and his astronomical observations were of great importance. He tried hard to capture the beauty of the aurora but never felt he managed to get its true colours. The trips regularly experienced temperature of –30°C, and a low of –47°C was recorded. Porter suffered frostbite, not surprisingly.

By the age of 34 he felt he should settle down, so in 1906 moved to Maine to teach art and attempt some farming. It soon became apparent that he was better suited to architecture. Furthermore, his interest in astronomy continued to grow. Telescopes at that time were very expensive, so he decided to build his own, having seen an article in a magazine, and soon became an expert on making mirrors. Apparently the cold in the winter and mosquitoes in the summer were a constant source of annoyance to him, which inspired him to develop a turret-style telescope (*see left*) to shelter from the elements and mosquitoes. He even built a tunnel from his house to his turret so that he didn't have to go outside!

Porter moved back to Springfield in Vermont to work at the Jones & Lamb Machine Company. When recession began to affect the company, he persuaded them to diversify and begin making mirrors for telescopes. He taught the workers himself, and the company became well known for supplying 7" to 9" mirrors, tubes and mountings. He helped form the Springfield Telescope-Making Club in 1920 and promoted outreach groups to encourage people to make their own telescopes. The club built its own clubhouse, *Stellafane* (Latin for 'shine to the stars'). He published a book containing many detailed illustrations to promote amateur telescope making.

Porter's artistic abilities proved very useful when he was recruited to work on the design of the new large professional telescopes. He moved to Pasadena in 1926 to work on the 200" Mount Palomar telescope; his drawings detailing the cross-sections of designs assisted greatly in visualising what was required, in the days before CAD. Indeed, the drawings and paintings are fabulous works of art in themselves.

Porter died in 1949. He had said that nothing had given him more pleasure than knowing he had helped people into building their own telescopes and thus discovering the wonders of the stars.

Isaac Roberts, E.E. Barnard and the mysterious nebulae

Lee MacDonald from the Webb Deep-Sky Society introduced us to the story of Isaac Roberts and E.E. Barnard. **Isaac Roberts** (1829–1904) was one of the pioneers of deep-sky astrophotography, whose images became world famous and showed there was much more to nebulosity that had been appreciated up until then

He was born in Wales but spent most of his working life in Liverpool as a master builder. His company, Roberts & Robinson, built many of the famous buildings in Liverpool, including Lime Street Station. He retired from building in 1888.

Roberts was a self-taught astronomer and in the 1880s started to take his interest more seriously. He began experimenting with stellar photography in 1883 and purchased a 20" f/5 refractor, which was ideal for stellar and nebular photography. He set up the photographic plate at the opposite end to the mirror and used very long exposure times. Even then, his notes highlighted his frustration with clouds over Liverpool skies! His assistant at the time was William Sadler Franks, who in later years lived in the same village as a young Patrick Moore and shared his knowledge of astronomy.

By the 1880s many nebulae had been discovered but had aroused relatively little interest. At that time, attention was more on *where* things were rather than *what* they were. Professional astronomers were working on star catalogues, double stars etc and nebulae were more of a curiosity or even nuisance (think of Messier's catalogue of things to ignore). It was the amateurs who were left to explore the nature of nebulae. Roberts's early target of M31 caused a big stir. It was felt that it suggested a star-forming nebulosity. Roberts had a rigorous, careful approach to astrophotography and didn't doctor his photographs. He took photos over a period of time to see if there was any rotation; none was found, which suggested the targets were a long way away.

Edward Emerson Barnard was born in Nashville, Tennessee, in 1857. Barnard was to become a great rival of Roberts. Since the age of 9 he had worked in a photography shop and was a self-taught amateur astronomer. He discovered a number of comets and was hired initially by the Lick Observatory in California but spent the rest of his time in Chicago. By 1889 he owned a 6" f/5 reflecting telescope with a Bruce camera and was taking 4-hour exposures for his astrophotography images.

Roberts and Barnard first clashed in 1895 at an RAS meeting, over images taken in the region of 15 Monocerotis. Roberts thought it showed many faint stars and Barnard thought it showed nebulosity. Roberts did not appreciate that the faintness of the stars was unaffected by the telescope's aperture. Bernard appreciated that it was the focal ratio and not the aperture that was key to recording the extent of nebulosity – he had discovered this from his own experimental work.

Their second clash was from 1896 to 1900 over the Pleiades. Barnard's 10¼-hour exposure showed what he thought to be faint nebulosity outside the cluster. Roberts disagreed, saying that the effect was due to a defective image and that it wasn't really there.

The pair continued to clash over a number of issues and Roberts would not accept any criticism, nor engage in any discussion. There is evidence to suggest this was part of his character – an unfortunate personality trait. However, the images the pair had produced

meant that nebulae were now taken seriously, and indeed Edwin Hubble went on to use some of their photographic survey work to help with his theory on galaxies and their motion away from us.

Barnard died in 1923. He remained Professor of Practical Astronomy at the University of Chicago until his death.

As the photographs below show, the rivals looked rather similar.

Isaac Roberts

E.E. Barnard

How astronomy has changed in my lifetime

Michael Roe

My first memory of anything to do with astronomy is from about November 1965 when I was four – my dad showed me the North Star on our first walk to Brotton Library. I knew very little about space then, but later learned much more from any and all books that I could find, many of them from the library. Astronomy magazines didn't seem to be available through newsagents; in fact, I never came across any until 1981.

In 1968/69 I first saw Patrick Moore on TV introducing the Apollo Moon landings. Of course, both he and my hero Neil Armstrong have died recently. What will happen to public interest in astronomy and space travel without them, I wonder?

Planets and the Moon

At about the same time, I was reading some rather out-of-date books, including speculation that Mars showed green markings due to lichen-like plants and maybe something more biologically advanced! Mercury was assumed to be barren and very hot, perhaps with craters and with one face always facing the Sun, the other thought to be permanently dark and frozen. Venus was a mystery, shrouded as it was in a thick, cloudy atmosphere. It was

believed to be a dusty desert, but its temperature was beginning to be measured, revealing a very hot planet.

Our Moon was being mapped at this time by satellites in orbit around it. Some astronomers thought the craters were volcanic, while others believed they were impact craters. Only recently has all lunar photography been much improved, after a wait of 40 years!

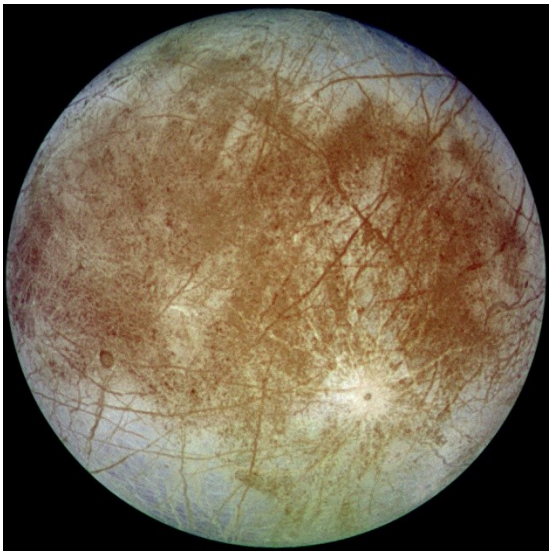
In the mid-1960s Jupiter was known to have variable dark bands and spots in a deep swirling atmosphere, while its moons were assumed to be icy worlds. Saturn was the only planet known to have any rings and furthermore had bands on its gassy surface. Titan, its largest moon, was known to have a methane atmosphere, but all the smaller ones were assumed to be icy, although Iapetus had one side darker than the other.

Uranus was little more than a small greenish disk even through the best telescopes, although some astronomers claimed to have observed dark bands. Even today, anyone with a good telescope can see for themselves what a tiny-looking and difficult planet it is to observe. Neptune was even more difficult – a tiny, dim, bluish disk – though again some astronomers claimed to have seen details on it. Through the average amateur telescope it appears little larger than a star of similar brightness.

With the exception of the early Mariner 4 studies of Mars, all information about the planets was obtained telescopically, often using spectroscopes. As for other solar system bodies, fewer than 2000 asteroids were numbered, and comets were still a subject for conjecture – one astronomer insisted they were flying sandbanks with no true nucleus!

The Sun and stars

The Sun was fairly well understood, but observations since have increased our knowledge of it hugely at all observable wavelengths.



The main completely new area of knowledge about other stars is the discovery of planets around them. In 1965 it was thought possible that such things existed, but there was no real proof. The long search for life beyond Earth has still not turned up any strong evidence since the hunt began in 1960. Within our solar system, Mars and Jupiter's moon Europa (*see right*) seem to be the best candidates. Any life beyond our solar system would be well beyond our direct detection abilities. I suspect that intelligent beings elsewhere do exist but are much more distant than was formerly conjectured.

Since 1965, we have learned a huge amount about objects in our galaxy and beyond. Cosmologists seem to bring out new theories all the time, although personally I've never had much interest in this branch of astronomy.

Spacecraft

Orbiting satellites and telescopes have advanced astronomical knowledge enormously. The great unmanned spacecraft – Mariner and Viking to Mars, Venera to Venus, and the Voyager craft to Jupiter and then on to Saturn, Uranus and Neptune – have revealed their target worlds and moons to an amazing degree.

More modern craft such as Galileo to Jupiter, Cassini to Saturn, Messenger to Mercury, and the Phoenix Lander and the three rovers on Mars continue this work, while the Lunar Reconnaissance Orbiter has transformed our detailed knowledge of the Moon's surface and physical characteristics.

Yet no one has set foot on the Moon for 40 years, since the end of the Apollo adventure, simply the greatest achievement of the human race. Moreover, no probe has safely landed on the Moon for 36 years, even though it's so relatively easy to reach.

We could have done better! The Curiosity rover on Mars is almost the last of its kind; NASA's plan for Mars in future is just to send an atmospheric probe.

And this is what disappoints me now. There is so little general interest in the more recent probes, with a public having virtually no interest in science, and the media using comedians to present science programmes. So, everyone, enjoy the last interplanetary spacecraft such as the New Horizons craft to Pluto, and the Dawn mission to Ceres, the largest asteroid.

But don't worry about the media panic about asteroids colliding with Earth. It will happen only every several thousand years. I've examined many Palomar Sky Survey photographs without finding one near-Earth asteroid, though I *have* found many other asteroids further away.

THE TRANSIT QUIZ

Answers to April's quiz

Every answer starts with the letter D.

1. The angular distance of a celestial body north or south of the celestial equator. **Declination**

2. Another name for the planetary nebula M27. **Dumbbell Nebula**

3. The NASA mission that sent a 500kg instrument package hurtling into Comet 9P/Tempel 1 in July 2005. **Deep Impact**

4. A useful empirical measure of the resolving power of a telescope. **Dawes limit, devised by William Dawes (1799–1868). According to this criterion, the resolving power in arc seconds of a telescope with aperture *D* millimetres is 115.8 / *D.***

5. The numerical difference between the apparent and absolute magnitudes of a star. **Distance modulus**

6. The most distant and most luminous of all first-magnitude stars. **Deneb (Alpha Cygni)**

7. The phase of a body in the Solar System when exactly half of its sunlit side is visible. **Dichotomy**

8. Epsilon Lyrae. **The Double Double – a well-known pair of double stars.**

9. Another name for the diffuse nebula M43. **De Mairan's Nebula (part of the Great Orion Nebula)**

10. The Danish compiler of the *New General Catalogue* [NGC] *of Nebulae and Clusters of Stars.* He worked at Birr Castle and became Director of the Armagh Observatory. **John Louis Emil Dreyer (1852–1926)**

May's quiz

This month, every answer starts with the letter E. The questions are in very rough order of increasing difficulty.

1. The apparent yearly path of the Sun against the background stars.
2. The largest object situated at one astronomical unit (AU) from the Sun.
3. Types E0 to E7 in the Hubble classification of galaxies.
4. One of the divisions in Saturn's A-ring.
5. The home of the Pillars of Creation.
6. The more modern name for what used to be known as the Kuiper belt.
7. The constellation of which Achernar is the brightest star.
8. A bright, bluish planetary nebula in Gemini. In long-exposure photographs, it resembles a face surrounded by a fur hood.
9. The first near-Earth asteroid to be discovered, in 1898.
10. The first Mars-Trojan asteroid to be discovered, in 1990.