AUCKLAND ASTRONOMICAL SOCIETY

February 2015

SOCIETY JOURNAL

February Meeting: Monday February 9th at 8:00pm

The Copernicus Complex
Are We Special in the Cosmos?

Is humanity on Earth special or unexceptional? Extraordinary discoveries in astronomy and biology have revealed a universe filled with endlessly diverse planetary systems, and a picture of life as a phenomenon intimately linked with the most fundamental aspects of physics. But just where these discoveries will lead us is not yet clear. We may need to find a way to see past the mediocre status that Copernicus assigned to us 500 years ago. Dr. Scharf helps us to come to grips with the implications of some of the latest scientific research, from the microscopic to the cosmic.

Caleb Scharf was born and educated in England. He received his B.Sc. in physics from Durham University, and his Ph.D. in astronomy from the University of Cambridge. Following postdoctoral work in X-ray astronomy and observational cosmology at the NASA Goddard Space Flight Center and the Space Telescope Science Institute in Maryland, he has been a research scientist at Columbia University in New York. He is currently the director of the multidisciplinary Columbia Astrobiology Center. His research interests include the study of exoplanets, exomoons, and the nature of environments suitable for life.

This is a rebroadcast of a lecture given as part of the Silicon Valley Astronomy Series

Calendar of Events for 2014

February 2015 Programme

Mon	2	8:00pm	Introduction to Astronomy with James Kennedy, NASA—Lessons in Life and Leadership—Ispired by Stories of Space Exploration
Fri	6	7:00pm	Young Astronomers with Margaret Arthur—younger group
Mon	9	8:00pm	Monthly Meeting with Caleb Scharf—The Copernicus Complex: Are We Special in the Cosmos?
Fri	13	7:00pm	Young Astronomers with David Wardle—older group
Mon	16	7:00pm	Astrophotography Group with Keith Smith
		8:00pm	Practical Astronomy with Bill Thomas—Telescopes and Accessories
Sat	21	4:00pm	Warkworth Radio Telescope Tour
		6:30pm	Dark Sky Observing Night
Mon	23	8:00pm	Film Night with Gavin Logan—Which Universe are we in?

Introduction to Astronomy, Monday 2 February at 8:00pm

James Kennedy started working for NASA in 1968. He grew as an engineer and leader in key positions including Project Manager, Director of Engineering and Director of NASA. Under Kennedy's leadership, Kennedy Space Center successfully completed 15 launches of satellites and robots currently exploring our Universe with high profile missions such as Spirit and Opportunity to Mars and Pluto New Horizons. The presentation is based on true stories of people at NASA, each of them associated with a leadership tip.

March 2015 Programme

Mon	2	7:00pm	Introduction to Astronomy with Bernie Brenner and Peter Felhofer
Fri	6	7:00pm	Young Astronomers with Margaret Arthur
		8:00pm	Young Astronomers with David Wardle
Mon	9	8:00pm	Monthly Meeting
Wed	16	7:00pm	Astrophotography Group with Keith Smith
		8:00pm	Practical Astronomy with Bill Thomas
Mon	23	8:00pm	Film Night with Gavin Logan

Welcome New Members

Steve Baldwin (ordinary)
Rachael McDouall (family)
Michael Ashby (ordinary)
David Havell (family)
Andrea Bruce (ordinary)
Thomas Harvey (ordinary)
Saumitra Kalikar (family)
Prakash Abraham (ordinary)
Adrian Dickison (family)
Dominick Stephens (ordinary)
Josh Ryhen (ordinary)
Zhongshan Duanmu (ordinary)
Demetrios Marolias (ordinary)
Don Smith (ordinary)
Tim Antoniadis (ordinary)
Sam Duncan (ordinary)
Karla Hansen (country)
Hugh Sundae (family)
Diego Nievas (family)
Marc Touchette (family)
Mijail Linares (ordinary)
Nancy Holland (ordinary)
Ben Hart (ordinary)
Heiryck Gonzalez (family)

Film Night Monday February 23 at 8:00pm

A documentary which examines the latest theories on quantum mechanics and cosmology and how they now appear to open the way for new thinking about the nature of the Universe.

The film is 50 minutes long and will be followed by the December 2014 Sky at Night show about Nebula.

Dark Sky Observing Night: Saturday 21st February - 6:30pm onwards

We are starting the year off with a Dark Sky Observing Night. This will be a great opportunity to explore the Summer night sky in a reasonably dark site and to try out a variety of telescopes. Feel free to bring a telescope or binoculars. There will be AAS telescopes available to use if you cannot bring your own and plenty of people willing to share their knowledge. Dave Wyers has kindly agreed to host us once again at his place.

There will be a BBQ from 6:30pm onwards with telescope viewing as soon as it is dark.

Venue:

490 Whitehills Rd
Wainui (near Silverdale)
Google Map: http://goo.gl/maps/mgDb5
this is about a 40min drive north of the Harbour Bridge

All members are welcome. Bring a picnic dinner or food for the BBQ and your supplies for the evening

Please bear in mind when parking that members will be leaving with parking lights only. Do not obstruct paths and check you have not parked in an inconvenient place.

Tour of Warkworth Radio Observatory - Saturday 21st February - 4:00pm

AUT University have kindly agreed to let members visit and tour their radio telescope observatory at Warkworth. The site has two radio telescopes 30m and 12m.

To get there head north on SH1. The observatory is located on Thompson Rd (on some maps it is Satellite Station Rd), just off SH 1 about 4km south of Warkworth. Turn right just after the Honey Centre. Meet at the gate of the fist large dish on the left.

Please note the turn off from SH1 to Thompson Rd can be difficult/dangerous if there is significant traffic heading south on SH1. Please exercise appropriate care and if in doubt proceed past the intersection into Warkworth township (approx 4 mins), turn there and head back south to make a (safe) left hand turn into Thompson Rd.

A Map of the area is attached
Google Map: http://goo.gl/maps/N52jt

More details on the observatory can be found at http://www.irasr.aut.ac.nz/radio-telescope.
This tour will be held prior to the Dark Sky Observing Night.

Young Astronomers - Friday 13th February - 7:00pm

The program for the 1st Term of 2015 for the older group of Young Astronomers is to look at building a sundial.

While my focus will be to support the Young Astronomers in this project, The is likely to be some interest from other AAS Members who are also welcome to attend. This will be an ongoing practical project which will continue from 8:00pm on the first Friday of each month.

There are many different design possibilities for sundials and each style has different benefits. To start with, I will go through some different design types and see if there is any interest from you to build your own sundial at home. I hope that this will be an interactive, practically based program. A well designed sundial can tell you both the time of day and day of the year (provided the Sun is shinning).

To start with, please refresh yourselves with:

- Kepler's three laws of planetary motion,
- Obliquity of the ecliptic, the Sun's declination, Tropics of Cancer and Capricorn,
- The Equation of Time,
- Equinoxes, and
- The terms umbra and penumbra, great circle and small circle.

Please try and locate your home's (or the location of the sundial's) latitude and longitude.

I have uploaded a SketchUp file of the sundial at the Hamilton Gardens. I will be using this to explain some of the geometry of sundials: https://www.dropbox.com/s/p1isuluh2zcds4y/Sundial.skp?dl=0

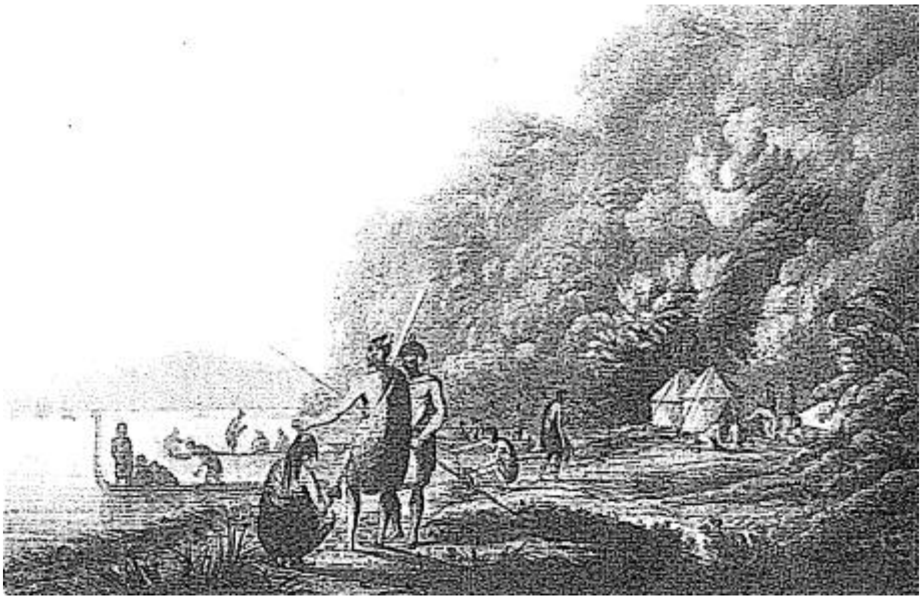
In order to view this file, you will need to have SketchUp Make or SketchUp Pro installed on your computer or tablet.

http://www.sketchup.com/download

Early Expeditions to New Zealand

By Garry Tee (reprinted from the New Zealand Astronomical Yearbook 2003)

On the early expeditions to New Zealand, astronomical observations were very important for navigation. Latitude was measured by observation of the Sun or stars, but longitude could not be measured at sea before Captain Cook's First Voyage.



"William Wales's Observatory at Ship Cove in 1777", oil painting by James Webber, Suter Art Gallery

ABEL TASMAN

Abel Janszoon Tasman (c1603-c1659) was a Dutch seaman employed by the Dutch East India Company. Since 1606, several Dutch voyagers had charted several parts of the north, west and south coasts of Australia, which looked distinctly unpromising for trade. Anthonie van Diemen, Governor-General of the Company's base at Batavia (now Jakarta), sent Tasman on exploring expeditions in 1642-1643 and in 1644, with Francois Jacobszoon Visscher as Pilot Major.

Tasman and his crew became the first Europeans known to have seen New Zealand. On 1642 December 13 they sighted mountainous land south of Cape Foulwind, and on December 18 the two ships moored in Golden Bay. The local Maori attacked a ship's boat, killing four crewmen, and so Tasman sailed north from the bay which he called Murderer's Bay (now Golden Bay). Tasman named Cape Maria van Diemen and the Three Kings Islands, where his crew failed to land [Sharp] [Slot].

The charts of New Zealand, Australia, New Guinea, Tonga, Fiji et cetera produced by Tasman and Visscher were more accurate than any previous charts produced by navigators. Visscher appears to have done the calculations for determining latitude and longitude. Apart from a few errors in calculation, his latitudes are mostly correct within a few minutes of arc, with an instrumental bias of 8 minutes [Slot, p.60]. Longitudes could only be estimated by measuring the speed, direction and duration of travel from a point of known position, followed by complicated calculations in spherical trigonometry. Tasman and Visscher skillfully applied the available techniques for estimating longitude, and their longitudes are impressively accurate. They also measured the magnetic declination (i.e. the direction of the compass needle) at various places throughout their explorations.

There seems to have been some knowledge of Aotearoa in early Polynesia. But at Tahiti in 1769, the navigator Tupaia drew for Captain Cook a chart of the islands which he knew of, which did not include Aotearoa [Duff pp, 17-18]. New Zealand was truly discovered to the world by the charts of Tasman and Visscher, and later by Tasman's journal.

JAMES COOK

James Cook (1728-1779) was the first person who could determine longitude at sea. On his First Voyage (1768-1771) he used the first edition (1766) of the Nautical Almanac, which contained tables for using the Moon as a clock to determine standard time (at Greenwich). Cook was highly enthusiastic about that revolutionary advance, which enabled him to measure longitude by observations of the Moon and calculations taking a few hours. The Royal Society appointed the astronomer Charles Green, to observe from Tahiti the Transit of Venus on 1769 June 3.

Cook was anxious to check the accuracy of the lunar method, by making some independent measurement of standard time. The Nautical Almanac listed a Transit of Mercury on 1769 November 9, at a time when it would be visible from New Zealand. Cook reached Whitianga on 1769 November 3, and decided that there would be a convenient site for observing that Transit of Mercury. Green and Cook observed that Transit of Mercury from Cook Beach, about 250 metres from Purangi River and from those observations Green calculated their position as 36^{0}48'South, 184°04'West (or 175° 56' East) [Begg & Begg p.36]. The modern values for their observation point are 36° 50'18" South, 175°45'23" East. The lunar method was vindicated by that independent check, and Cook named the bay as Mercury Bay.

Two hundred years later, on 1969 November 9, J. C. Beaglehole unveiled a monument near the mouth of Purangi River, with an inscribed bronze plaque [Porter p.73].

MERCURY BAY
NEAR THIS SPOT ON 10 NOVEMBER 1769
JAMES COOK AND CHARLES GREEN
OBSERVED THE TRANSIT OF MERCURY TO
DETERMINE THE LONGITUDE OF THE BAY

Cook recorded the date as 1769 November 9; but if we apply the International Date Line (which had not then been established), then the date in the New Zealand time-zone was 1769 November 10.

At Ship Cove in Queen Charlotte Sound, Cook and Green used the lunar method to estimate the longitude as

175°09'[Beaglehole p.336]. The modern position is 41°05'44" South, 174°14'02" East [Begg & Begg p.141].

On Cook's Second Voyage (1772-1775), William Wales was astronomer on Cook's ship HMS Resolution and William Bayly was astronomer on HMS Adventure. Some of the new chronometers were provided by the Board of Longitude, which instructed Wales and Bayly to compare chronometers with the lunar method for determining longitude [Begg & Begg pp. 90-91]. The astronomers demonstrated that the chronometers were more accurate than the lunar method, and Cook enthusiastically adopted chronometers for determining longitude.

After the very first voyage in Antarctic waters, Cook's ship HMS Resolution stayed at Dusky Bay for refreshment of the crew, from 1773 March 26 to May 11. For most of that time the ship was moored at Pickersgill Harbour, where a small promontory was named Astronomers Point [Begg & Begg, plates 123 & 133]. Wales and 2 sailors cleared about 4000 square metres of rainforest as the site for an observatory, and Wales got 2 trees chopped down so that he could mount his astronomical instruments on the tree stumps. After many observations of Sun, Moon and stars he computed the position as 45°47'26" South, 166°18'09" East - the modern figures are 45°47'45" South, 166° 33'56" East [Begg & Begg p.105].

When HMS Resolution departed from Dusky Bay; most of the crew were cheerful and fit from their refreshment. But Wales wrote on May 10 "We are now (thank God) leaving this dirty, and on that account, disagreeable Place; after a stay of near Six weeks, during the greater part of which I was continually troubled with severe Colds, attended with a fever, owing to my being almost always wet and sometimes so bad, that it was with the utmost difficulty that I attended my business" [Beaglehole p.329].

In the phenomenally wet environment of Dusky Bay, wood does not decay readily: almost 200 years after those 2 trees were chopped down, their stumps were largely intact. [Begg & Begg Plate 143]

Whilst HMS Adventure waited at Ship Cove (in Queen Charlotte Sound) for HMS Resolution, Bayly's observatory was erected on Hippah Island and he measured the longitude as 173°48'55½" East. Wales used the chronometer (based on his longitudes for Dusky Bay) to estimate a similar longitude for Queen Charlotte Sound. Cook was much concerned about the difference between those chronometer longitudes and his lunar-based longitude of 175°09' [Beaglehole p.336].

At Ship Cove in Queen Charlotte Sound in October 1774, Wales set up his observatory, and determined its position as 41°6' South, 174°25'7½" East. The modern position is 41° 05'44" South, 174°14'02" East [Begg & Begg p.141]. Cook then acknowledged that his First Voyage chart of New Zealand was slightly inaccurate, with the north part of the South Island shown with somewhat less than its actual width. He wrote that "I mention these errors not from a supposition that they will much affect either Navigation or Geography, but because I have no doubt of their existence, for from the multitude of observations which Mr. Wales took, the situation of few parts of the world are better ascertained than that of Queen Charlottes Sound" [Beaglehole p.425].

In 1776, James Cook and William Wales were elected as Fellows of the Royal Society [Beaglehole p.451].

On Cook's Third Voyage (1776-1779), Second Lieutenant James King (1750-1784) acted as astronomer on HMS Resolution and William Bayly was the astronomer on HMS Discovery, with James Webber as the official artist. At Ship Cove in Queen Charlotte Sound, the observatories were erected on 1777 February 12-13. James Webber made an oil painting (now in the Suter Art Gallery, Nelson) of Ship Cove, showing the two tents of the observatory, with a group of Maori watching the astronomers working at their instruments. During the Second Voyage, the Maori at Ship Cove had killed 10 men from HMS Adventure, and hence in 1777 the astronomers were guarded by some marines. Later Webber published an aquatint version which is reproduced here, since the details in the original oil painting are now less clear than in some prints of the aquatint.

"William Bayly's Observatory at Ship Cove in 1777", oil painting by James Webber, Suter Art Gallery

Bayly determined the position as 41°06' South, 174°25'15" East, which agreed well with Wales's observatory result of 41°06' South, 174°25'7½" East in October 1774 [Begg & Begg p.141].

Captain Cook was killed at Hawaii on 1779 February 14, and Captain Charles Clerke succeeded Cook as Commander of the expedition. After Clerke died on 1779 July 22, James King commanded HMS Discovery, and he wrote volume 3 of the official account of Cook's Third Voyage [Beaglehole pp. 496,497,675,686,691,692]. Captain James King was elected as Fellow of the Royal Society in 1781.

FABIAN BELLINGSHAUSEN

Fabian Gottlieb von Bellingshausen (1778-1852) commanded the Russian Antarctic Expedition (1819-1821), which discovered the first land south of the Antarctic Circle ever to be seen by humans. The astronomer was Ivan Mikhaylovich Simonov (1794-1855), Professor of Physics at Kazan University and the best friend of the great mathematician Professor Nikolay Ivanovich Lobachevsky.

From 1820 May 28 to June 3 (Julian calendar), the ships moored at Captain Cook's base in Queen Charlotte Sound. The Russians established very friendly relations with the Maori, who performed hakas to entertain their visitors. Simonov wrote "Indeed, the New Zealanders struck us as a people with the fire of intellect in their eyes, martial pride in their bearing, and pleasant facial features" [Barratt p.48]. Brisk well-controlled trading took place, with Simonov acquiring many artefacts, including some fine korowai cloaks and 3 incomplete specimens of flax fabric, which revealed the method of manufacture [Barratt pp. 111-113 & 118-119].

On May 30, Simonov wrote "I occupied myself from early morning onwards in seeking a spot suitable for astronomical observations". He was not able to establish an observatory upon the site of the observatories of Wales or of Bayly. "Since our ships were to remain only a very short time in Queen Charlotte Sound, we did not erect an observatory on land, but every day I went ashore to make the observations that would serve to fix our latitude and longitude and thrice daily, to check our chronometers" [Barratt p.53]. He calculated the longitude as 174° 23'52" East [Barratt p.45]. The modern position is 41°05'44" South, 174°14'02" East [Begg &, Begg p.141].

In August 1821 the expedition returned triumphantly to St Petersburg. Simonov was delighted to meet there his best friend Lobachevsky, who was buying mathematical books for Kazan University Library. Bellingshausen had been instructed by the Naval Minister that all objects collected on the expedition were to be presented through him to the Tsar [Barratt p. 106]. Consequently, the Miklukho-Maklay Institute of Ethnography in St Petersburg has a rich collection of early Maori artefacts from Queen Charlotte Sound [Barratt Plates 1-34, pages 107-111 & 115-118]. But Simonov, as a civilian astronomer, did not regard himself as bound by naval orders. Lobachevsky arranged for Simonov's collection to be transported to Kazan with the books which he had bought [Karimullin & Laptev p.112]. Kazan University now holds the Simonov Collection with some significant early Maori artefacts [Barratt pp. 111-113 & 118-119], thanks to the great mathematician Nikolay Ivanovich Lobachevsky.

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Frances Porter, A Sense of History: A Commemorative Publication for John Cawte Beaglehole, O.M., About James Cook's Landing Places in New Zealand, Government Printer, Wellington, 1978.

Andrew Sharp, The Voyages of Abel Janszoon Tasman, Clarendon Press, Oxford, 1968.

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Slooh—An Update

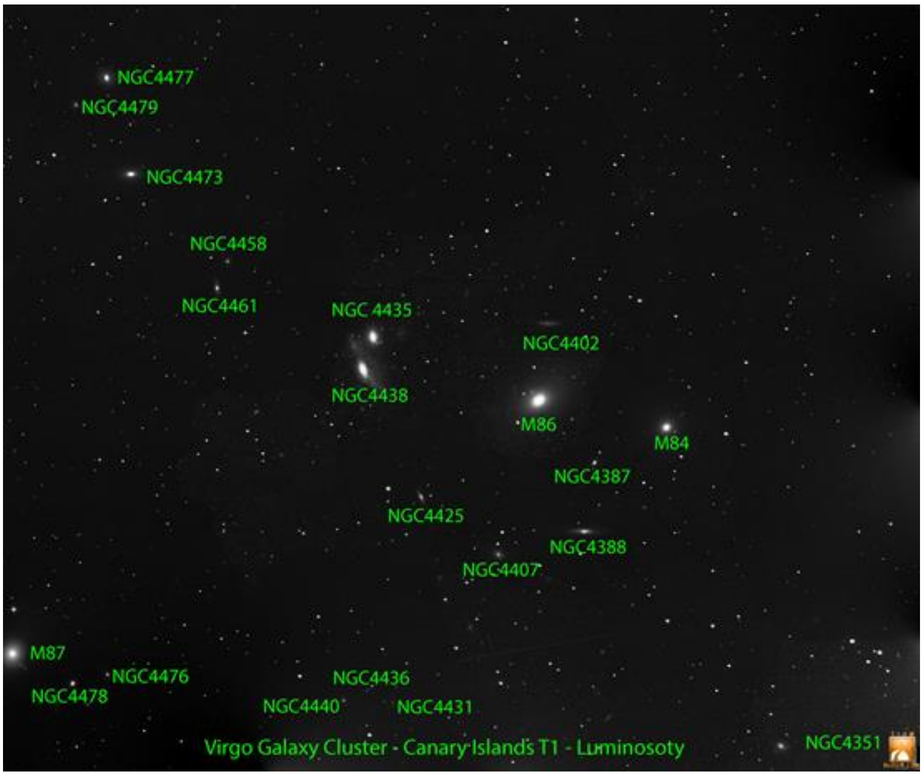
By Keith Smith

A while ago, in the June 2013 journal, I wrote about my usage of the online observatories accessed through Slooh (www.slooh.com). Since I wrote that article, quite a few things have changed so it's probably about time I wrote an update.

The first, and probably the most important, is that the Chile Observatory is now back on line. In my last article I mentioned that it had developed a fault in January '12 and, since then, it was uncertain whether or not it was able to come back on owing to external circumstances. Well I'm pleased to report that those circumstances have been resolved and Chile is running again, with several upgrades including the same updated software that controls the two Teide telescopes. It was made operational again last June which means that Slooh, once again, can cover both celestial hemispheres. The equipment installed in the Chile dome (usually referred to as C1) is similar to that in the Mt Teide second dome (T2), offering both a wide field and a high magnitude picture. The only main difference is that the C2HM has a slightly wider field of view than the T2HM.

Pillars of Creatiion in the Eagle Nebula (M16) - T2HM

Along with that, the new software means that FITS files can also be obtained from Chile. While Teide runs on UTC +0, Chile is at UTC -5 so there is some overlap between their hours of operation. Additionally, the system has been tweaked so that FITS and AutoSnap are now automatically on for all missions – including those from the pull-down list, which will produce the standard LRGB FITS.



For catalogue and co-ordinate missions, a new processing option has been added, called Deep Mono. This, instead of producing a colour image, produces a monochrome image that is made up by using more grey scale exposures instead of the red, green, and blue exposures that make up the standard images. This is to enable more detail to be collected and extracted from the resulting FITS when colour data is not needed or irrelevant.

The other major change is that the Facebook group has been shut down and replaced by what is known as the 'Slooh Clubhouse'. Here, each member has their own personal space where they can set up albums etc for others to look at, can contribute to the 'Astro Chatter' space where the full resolution images can be shared (instead of having to put up with Facebook reducing the image quality) as well as discussing various topics. Dedicated areas can also be set up for special interest groups, such as the comet hunters, the asteroid trackers, the image processors etc. My area is full of galleries of Messier objects, Caldwell catalogue, Arps Peculiar Galaxies, Bennett Catalogue, all my own FITS processing results, mosaics (a picture made up of several smaller pictures to cover a wider area of the sky) and anything else I find interesting.

Members use Slooh for all sorts of things. Currently I'm using the Chile telescopes to make a mosaic of both Magellanic Clouds using Chile's Wide Field scope while collecting FITS of various southern sky objects, such as the Tarantula Nebula (NGC2070) and the Eta Carina Nebula (NGC 3372). I'm still working my way through the Herschel 400 list with T1 (the half metre) as well as using both the T2 High mag and the C1 High mag to watch Jupiter and its moons. I'm also using both T1 and T2 to collect FITS sets of Messier objects for later processing with MaxIM. The results of all these end up being placed on my personal space in the Clubroom for other people to look at and comment.

It's also fun just to see what others are looking at, and there's nothing stopping you from capturing your own image of whatever it is, whether it be a galaxy, comet, or even a newly discovered Near Earth Asteroid. Some members use Slooh to monitor the positions of comets and asteroids and report their findings to the Minor Planet Center. Others are working on their own pictures and mosaics and some just like to watch and see what can be seen. Slooh caters for all ages, as well as levels of knowledge, from absolute novice to experienced astrophotographer. The community in the Clubhouse are always ready to answer questions and offer guidance and there are a lot of 'how to' tutorials in the Clubhouse as well.

I'm not sure what their plans for the future are but let us hope they keep going, as this is one way to beat those cloudy night blues and also to use telescopes in dark sky locations without the hassles of going there and setting up your own equipment. Very useful for people in light polluted areas – such as most of Europe and the continental United States.

Kuiper Belt Objects

By Chris Benton

Exciting new discoveries are continuously being made forcing astronomers to rethink our understanding of the outer Solar System. Recent decades have seen the development of more powerful Earth- and space-based telescopes in addition to interplanetary spacecraft travelling through the Solar System. Kuiper Belt Objects (KBOs), a large group of small bodies outside the orbit of Neptune, make up a significant part of this research and the findings have prompted much thought and discussion in the astronomical community. Discussion of their diverse range of physical and orbital properties is most interesting.

KBOs collectively, with all objects orbiting the Sun beyond the orbit of Neptune, are known as Trans-Neptunian Objects (TNOs). Composed mainly of ice and rock, they reside in a vast and thick doughnut shaped region called the Kuiper Belt which extends from approximately 30 to 60 AU (4.5 to 7.4 billion kilometres) from the Sun and is relatively close to the ecliptic (Freedman 2011). The Kuiper Belt shape and location is best illustrated in Figure 1. Currently over 1500 TNOs are documented (IAU_TNO list 2014) and it is thought that over 100,000 exist with diameters over 100 km (Stern 2012). The total mass of the Kuiper Belt is estimated to be approximately one tenth of Earth's mass (Rothery et al. 2011).

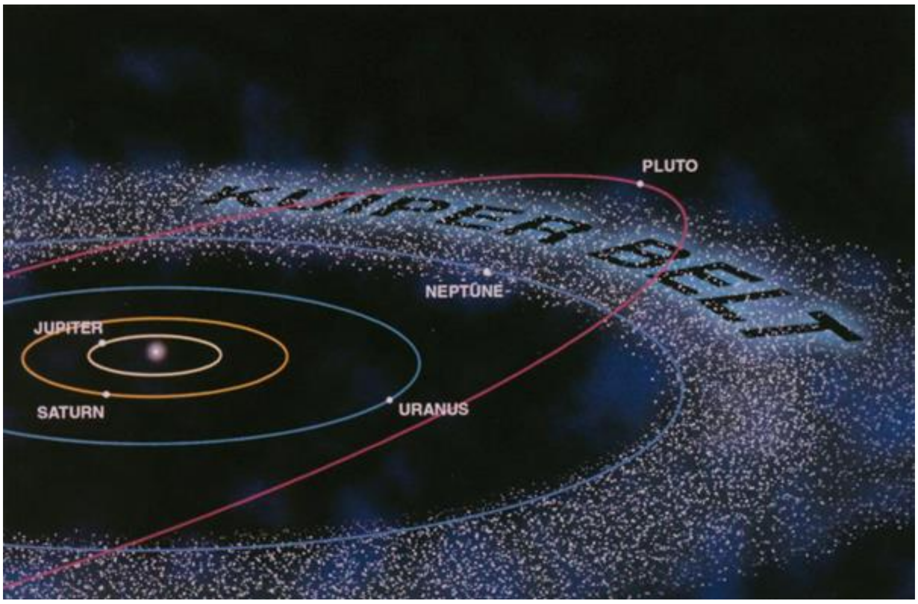


Figure 1: The Kuiper Belt in the outer Solar System.

Being faint, small and having slow orbital speeds KBOs have been difficult to detect. The discovery of Pluto in 1930 by observing its motion against the background stars was our first glimpse of this outer region of the Solar System. The existence of the Kuiper Belt was hypothesized after work by astronomer Gerard Kuiper in the 1950s (Rothery et al). The discovery of Chiron in 1977 between Jupiter and Uranus, and later Pholus in 1992, revealed a new class of objects called Centaurs. These have orbits of high eccentricity and by definition their paths cross those of the gas giant planets. This was evidence for a population of objects beyond Neptune. In 1992, using the newly introduced CCD camera, Jewitt and Luu discovered 1992 QB1 which confirmed the Kuiper Belt's existence. With improved equipment and increasing interest more objects were identified over the following years.

With the discovery of the Kuiper Belt, much research and debate has focused on its origin. KBOs are currently thought to be fragments of material from the outer part of the original protoplanetary disc that did not form into planets (WikiWeb_KB). Computer models indicate that early in the evolution of the Solar System, the orbits of the gas giants moved resulting in Neptune's orbit increasing out towards the Kuiper Belt region which was significantly closer to the Sun and having substantially more mass than today. This would have caused a major disruption in the region. Levison et al. (2008) suggest this may have reduced the number of KBOs by 99% and pushed the orbits of the remaining KBOs further out. This traditional theory is known as the Nice model, from Nice in France where it was first proposed. However, Lovett (2010) points out the model has a problem. About 30% of KBOs are part of binary systems. For example, Pluto and its largest moon Charon are tidally locked together. Some of these systems are only loosely bound, taking 4 to 17 years to orbit one another. One would think these orbits would not have survived any violent events. Morbidelli (2005) and JewitWeb also raise the possibility of other influences such as gravitation from a passing star or another undetected distant planet, or even large scale collisions and grinding of small fragments resulting in dust that was expelled by the pressure of solar radiation. The relevance of the large amount of missing mass is that the current density of the Kuiper Belt is too low and insufficient for the KBOs larger than 100km to have formed through the process of accretion (Delsanti 2006).

Three main types of KBOs are described by Rotherly et al. 2011. These are based on their orbital semi-major axes and eccentricity and included the Resonance KBOs, the Classical KBOs and the KBOs of the Scattered Disc Objects. Figure 2 plots these KBO groups.

The Resonance KBOs have a semi-major axis of 39.4 AU and number about 200 [International Astronomical Union (IAU)]. Since they are relatively close to Neptune and its significant gravitational field, this semi-major axis distance has enabled them to be locked in a 3:2 orbital resonance with Neptune which implies they orbit the Sun twice for every three orbits of Neptune. This type of resonance is stable and these KBOs will maintain these orbits for a long time. This Resonance group makes up about 25 % of known KBOs and includes the dwarf planet Pluto and its five known moons. Not surprisingly this group is also known as

"Plutinos" meaning little Plutos. It is due to the 3:2 resonance that despite the orbits of Pluto and some other Plutinos actually crossing the path of Neptune's orbit, they will never collide. As shown in Figure 2 (from JewittWebb) the resonance KBOs exhibit a wide range of orbital eccentricities from approximately 0.05 to 0.35. Chiang et al. (2003) comments that this may be evidence they were forced to this current region from another location when Neptune moved further outwards in the Solar System. Johnston (2007) also describes a sparsely populated region in the Kuiper Belt at about 47.7 AU whose objects have a 1:2 resonance with Neptune. These objects orbit the Sun once for every two Neptune orbits. They are also known as "Twotinos".

Further out from the Plutinos there is the main group known as the Classical Objects with semi-major axes in the 42 to 48 AU range where there is no significant gravitational influence from Neptune. Since object 1992 QB1 was the first of this class to be discovered the group is also known as "Cubewanos". Two-thirds of known KBOs reside there (Lunine 2003) and their orbital eccentricities range from 0.002 to 0.2. WikiWeb_KB describes two separate populations with different orbits and colours. One group has orbits with low eccentricities of less than 0.1 and lie within 10 degrees of the ecliptic whilst the other group has orbits inclined to the ecliptic by up to 30 degrees. These differences may reflect different origins and orbital evolution. The former group is redder in appearance than the later, suggesting different surface compositions and evolution. (Levison et al, 2008).

Another group, the Scattered Disc Objects, can be disturbed by Neptune and have semi-major axes ranging from 30 AU to 60 AU. They have large orbital eccentricities ranging from very close to 0.0 to 0.7 and some of these KBO's aphelia can extend to 100 AU! Those with large eccentricity spend a lot of their time at these large distances and hence only a small number to date have been identified. Also of note, their perihelia can come close to the orbit of Uranus and due to gravitational interactions with the gas giants, some head further into the Solar System to become Centaurs or Jupiter-family comets. Because of the nature of these orbits and that only the inner portion of their orbit takes them into the Kuiper Belt, the term Trans-Neptunian Objects is more fitting for this group. The largest dwarf planet Eris and its moon Dysnomia are Scattered Disc Objects.

Jewitt (JewittWeb) makes note of a fourth group known as Detached KBOs. As shown below in Figure 2 they have semi-major axes beyond approximately 50 AU. Because of their remote distance they are not affected by the gravity of the outer planets. Sedna is the best known of this group.

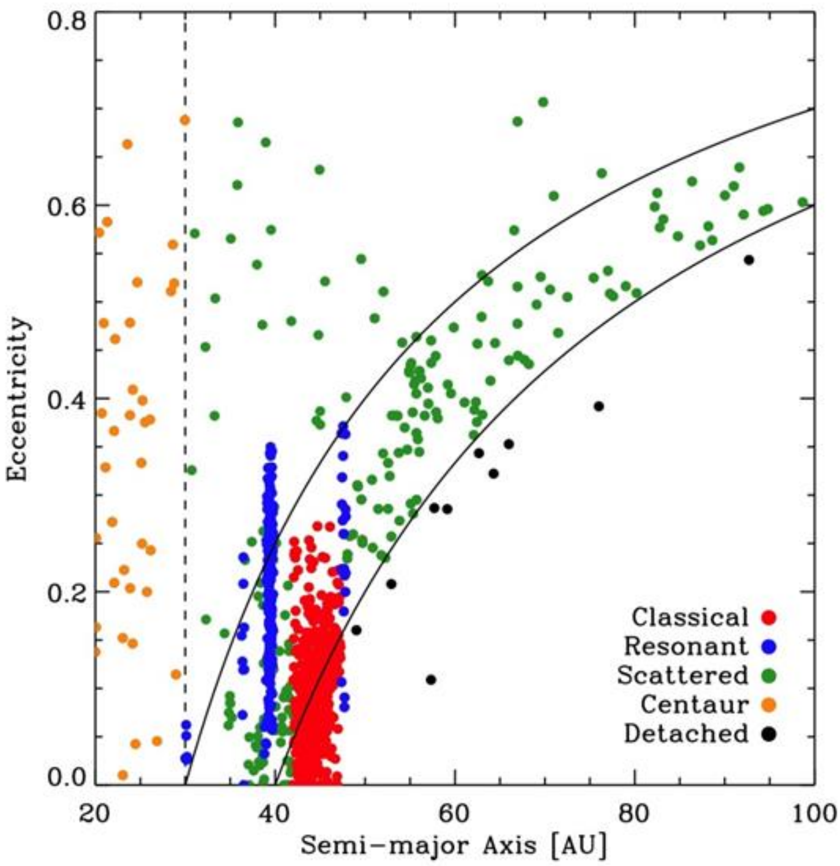


Figure 2: KBOs and Centaurs in relation to their semi-major axes and orbital eccentricities. (JewittWeb).

Because of these large distances and the overall small sizes of the KBOs, determining their physical properties is not easy and analysis has mostly focused on the larger objects. Pluto, with a diameter of 2300 km, can be accurately measured by the occultation of stars (WikiWeb_TNO). Measurements of the amount of reflected light and emitted infrared heat are used to determine the albedo and size of the other larger objects.

The mass of Individual KBOs is made from observations of the orbital properties of those with satellites or in a binary system enabling calculation of densities which give us clues to the nature of their interiors including the most likely ratio of rock versus ice. Lovett (2010) highlights the wide range in densities with some at 3.0 g/cm^3 indicating a mostly rocky composition whilst others are so low as to indicate they are mostly water ice with empty voids. Pluto's density is in the middle of these at 2.0 g/cm^3.

With modern ground-based telescopes and the Hubble Space Telescope using high resolution equipment, detailed spectral analysis of the light reflected from the KBO surfaces can be made in the infrared, optical and ultraviolet ranges. Plotting the albedo against the spectrum of wavelengths detected gives information on the surface composition. Dark and red colours in the optical range may imply the presence of complex organic molecules. Also each chemical substance has its own signature pattern of absorption lines at different wavelengths giving valuable information not only on the surface material, but also many processes that alter the surface including atmospheric changes, radiation processes, impacts, and volcanic outgassing (Brown 2011).

Since the temperature of the Kuiper Belt is only 50 K (Jewitt and Luu 2004), it is no surprise KBOs prime surface composition is a mixture of ices including water (H_2O), ammonia (NH_3), methane (CH_4), nitrogen (N_2) and carbon monoxide (CO) (Rotherly et al. 2011).

Brown (2005) discusses many of the different findings to date and their potential significance. For example, the ability to retain the more volatile compounds like CH_4, N_2 and CO depends on the surface temperature and gravity of an object and hence these are found to be more abundant on the largest and coldest KBOs including Pluto, Eris and Sedna. Pure ethane ice has been found on Makemake (Brown 2011). This is an irradiation product of CH_4 and reflects exposure to the solar wind, Ultra Violet radiation and cosmic rays (Bennett et al 2006). Trujillo et al. (2007) noted that the surface of Haumea is mainly pure water with no signs of dust, rock fragments or irradiated hydrocarbons. Its two moons appear to have similar surfaces (Barkume, Brown and Schaller 2006; Fraser and Brown 2009). In the context of Haumea's rapid rotation, Rabinowitz et al. (2008) suggests that could be the result of a relatively recent collision. Computer models by Levison et al. (2008) however suggest any collision would have occurred at a much earlier time in the Solar System. Jewitt and Luu (2004) observed ammonia hydrate and crystalline water ice on Quaoar. They commented that crystals imply the heating of ice to over 100 K, and also since irradiation would have destroyed these compounds over a time frame of 10 million years Quaoar must have been resurfaced by impacts, cryovolcanic outgassing or both. Figure 3, a cut away view of a KBO, shows some of the structural features and processes suggested by these observations.

To further advance our understanding of the Kuiper Belt, in 2006 NASA launched the space probe New Horizons. It will fly past Pluto in July 2015 and then onwards to other KBOs in 2017 (NASAWeb). This has onboard spectrometers to study the temperature and composition of its surface and atmosphere. Spectrometers will also study the surrounding solar wind and plasma particles escaping from Pluto. A high resolution camera will study geological features. We wait to see what surprises it will bring us!

This discussion on what we know about KBOs has shown us that they are an extremely diverse group of interesting objects. The study of the orbital and compositional properties of KBOs is ongoing and continues to improve our understanding of past and present events and conditions in the Solar System. More exciting data is expected in the future.

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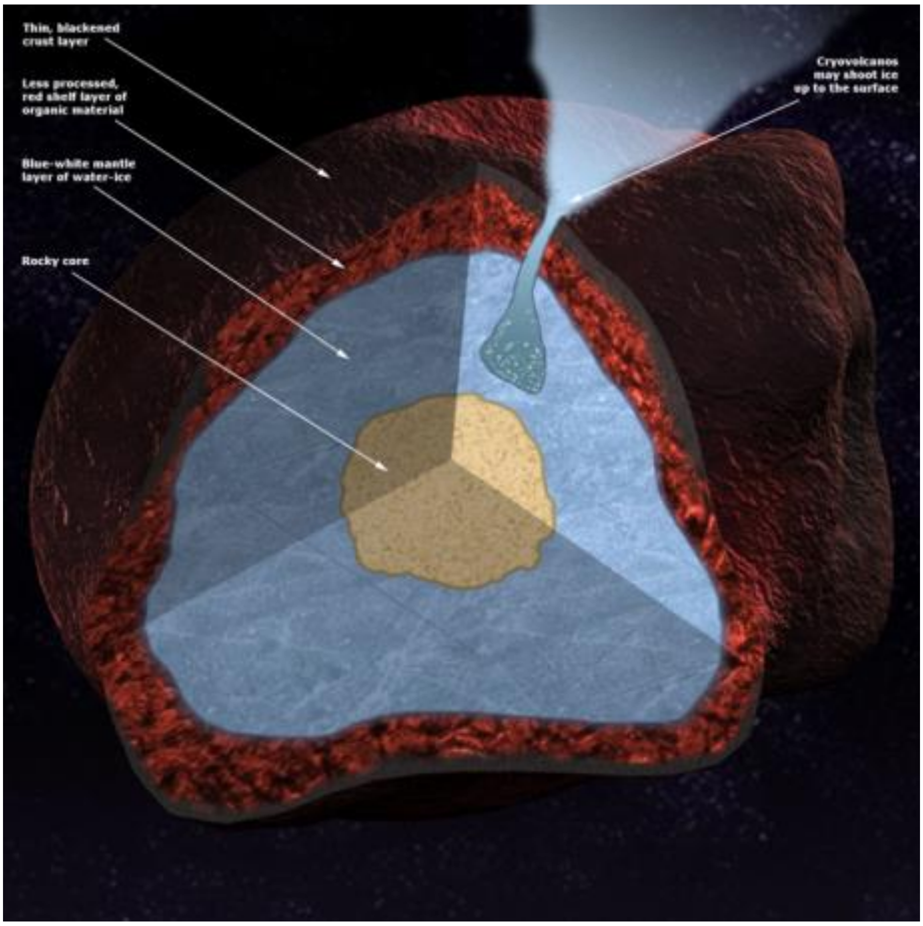


Figure 3: Cut away view of a KBO.

Eight new planets found in 'Goldilocks' zone: Two are most similar to Earth of any known exoplanets

From Harvard-Smithsonian Center for Astrophysics

Astronomers announced today that they have found eight new planets in the 'Goldilocks' zone of their stars, orbiting at a distance where liquid water can exist on the planet's surface. This doubles the number of small planets (less than twice the diameter of Earth) believed to be in the habitable zone of their parent stars. Among these eight, the team identified two that are the most similar to Earth of any known exoplanets to date.

"Most of these planets have a good chance of being rocky, like Earth," says lead author Guillermo Torres of the Harvard-Smithsonian Center for Astrophysics (CfA).

These findings were announced today at a meeting of the American Astronomical Society.

The two most Earth-like planets of the group are Kepler-438b and Kepler-442b. Both orbit red dwarf stars that are smaller and cooler than our Sun. Kepler-438b circles its star every 35 days, while Kepler-442b completes one orbit every 112 days.

With a diameter just 12 percent bigger than Earth, Kepler-438b has a 70-percent chance of being rocky, according to the team's calculations. Kepler-442b is about one-third larger than Earth, but still has a 60-percent chance of being rocky.

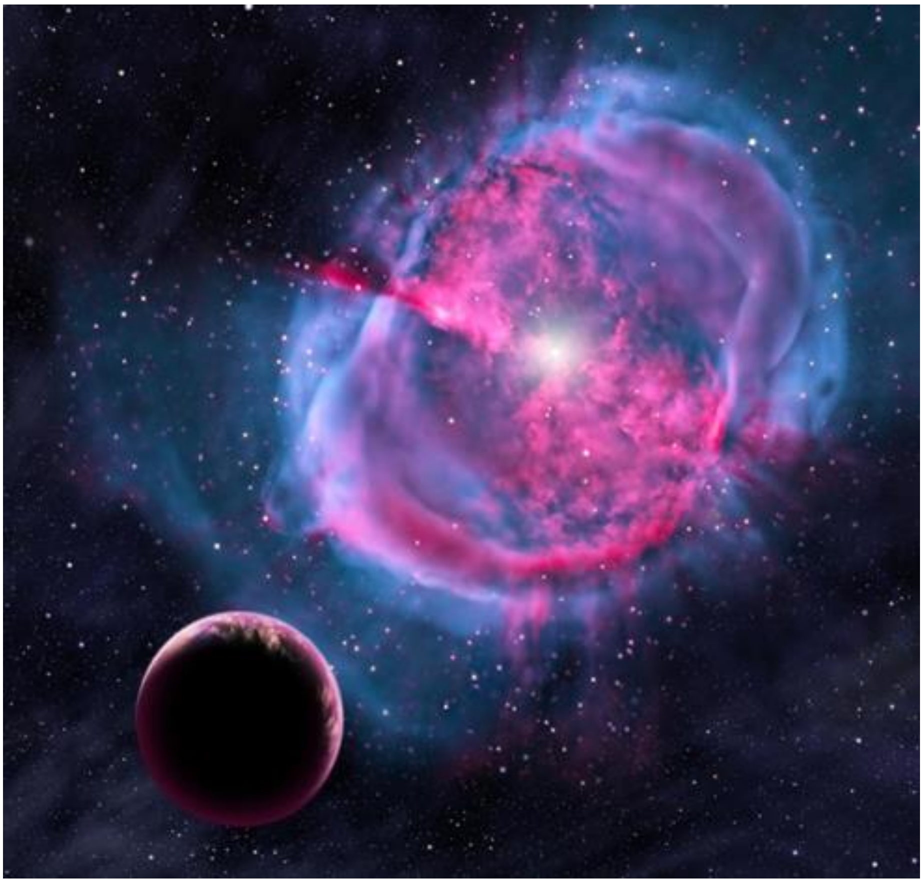
To be in the habitable zone, an exoplanet must receive about as much sunlight as Earth. Too much, and any water would boil away as steam. Too little, and water will freeze solid.

"For our calculations we chose to adopt the broadest possible limits that can plausibly lead to suitable conditions for life," says Torres.

Kepler-438b receives about 40 percent more light than Earth. (In comparison, Venus gets twice as much solar radiation as Earth.) As a result, the team calculates it has a 70 percent likelihood of being in the habitable zone of its star.

Kepler-442b get about two-thirds as much light as Earth. The scientists give it a 97 percent chance of being in the habitable zone.

"We don't know for sure whether any of the planets in our sample are truly habitable," explains second author David Kipping of the CfA. "All we can say is that they're promising candidates."



This artist's conception depicts an Earth-like planet orbiting an evolved star that has formed a stunning "planetary nebula." Earlier in its life, this planet may have been like one of the eight newly discovered worlds orbiting in the habitable zones of their stars. Credit: David A. Aguilar (CfA)

Prior to this, the two most Earth-like planets known were Kepler-186f, which is 1.1 times the size of Earth and receives 32 percent as much light, and Kepler-62f, which is 1.4 times the size of Earth and gets 41 percent as much light.

The team studied planetary candidates first identified by NASA's Kepler mission. All of the planets were too small to confirm by measuring their masses. Instead, the team validated them by using a computer program called BLENDER to determine that they are statistically likely to be planets. BLENDER was developed by Torres and colleague Francois Fressin, and runs on the Pleaides supercomputer at NASA Ames. This is the same method that has been used previously to validate some of Kepler's most iconic finds, including the first two Earth-size planets around a Sun-like star and the first exoplanet smaller than Mercury.

After the BLENDER analysis, the team spent another year gathering follow-up observations in the form of high-resolution spectroscopy, adaptive optics imaging, and speckle interferometry to thoroughly characterize the systems.

Those follow-up observations also revealed that four of the newly validated planets are in multiple-star systems. However, the companion stars are distant and don't significantly influence the planets.

As with many Kepler discoveries, the newly found planets are distant enough to make additional observations challenging. Kepler-438b is located 470 light-years from Earth while the more distant Kepler-442b is 1,100 light-years away.

Graham Blow 1954-2014

Long term Society member Graham Blow died at the age of 60 at the end of 2014. He passed away peacefully at his home on the 31st December. His death followed a severe heart attack a week earlier. Graham's funeral was held on Monday 5 January at Houghton Bay, Wellington.

A member since 1970, Graham will be remembered for his enthusiasm for occultation observing. He formed the RASNZ Occultation Section in October 1977 and remained director of the Section for over 37 years until his death.

One of Graham's legacies will be the series of Trans-Tasman Symposium on Occultation, TTSO, meetings started in 2007 and held annually since then alternating between New Zealand and Australia. The 2015 TTSO9 will be held at Tekapo on Monday and Tuesday May 11 and 12 following the RASNZ conference.

In the mid-1970s Graham and others organized the National Committee for student astronomy. This got a lot of secondary school pupils involved in astronomy. Some are now RASNZ members.

One of Graham's greatest achievements was in 1988 when Pluto occulted a 12th magnitude star. Graham encouraged several observers with photo-electric equipment to observe the event. It happened that NZ was at the southern edge of the occultation track. Seen from Mt John the star just grazed Pluto's atmosphere, till then unknown. Observers further north at Black Birch and Auckland saw the star occulted by the planet. These observations contributed to the first accurate determination of Pluto's size. The occultation also started studies of Pluto's atmosphere that continue today.

AUCKLAND ASTRONOMICAL SOCIETY

Notice of Annual General Meeting

The Annual General Meeting of the Auckland Astronomical Society Inc. will be held at the Stardome Observatory, One Tree Hill Domain on **Monday 27th April 2015** starting at **8:00pm**.

All society members are encouraged to attend and help with the future of the Society.

The agenda and a copy of the reports will be posted on the member's area of the society website (www.astronomy.org.nz) at least one week before the meeting. Printed copies will also be distributed at the meeting.

Nominations are open for all council positions; President, Vice President, Treasurer, Secretary, Librarian, Curator of Instruments, Editor and three to five council members.
Nominations must be received by the Secretary by Monday 6th April 2015 and must be made using the form below. Note nominees, nominators and seconders must be current financial members.

Any questions or enquires can be directed to Bill Thomas (President) by email to president@astronomy.org.nz or phone 09 478 4874.

Nomination for Auckland Astronomical Society Council

To be completed by the nominator & a seconder. Both must be a current financial member.

I .... nominate ....

for the position of ....

signed: ....dated:

I .... second the nomination of ....

for the position of ....

signed: ....dated:

To be completed by the nominee. The nominee must be a current financial member and have been so for at least one year.

I .... accept nomination for ....

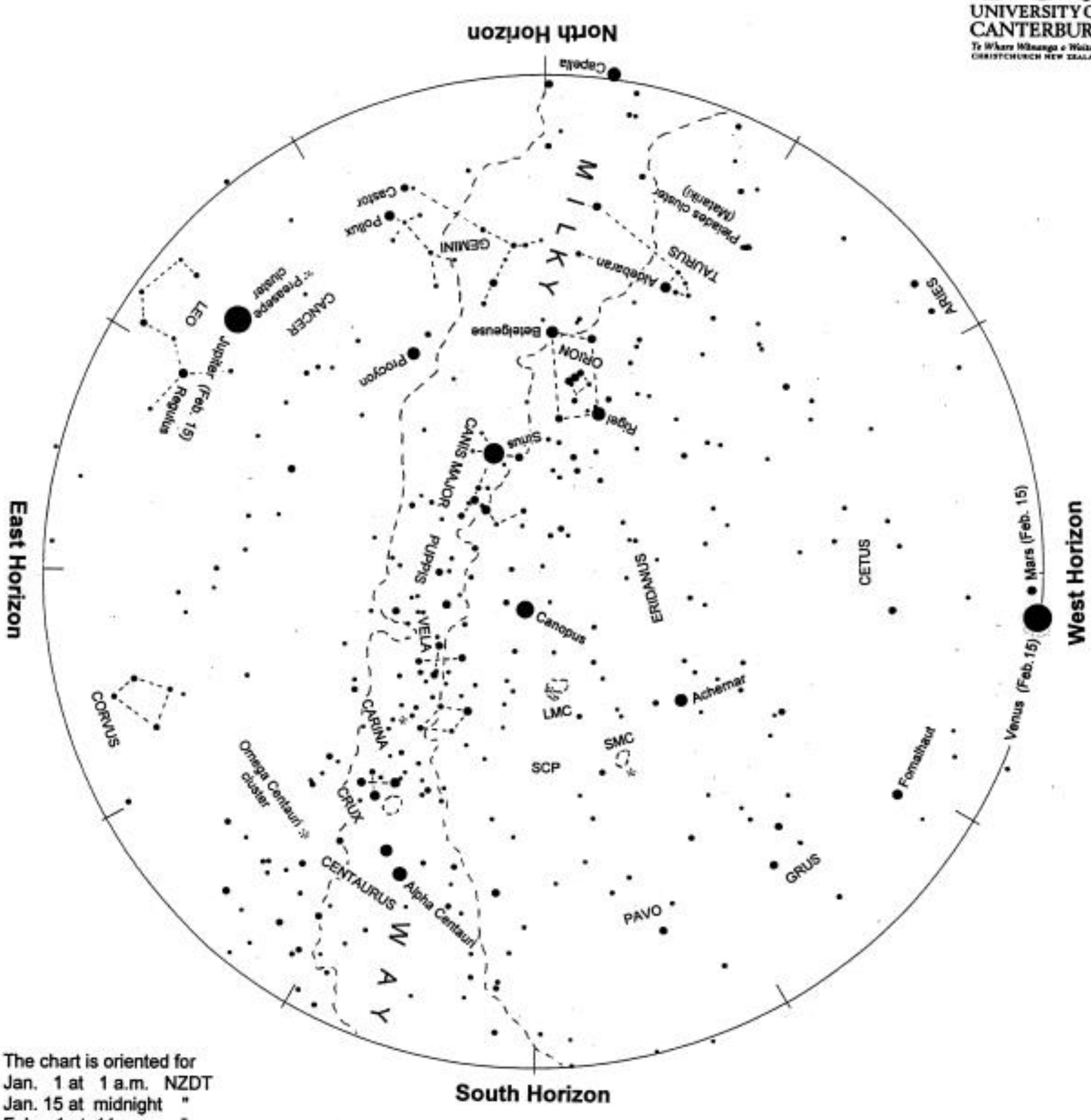
signed: ....dated:

SEND FORM TO: The Secretary, Auckland Astronomical Society
PO Box 24187, Royal Oak, Auckland 1345

Must be received by 6th April 2015.

PO Box 24187, Royal Oak, Auckland 1345, New Zealand • www.astronomy.org.nz

The Night Sky for February 2015



The chart is oriented for
Jan. 1 at 1 a.m. NZDT
Jan. 15 at midnight "
Feb. 1 at 11 p.m. "
Feb. 15 at 10 p.m. "

Evening sky in February 2015

To use the chart, hold it up to the sky. Turn the chart so the direction you are looking is at the bottom of the chart. If you are looking to the south then have 'South horizon' at the lower edge. As the earth turns the sky appears to rotate clockwise around the south celestial pole (SCP on the chart). Stars rise in the east and set in the west, just like the sun. The sky makes a small extra westward shift each night as we orbit the sun.

Venus and Jupiter appear on opposite sides of the sky soon after sunset. Venus sets an hour after the sun. Jupiter is in the sky all night. Mars is near Venus but much fainter. Sirius, the brightest star, is north of the zenith. Canopus, the second brightest star, is south of overhead. Orion, containing 'The Pot', is midway up the north sky. Below and left of Orion are Taurus and the Pleiades/Matariki cluster. The Southern Cross and Pointers are midway up the southeast sky. The Clouds of Magellan, LMC and SMC, nearby small galaxies, are high in the southern sky.

Chart produced by Guide 8 software; www.projectpluto.com. Labels and text added by Alan Gilmore, Mt John Observatory of the University of Canterbury, P.O. Box 56, Lake Tekapo 7945, New Zealand. www.canterbury.ac.nz

The Evening Sky in February 2015

By Alan Gilmore

Bright planets appear on opposite sides of the sky at dusk. Brilliant **Venus** appears low in the west soon after sunset. **Jupiter** appears low in the northeast, shining with a steady golden light. Above and right of Venus, for most of the month, is the red planet **Mars**. It is much fainter than Venus but is the only other brightish 'star' in that vicinity. Venus keeps its position in the twilight all month. Mars slips down the sky. Venus and Mars will be close together around the 21st. After that Mars disappears into the twilight. Their closeness is just a line-of-sight effect. On the 21st Venus is 213 million km from us; while Mars is 329 million km away. The crescent Moon will be near the pair of planets on the 21st.

A telescope will easily show Jupiter's four bright moons. Binoculars, steadily held, often show one or two of them looking like faint stars very close to the planet. Jupiter is 652 million km from us mid month, the closest it gets this year. The planet is 11 times Earth's diameter and 320 times Earth's mass. It sets in the northwest at dawn.

Sirius, 'the Dog Star', marks the head of **Canis Major** the big dog. A group of stars above and right of it make the dog's hind-quarters and tail, upside down. **Procyon**, in the northeast below Sirius, marks the smaller of the two dogs that follow Orion the hunter across the sky. Sirius is eight light years* away.

Below and left of Sirius are bluish **Rigel** and orange **Betelgeuse**, the brightest stars in **Orion**. Between them is a line of three stars: Orion's belt. To southern hemisphere star watchers, the line of three makes the bottom of 'The Pot'. The handle of The Pot is Orion's sword, a fainter line of stars above the bright three. At its centre is the Orion Nebula; a glowing gas cloud around 1300 light years away.

Orion's belt points down and left to the orange star **Aldebaran**. Continuing the line finds the **Pleiades** or **Matariki** star cluster. Aldebaran is Arabic for 'the eye of the bull'. It is on one tip of an upside-down V that makes the face of **Taurus**. The V-shaped group is called the Hyades cluster. It is 130 light years away. Aldebaran is not a member of the cluster but merely on the line of sight, 65 light years from us. It is 145 times brighter than the Sun. The **Pleiades** or **Matariki** star cluster is also known as the Seven Sisters and Subaru. Six stars are seen by eye; dozens are visible in binoculars. The cluster is 440 light years from us. From northern New Zealand the bright star **Capella** is on the north skyline. It is 90,000 times brighter than the Sun and 3300 light years away.

Crux, the Southern Cross, is in the southeast. Below it are Beta and **Alpha Centauri,** often called 'The Pointers'. Alpha Centauri is the closest naked-eye star, 4.3 light years away. Beta Centauri, like most of the stars in Crux, is a blue-giant star hundreds of light years away. **Canopus** is also a very luminous distant star; 13 000 times brighter than the Sun and 300 light years away.

The **Milky Way** is brightest in the southeast toward Crux. It can be traced up the sky, fading where it is nearly overhead. It becomes very faint east, or right, of Orion. The Milky Way is our edgewise view of the galaxy, the pancake of billions of stars of which the Sun is just one.

The Clouds of Magellan, **LMC** and **SMC** are high in the south sky, easily seen by eye on a dark moonless night. They are two small galaxies about 160 000 and 200 000 light years away.

Saturn (not shown) rises in the southeast before 2 a.m. at the beginning of the month; at midnight by the end. It has a creamy colour. To its right and fainter is the orange star Antares, marking the Scorpion's heart. Saturn is 1506 million km away mid month. It is always worth a look in a telescope.

Mercury (not shown) makes its best morning sky appearance of the year in February and March. It moves rapidly up the eastern dawn sky in the first week of February. By the 14th it is rising two hours before the Sun, the only bright star in the east. It remains prominent in the morning sky through March.

*A **light year** (**l.y**.)is the distance that light travels in one year: nearly 10 million million km or 10^{13} km. Sunlight takes eight minutes to get here; moonlight about one second. Sunlight reaches Neptune, the outermost major planet, in four hours. It takes four years for sunlight to reach the nearest star, Alpha Centauri.

Notes by Alan Gilmore, University of Canterbury's Mt John Observatory, P.O. Box 56, Lake Tekapo 7945, New Zealand.

www.canterbury.ac.nz

NASA Goddard Instrument Makes First Detection of Organic Matter on Mars

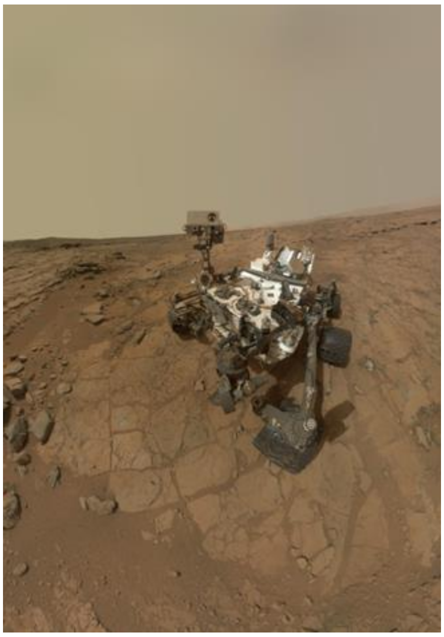
From NASA

Scientists have made the first definitive detection of organic molecules at Mars. The surface of Mars is currently inhospitable to life as we know it, but there is evidence that the Red Planet once had a climate that could have supported life billions of years ago.

The team responsible for the Sample Analysis at Mars (SAM) instrument suite on NASA's Curiosity rover has made the first definitive detection of organic molecules at Mars. Organic molecules are the building blocks of all known forms of terrestrial life, and consist of a wide variety of molecules made primarily of carbon, hydrogen, and oxygen atoms. However, organic molecules can also be made by chemical reactions that don't involve life, and there is not enough evidence to tell if the matter found by the team came from ancient Martian life or from a non-biological process. Examples of non-biological sources include chemical reactions in water at ancient Martian hot springs or delivery of organic material to Mars by interplanetary dust or fragments of asteroids and comets.

The surface of Mars is currently inhospitable to life as we know it, but there is evidence that the Red Planet once had a climate that could have supported life billions of years ago. For example, features resembling dry riverbeds and minerals that only form in the presence of liquid water have been discovered on the Martian surface. The Curiosity rover with its suite of instruments including SAM was sent to Mars in 2011 to discover more about the ancient habitable Martian environment by examining clues in the chemistry of rocks and the atmosphere.

The organic molecules found by the team were in a drilled sample of the Sheepbed mudstone in Gale crater, the landing site for the Curiosity rover. Scientists think the crater was once the site of a lake billions of years ago, and rocks like mudstone formed from sediment in the lake. Moreover, this mudstone was found to contain 20 percent smectite clays. On Earth, such clays are known to provide high surface area and optimal interlayer sites for the concentration and preservation of organic compounds when rapidly deposited under reducing chemical conditions.



MSL Curiosity rover at "John Klein" drill site. This self-portrait of NASA's Mars rover Curiosity combines dozens of exposures taken by the rover's Mars Hand Lens Imager on Feb. 3, 2013 plus three exposures taken May 10, 2013 to show two holes (in lower left quadrant) where Curiosity used its drill on the rock target "John Klein". Credit: NASA/JPL-Caltech/MSSS

While the team can't conclude that there was life at Gale crater, the discovery shows that the ancient environment offered a supply of reduced organic molecules for use as building blocks for life and an energy source for life. Curiosity's earlier analysis of this same mudstone revealed that the environment offered water and chemical elements essential for life and a different chemical energy source.

"We think life began on Earth around 3.8 billion years ago, and our result shows that places on Mars had the same conditions at that time -- liquid water, a warm environment, and organic matter," said Caroline Freissinet of NASA's Goddard Space Flight Center in Greenbelt, Maryland. "So if life emerged on Earth in these conditions, why not on Mars as well?" Freissinet is lead author of a paper on this research submitted to the *Journal of Geophysical Research-Planets*.

The organic molecules found by the team also have chlorine atoms, and include chlorobenzene and several dichloroalkanes, such as dichloroethane, dichloropropane and dichlorobutane. Chlorobenzene is the most abundant with concentrations between 150 and 300 parts-per-billion. Chlorobenzene is not a naturally occurring compound on Earth. It is used in the manufacturing process for pesticides (insecticide DDT), herbicides, adhesives, paints and rubber. Dichloropropane is used as an industrial solvent to make paint strippers, varnishes and furniture finish removers, and is classified as a carcinogen.

It's possible that these chlorine-containing organic molecules were present as such in the mudstone. However, according to the team, it's more likely that a different suite of precursor organic molecules was in the mudstone, and that the chlorinated organics formed from reactions inside the SAM instrument as the sample was heated for analysis. Perchlorates (a chlorine atom bound to four oxygen atoms) are abundant on the surface of Mars. It's possible that as the sample was heated, chlorine from perchlorate combined with fragments from precursor organic molecules in the mudstone to produce the chlorinated organic molecules detected by SAM.

In 1976, the Gas Chromatograph Mass Spectrometer instrument on NASA's Viking landers detected two simple chlorinated hydrocarbons after heating Martian soils for analysis (chloromethane and dichloromethane). However they were not able to rule out that the compounds were derived from the instrument itself, according to the team. While sources within the SAM instrument also produce chlorinated hydrocarbons, they don't make more than 22 parts-per-billion of chlorobenzene, far below the amounts detected in the mudstone sample, giving the team confidence that organic molecules really are present on Mars.

The SAM instrument suite was built at NASA Goddard with significant elements provided by industry, university, and national and international NASA partners.

For this analysis, the Curiosity rover sample acquisition system drilled into a mudstone and filtered fine particles of it through a sieve, then delivered a portion of the sample to the SAM laboratory. SAM detected the compounds using its Evolved Gas Analysis (EGA) mode by heating the sample up to about 875 degrees Celsius (around 1,600 degrees Fahrenheit) and then monitoring the volatiles released from the sample using a quadrupole mass spectrometer, which identifies molecules by their mass using electric fields. SAM also detected and identified the compounds using its Gas Chromatograph Mass Spectrometer (GCMS) mode. In this mode, volatiles are separated by the amount of time they take to travel through a narrow tube (gas chromatography -- certain molecules interact with the sides of the tube more readily and thus travel more slowly) and then identified by their signature mass fragments in the mass spectrometer.

The first evidence for elevated levels of chlorobenzene and dichloroalkanes released from the mudstone was obtained on Curiosity Sol 290 (May 30, 2013) with the third analysis of the Cumberland sample at Sheepbed. The team spent over a year carefully analyzing the result, including conducting laboratory experiments with instruments and methods similar to SAM, to be sure that SAM could not be producing the amount of organic material detected.

"The search for organics on Mars has been extremely challenging for the team," said Daniel Glavin of NASA Goddard, a co-author on the paper. "First, we need to identify environments in Gale crater that would have enabled the concentration of organics in sediments. Then they need to survive the conversion of sediment to rock, where pore fluids and dissolved substances may oxidize and destroy organics. Organics can then be destroyed during exposure of rocks at the surface of Mars to intense ionizing radiation and oxidants. Finally, to identify any organic compounds that have survived, we have to deal with oxychlorine compounds and possibly other strong oxidants in the sample which will react with and combust organic compounds to carbon dioxide and chlorinated hydrocarbons when the samples are heated by SAM."

As part of Curiosity's plan for exploration, an important strategic goal was to sample rocks that represent different combinations of the variables thought to control organic preservation. "The SAM and Mars Science Laboratory teams have worked very hard to achieve this result," said John Grotzinger of Caltech, Mars Science Laboratory's Project Scientist. "Only by drilling additional rock samples in different locations, and representing different geologic histories were we able to tease out this result. At the time we first saw evidence of these organic molecules in the Cumberland sample it was uncertain if they were derived from Mars, however, additional drilling has not produced the same compounds as might be predicted for contamination, indicating that the carbon in the detected organic molecules is very likely of Martian origin."

Stardate 2015

By Gavin Logan

Stardate 2015 was held at Stonehenge NZ in Carterton instead of its usual Hawkes Bay venue. Every night was clear giving attendees plenty of opportunities for telescope viewing. A variety of telescopes were available. A 20 inch Dobsonian gave views of faint galaxies and was popular. An automated 300mm Goto Dobsonian attracted some attention, but in my view although it had reasonable tracking, provided poor accuracy at finding objects. The author's 120mm ED refractor on an HEQ5 Pro Equatorial Go to mount was very popular on Saturday Night (the only night it was set up) because of its accuracy at finding objects and its surprisingly good views of even faint objects.

During the day, talks were given on subjects ranging from astrophotography, Megalithic building, exoplanets to the search for life on other planets.

Campers and attendees preparing telescopes for another clear night at Stardate 2015.

Futuristic Space Travel and Popcorn

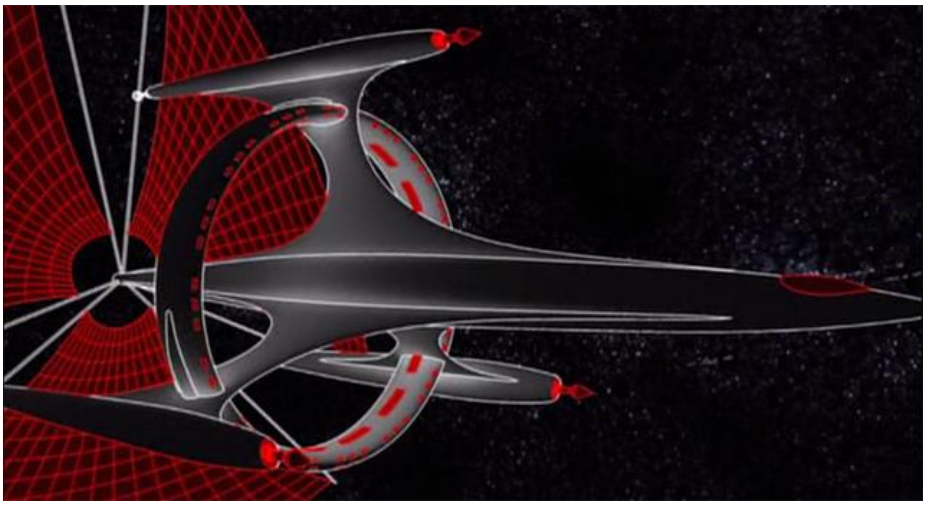
By Gavin Logan

December's Film Night was well attended even though it was held just before Christmas. Society members who attended were treated to Sci Fi Science films looking at how future space travel might work and whether it could be possible to travel faster than the speed of light. The theme was: Can science fiction become reality?

What type of space ship is needed to travel the very long distances and how would they be build? Chemical fuels would not be adequate, so would a type of solar power or nuclear power be used as a replacement and is warping space and time possible? Tele-transportation was covered as was the idea of beaming people and materials almost instantly through space.

It was farfetched futuristic entertainment, but one which retained some basis in science. Traditional movie theatre pop-corn was served on the night.

Next month's Film Night will be on Monday 23rd February at 8pm at Stardom and will be slightly more down to earth!



A drawing of what a space ship of the future could look like.

It features a documentary that examines the latest theories on quantum mechanics and cosmology and how they now appear to open the way for new thinking about the nature of the Universe. The film is 50 minutes long and will be followed by the December 2014 Sky at Night show about Nebula.

Society Astronomical Equipment for Rent

The Society has a wide variety of equipment available for rental to members, from beginner friendly Dobsonian telescopes, through to more advanced computerised GOTO systems. All rental equipment is of high quality and regularly maintained.

Rental periods are normally in 4 week blocks, but other arrangements may be available if you have a specific requirement. Full training and support is given for all equipment, including advice if equipment is suitable for your needs, or experience level.

Current rental equipment includes:

* 200mm Astronz Dobsonian Telescopes ($10/week)
* Celestron Nexstar 5 127mm Schmidt Cassegrain Alt/Az GOTO Telescope ($12.50/week)
* iOptron Minitower multipupose Alt/Az Mount with Celestron C5 127mm OTA ($15/week)
* Meade 90mm Achromatic Refractor ($7.50/week)

Also, newly added to the rental stock

* Coronado PST 40mm Hydrogen-Alpha Solar Telescope ($12.50/week)
* iOptron ZEQ25 Computerised Equatorial Mount

We are often adding items to our rental equipment, and we're really keen to hear what other items may be useful to members - any ideas, or for any information regarding availability or how to rent equipment, please contact Steve Hennerley on 027 245 6441

Solar System Events February 2015

From the RASNZ Website

January 2	Aldebaran 1.4˚ south of the Moon
January 3	Moon northern most declination (18.7˚), Pluto at conjunction
January 4	Earth at perihelion
January 5	Moon full
January 8	Jupiter 4.8˚ north of the Moon, Regulus 3.9˚ north of the Moon
January 9	Moon at apogee
January 13	Moon last quarter, Spica 3.0˚ south of the Moon
January 14	Mercury greatest elong E(19)
January 16	Saturn 1.8˚ south of the Moon
January 18	Moon southern most declination (-18.6˚)
January 19	Pluto 2.8˚ south of the Moon
January 20	Mars 0.2˚ south of Neptune, Moon new
January 21	Mercury stationary, Mercury 2.9˚ south of the Moon, Moon at perigee
January 22	Venus 5.4˚ south of the Moon, Neptune 3.7˚ south of the Moon
January 23	Mars 3.8˚ south of the Moon
January 25	Uranus 0.6˚ south of the Moon Occn
January 27	Moon first quarter
January 29	Aldebaran 1.2˚ south of the Moon Occn
January 30	Mercury inferior conjunction
January 31	Moon northern most declination (18.5˚)

apogee: Furtherest point in the orbit of a body orbiting the Earth
conjunction: Two astronomical objects are 'lined up' (have the same right ascension) when viewed from Earth. If only one object is mentioned the Sun is generally the other object.
declination: 'Latitude' for celestial objects. The distance in degress above (north) or below (south) the celestial equator.
inferior conjunction: Conjunction where a solar system object is between the Earth and the Sun
perigee: Nearest point in the orbit of a body orbiting the Earth
perihelion: Nearest point in the orbit of a body orbiting the Sun

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