Stargazey Pie!
A slice of Highlands astronomical life!
Tues 2nd June 2015

# HAS Meeting Notices June 2015

1. **Current News and Dates for your Diary**

- **Solar Saturdays** have started - these take place at the Observatory at Culloden Moor (park at the far back left of the NTS Battlefield car park, there is a grassy path to your left which leads to the Observatory). Please check the website (www.spacegazer.com) before setting off to find out what time (and whether) the session is running. We have two special telescopes for looking at the sun. Children welcome but must be supervised.

- **30 June– The first official "Asteroid Day** "– a global awareness day to mark the anniversary of the Tunguska event in Siberia in 1908, when an asteroid or comet exploded in our atmosphere, fortunately killing no one but devastating a huge forest area. The day hopes to make us aware of the threat that asteroids present to us all. Further info at asteroidday.org

- **The next meeting is on Tuesday 7th July2015** - Denis Buczynski - "The Newsworthy Comets of 2015".

- **Events:** 3rd – 9th September 2015– the renowned Orkney Science Festival will be taking place. There is much to see and hear on astronomy subjects this year, but also music, arts, food an drink, and Orkney history. If you have not been before, and you can make it, then attendance is certainly recommended.

- **Suggestion Box** – at reception. Don't forget to let us know if you have any ideas you would like the committee to look at – this is your Society, please help the committee to provide what you are looking for. Or of course speak to a committee member.

- **Aurorae and Telephone alerts** – should you see an aurora, noctilucent clouds, or anything else of astronomical interest, please alert Paul or Pauline. It is never too late at night to let us know. PLEASE NOTE, the wording of the telephone alert is a little strange. If you receive a telephone call with a disembodied voice beginning, "This call will not cost you anything..." - please don't hang up, it is your aurora alert! Alerts can also be sent by text to your mobile – if you would prefer this option please check with Ronnie that we have you signed up for this.

- **Subscritions are now due –** as agreed at the AGM last month, these have been frozen for the second year in a row. You can now pay by on-line banking if this is easier (Sort Code 80-91-26; Acct no 00715043) - if we don't have your up to date details we will probably be in touch to ask you for these, or you can let us know at a meeting. You can also pay at the front desk before the meeting, or at tea break. Thank you for your continued support!

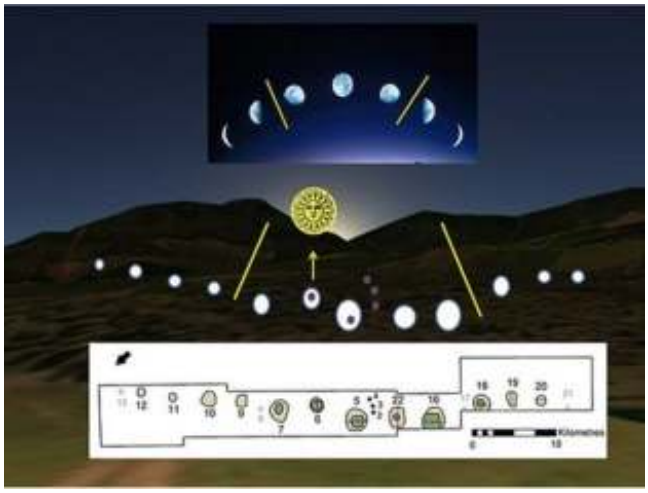
**Main Event**

Matjaz Vidmar is a physicist who graduated from the University of Edinburgh. He is now a post-graduate research student in The Institute for Study of Science, Technology and Innovation based at Royal Observatory Edinburgh (ROE). http://www.roe.ac.uk/~vidmar/ He is currently in his first year of a four course of his MSC by research and PhD after receiving a scholarship by the UK Scottish Space Sector. He is also widely involved with outreach activities with ROE. His talk is based on a question "What has space ever done for us"?

Matjaz answered this question with a brief history of astronomy in eight technologies and began by telling us that technology in astronomical research has influenced society in numerous ways and that this technology itself is used to make scientific discoveries. Through this talk he takes us from the earliest times of astronomy and shows us how it has progressed over the years with the advancement of technology.

1.1 Expanding Boundaries: time

Although some stone circles are older, Stonehenge is an iconic example. It is a calendar, which is a very important concept for understanding time and keeping track of time. Without knowing what time of year it is, the people of the day would not know when to sow their seeds and harvest their crops; it enabled them to determine the seasons. This was important in order to grow food, and keeping track of time started with agriculture.



The Warren Field pits in Aberdeenshire http://www.bbc.co.uk/news/uk-scotland-north-east-orkney-shetland-23286928 consist of 12 pits that correspond to a lunar calendar, which allowed people to work out what time of year it was.

The Mayan calendar, from Mexico, dates back to about the 5th Century BC. It was able to mark the end of a cycle. This is important in keeping time and even we mark the end of the old year and the start of the new.

Measuring time is now performed by clocks but to keep time precise, we need telescopes. The Transit telescope, which was based at Calton Hill, Edinburgh, looked at the transit of stars through the meridian in order to keep the observatory clock accurate. This was very important for navigation. Today we have atomic clocks and we can pinpoint our position precisely in our orbit around the Sun.

1.2 Expanding Boundaries: space

500 years ago, it was thought that the planets and the Sun orbited the Earth, and the stars were fixed in space. It was noticed that the planets wandered in strange paths but it was not understood why. However, when Copernicus realised the Sun was at the centre of our solar system and the stars were far away, the universe suddenly appeared bigger and our understanding of space increased. Now we know that space is huge.

1.3 Expanding Boundaries: vision

Seeing objects far away requires telescopes and we have had to develop this technology to order to see objects beyond anything we had seen before. Galileo discovered the Galilean moons orbiting Jupiter and realised that if those moons orbit another planet then not everything orbits Earth, thus reinforcing the idea of the Sun centred model of the solar system.

The first telescopes were refractors but these were limited in their size because the bigger the lens the longer the tube. Reflectors were developed allowing mirrors to be much larger and thus it became possible to see even further into space. The biggest telescope being built today has a mirror with a diameter of 40 m. This is the European Extremely Large Telescope (EELT).

1.4 Expanding Boundaries: memory

This section is to do with imagery and how it has developed. Mariner 4 produced the first partial digital image. Technology was developed to turn an analogue picture, taken by a camera on board the spacecraft, into a digital image and transmit this image to a computer here on Earth. This was a big step forward.

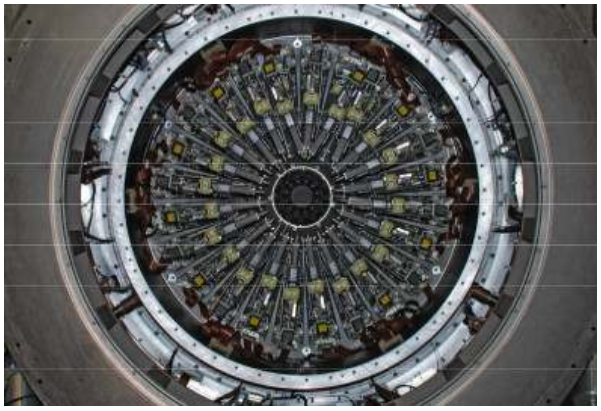
Astronomers even developed the use of books because it was the only way they could keep track of their astronomical observations and any changes that occurred. Nowadays we have computers.

2.1 Seeing Beyond: light

Newton used a prism to spilt light into its component colours and, just as importantly, he was able to combine the colours into white light again. Each colour has a different wavelength and different energy. Understanding colour is key to understanding vision, something that was investigated by Thomas Young, a scientist born in 1773.

2.2 Seeing Beyond: the invisible

This relates to the electromagnetic spectrum. The visible part of the spectrum allows us to see and to see in colour but there is more to the spectrum than we can see. Herschel discovered infrared light by picking up energy, in this case heat, in an area of the spectrum where the light is invisible. Astronomers were the first to use these invisible wavelengths. They use infrared light to see through clouds of gas and dust that normally absorbs light from the stars and re-radiate it as infrared light.

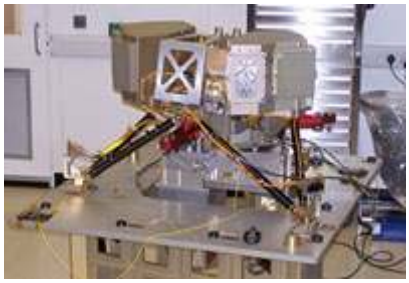


Kmos is an infrared spectrometer built by the Royal Observatory Edinburgh that can look at 24 targets simultaneously.

https://www.eso.org/sci/facilities/paranal/instruments/kmos.html

MIRI is an infrared instrument for the James Webb telescope and was also designed by the Royal Observatory Edinburgh. It is a camera and spectroscope designed to look at distant galaxies and newly forming stars as well as Kuiper Belt objects and other warm objects.

http://jwst-miri.roe.ac.uk/



A retinal densitometer has been developed by Cardiff University's School of Optometry and Vision in collaboration with the UK Astronomy and Technology Centre in Edinburgh and City University. This device can be used in the early detection of age related macular degeneration, since one of the first signs is a change in the way in which the light sensitive pigments in the macula regenerate after exposure to light. It does this by measuring the very small changes in the amount of light reflected by the retina. This is based on the technology to detect faint light from distant stars and galaxies.

The 'snow' on a TV is the cosmic microwave background. ALMA (Atacama Large Millimetre Array) is a large number of telescopes covering a wide area looking at the microwave portion of the sky. More data is produced from these telescopes than is found on the Internet so in order to extract and store the important information, 'Cloud' computing was developed and this is now something the public uses to store their data. The software for data reduction was developed in Edinburgh.

2.3 Seeing Beyond: from afar

We can now leave the Earth and look back to study it. Rockets were developed in the early 20th Century. Then came the technology to build satellites and many of these now monitor Earth and watch changes occurring. The ISS is actually a biomedical research lab trying to understand how our bodies are affected by the absence of gravity. Eventually this should allow us to expand our horizons further making it possible for humans to visit other planets.

2.4 Seeing Beyond: the whole of the universe

The first computer was the Antikythera Mechanism from Greece. Made in around100 BC it was able to tell you where the planets could be found in the sky.

Now we can determine the position of the planets using modern computers and even how the planets are formed using simulations developed by Edinburgh. Computers can determine much about our universe and simulations can even demonstrate how it has changed over a billion years and more.

3.0 Beyond the beyond

Cube sats, which are being built at Clydespace in Glasgow, and other small satellites, may be the future of scientific study of the Earth. They are less expensive (about £30,000 to launch) but, of course, their small size (about 10cm x 10cm) limits what science can be done however, they can take photographs, monitor wildlife, send radio communications, perform atmospheric research and do biology experiments. By using lots of them as a linked team, they may change the way we do science.

Mat has shown us how, and I shall quote part of his synopsis as it becomes an apt conclusion: "space innovation is allowing us to see the past and the future, distant and the invisible, to experience reality well beyond our imagination and then come to change the world for the better"

Thank you Matjaz for a very interesting talk about what space has done for us.

Next month we have Denis Buczynski telling us about the best comets this year. Look forward to seeing you all for tea, biscuits and conversation.

Sunny skies,
Pauline Macrae