Stargazey Pie!

A slice of Highlands astronomical life!

Tues 5th May 2015

HAS Meeting Notices May 2015

Current News and Dates for your Diary

- **Solar Saturdays** are ready to start, weather permitting - 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 are welcome but must be supervised.

- **The next meeting is on Tuesday 2nd June 2015** - Matjaz Vidmar (Royal Observatory Edinburgh) asking "What has Space Ever Done For Us?"

- **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 and drink, and Orkney history. If you have not been before, and you can make it, then attendance is certainly recommended.

- **23rd May 2015 – Saturn at Opposition –** Saturn at opposition means that it is highest in the sky at midnight although with BST that changes to 1 am. This means it is visible all night. It occurs when the Sun, Earth and Saturn form a line with Earth in the middle and at this time it is closest to Earth making it appear bigger and brighter. Three planets are visible in the sky at around 10 pm during May: Venus in the west, Jupiter in the south-west and Saturn in the south-east. Early May sees Mercury low in the west just after the setting Sun.

- **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 (01667 456789) or Pauline (07751 112 586). 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.

- **Subscriptions are now due** – as agreed at the AGM last month, these have been frozen for the second year in a row. You can pay by 0n-line banking if this is easier (Sort Code 80-91-26 account no. 00715043). If we don't have your up-to-date details we will probably be in touch to ask for these or you can let us know at one of the meetings. You can pay at the front desk before the meeting or at tea break. Thank you for your continued support.

Main Event

A visual guide to the Universe by David D Meyer, Professor of Physics and Astronomy of Dearborn Observatory and the Smithsonian Institution.

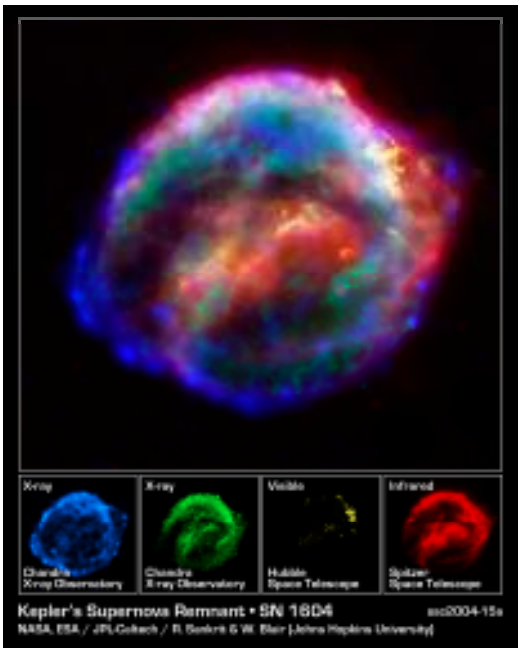
1) Probing the Cosmos from Space.

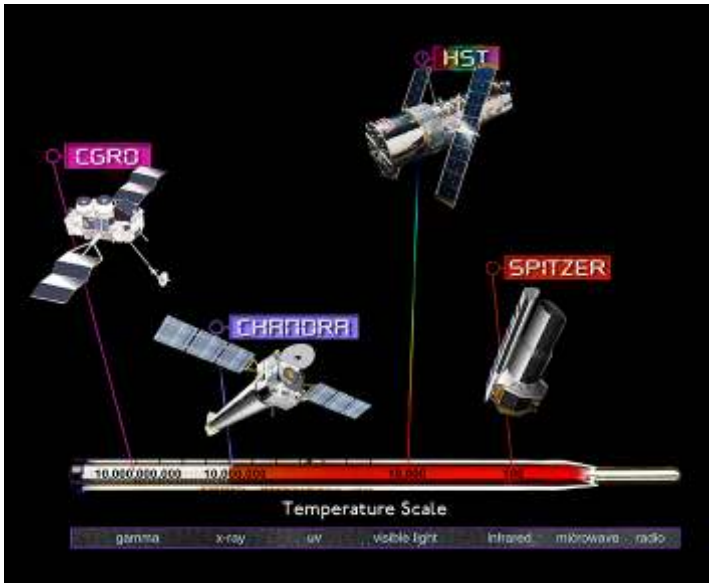
Most people think of space exploration as humans going into space and doing the exploring so why hasn't this happened? This is because it is expensive to do this; people need lots of things such as food, water, shelter and protection from radiation.

If we found life on Mars it would suggest life arose on two different planets and therefore could be common in the universe. This it is important to go to Mars to find out. However, a trip would cost 50 billion dollars, so instead of people robot spacecraft are sent. So far, the most ambitious is Curiosity, which ambles across the surface at a slow pace. Since signals take many minutes to travel from Mars to Earth it will therefore be a long time before its course can be altered although it is partly autonomous to prevent any big disasters. Mars has fascinated people for decades for it shows ancient watercourses. The rovers can study rocks up close for signs of past water. The climate has changed so liquid water is no longer present on the surface and the question is why? If water once existed, did life arise?

The greater the distance the longer it takes for signals to reach the Earth. From the Sun it would be 8 minutes; Neptune, 4 hours; Pluto, 4 ½ hours and thus a long time for New Horizons to communicate with Earth. The most distant spacecraft is Voyager 1. Launched in 1977, it is now 17 light years away. The closest star is Alpha Proxima at about 4.3 light years distant.

The light we see is a tiny piece of the electromagnetic spectrum, which covers very short to very long wavelengths. The photons produced by the wavelengths have different energies: long wavelengths have low energies and short wavelengths have high energies. The light we see is in the middle but is not the only way to view the universe as each region of the electromagnetic spectrum can give us a different picture. Not all the wavelengths can penetrate our atmosphere therefore space telescopes are vital. The atmosphere also limits the resolution of what can be seen from ground-based telescopes so the Hubble Space Telescope orbiting the Earth has a much higher resolution because there is no atmosphere to cause movement.





NASA's four great observatories were developed to take advantage of radiation emitted by the entire electromagnetic spectrum. They are the Hubble Space Telescope, Compton Gamma Ray Observatory (no longer functioning), Chandra X-ray Observatory and Spitzer Space Telescope. They can combine their images to provide a fuller picture of how galaxies and other objects in space work. 70 other space telescopes have been launched in the last 40 years.

The Milky Way is 100,000 light years in diameter. It has dark patches, which are interstellar dust. Using different wavelengths it is possible to study our Galaxy and by using infrared radiation we can see through the dust into the centre of the Milky Way, which is otherwise obscured. By using Kepler, we can search for exoplanets amongst the stars of our Galaxy, looking particularly for Earth-sized planets. Many have now been found.

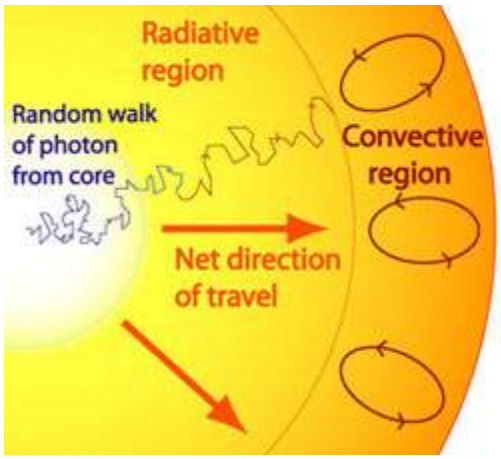
When we look far into space, the clusters of galaxies appear to form web-like structures giving the universe its structure. The more distant the star or galaxy the further back in time we are seeing it thus allowing us to witness the evolution of galaxies and provide confirmation of the big bang theory. WMAP shows the microwave sky as it was 13.7 billion years ago. It occurred 400,000 years after the big bang and is the furthest back in time we can go. The tiny density fluctuations in the WMAP produced the galaxies we see today.

By using space telescopes we can discover a great deal about our cosmos and how it all works.

2) The Magnetic Beauty of our Active Sun.

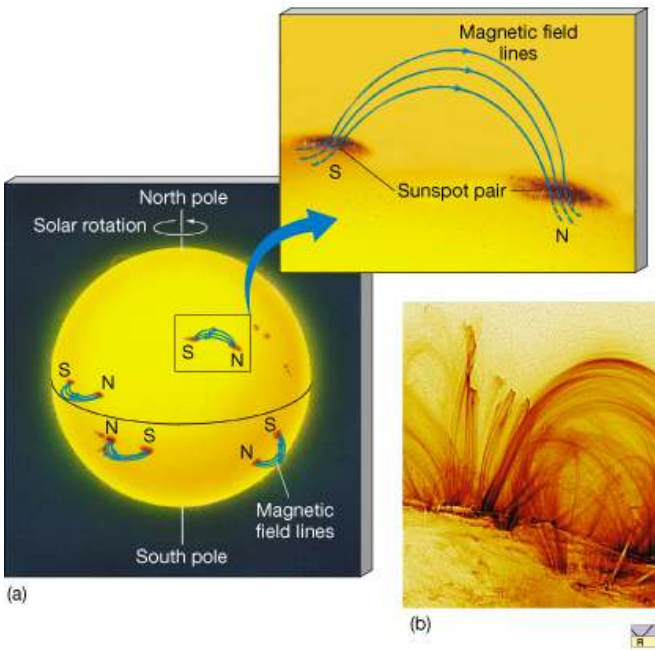
The Sun provides us with warmth and light enabling life to flourish. It looks constant but watching the surface, sunspots can be seen to come and go. These are areas where the Sun's magnetic field pokes through.

The Solar Dynamics Observatory
http://sdo.gsfc.nasa.gov/
https://www.nasa.gov/mission_pages/sdo/main/index.html
is a space observatory that takes images of our Sun in different wavelengths of light. These pictures show how the complex magnetic field of the Sun results in solar flares and coronal mass ejections.



The Sun shines through nuclear fusion reactions accounting for the huge energy output: 300,000 times as much energy is released from 1 g of hydrogen than 1 g of fuel. The gamma ray photons produced in the core are very energetic but because they constantly collide with so many other particles it can take 100,000 years to move 70% of the solar radius and is known as the random walk. It then only takes about three months to move through the last 30% by convection. Here, the photons move up to the surface, the photosphere, and escape into space. The granulation looks like a boiling saucepan of water.

Sunspots are dark because they are cooler which is thought to be due to magnetic fields suppressing the convection currents. Sunspots have strong magnetic fields and often come pairs with a magnetic loop between them. They are useful to work out the rotation of the Sun which is 25 days at the equator and 35 days nearer the poles.



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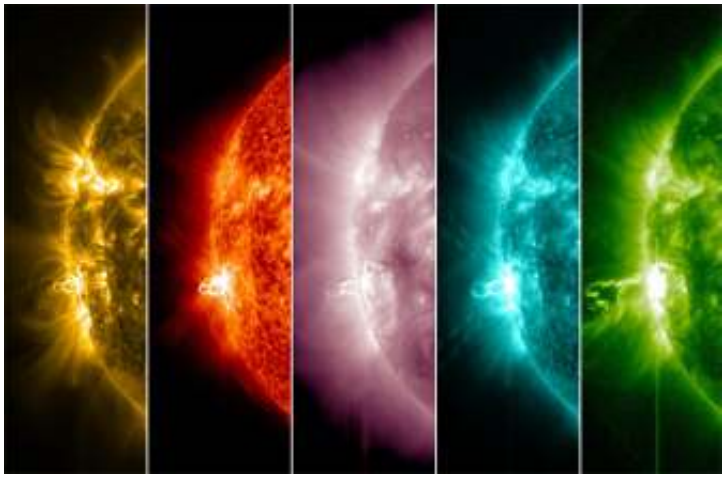
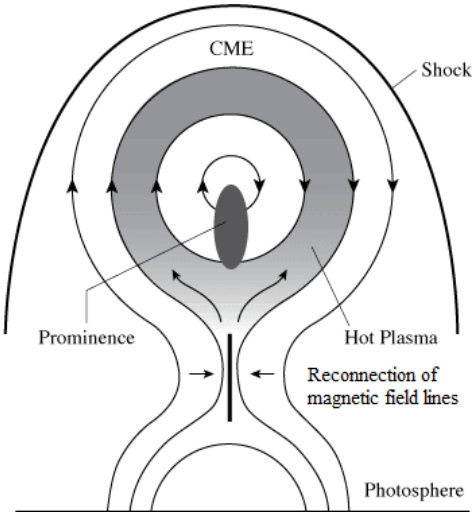
Sunspot frequency increases and decreases over a 11 year cycle. They start to emerge at high latitudes first then over the next few years appear closer and closer to the equator.

The solar convective zone is full of charged particles and the Sun's rotation generates the magnetic field, which becomes twisted as the Sun rotates and eventually pops out at the sunspots. The magnetic field becomes so twisted after 11 years that loops and thus sunspots pop up all over the surface. The magnetic loops drag up plasma and shape it to form beautiful semi circular patterns as above and can lead to solar flares, which are huge explosions and can heat the atmosphere above the photosphere giving rise to temperature increasing with height and is thought to be why the corona (Sun's upper atmosphere) is so hot.



The Solar Dynamics Observatory views the Sun constantly and can therefore study the evolution of sunspots using time-lapse photography. Different wavelengths of light allow astronomers to view different layers of atmosphere above the photosphere. It has already been seen that an effect on one part of the Sun can have an effect on another part of the Sun therefore it is important to study the whole of the Sun's magnetic field.



Magnetic fields are the key to energy release. When the field lines break and reconnect, this causes the top part of the gas to be ejected in a coronal mass ejection, the mass of which is equivalent to 1000 aircraft carriers moving at the speed 1000 times that of a bullet!

When a CME interacts with Earth's magnetic field, charged particles move down the field lines at the poles to interact with the atmosphere and produce the aurora. These charged particles can damage satellites and high voltage transformers. In 1859, the strongest geomagnetic storm recorded so far, disrupted the telegraph system. If this strength of storm happened today, damage to high voltage transformers could take months, even years, to recover parts of the electric grid therefore it is very important to try to predict if this is likely to happen and the Solar Dynamics Observatory is observing the Sun to do just that.

The images of the Sun taken by the Solar Dynamics Observatory showing the effects of its magnetic field are beautiful but also show how deadly our closest star can be.

Thank you Arthur for presenting these DVDs, which were both informative and interesting, made more understandable by the excellent illustrations and animations.

Next time we have Matjaz Vidmar telling us about the spin-offs from the space industry and how these have benefited us here on Earth in numerous ways, making our lives better and safer. Plus the usual tea, biscuits and chat of course.

Sunny skies,

Pauline Macrae