**U3Astronomy meeting 28-1-2011**

LOOKING BACK ON 2010

*New discoveries*

September saw the announcement of the discovery of the **most massive star** ever: mass 265 x the Sun, diameter 30 x the Sun, brightness 10 million x the Sun. Until this discovery a mass of 130-150 x the Sun was regarded as the limit.

And then, of course, there was the never ending discovery of new **exoplanets**. Total now well over 500, and growing ever faster.

*Plans extended and/or changed*

In February the famous **Cassini** mission to Saturn was extended until 2017 (instead of 2010). It was launched in 1997, arrived at Saturn in 2004 and since then has studied the planet + its rings + its 49 moons.

In March it was decided that the **International Space Station** will continue until at least 2020 (instead of 2015), and perhaps until 2028 (30 years after its construction was started).

*The Large Hadron Collider at full speed again*

In April the **Large Hadron Collider** was, for the first time, working at (almost) full speed. Repairs after the damage caused by a short circuit just one week after it had been started for the first time in September 2008, lasted over a year, and in November 2009 it was restarted, but then at low speeds for the time being.

*The Moon is shrinking*

One of the strangest discoveries of 2010 was that the Moon is shrinking!

Not fast – some 100 metres over the past 800 mln years. Cause: its core is contracting.

*Discovery*

Launch oft he shuttle *Discovery,* planned for its final journey to the ISS on 5/11, was halted when cracks were discovered in one of the fuel tanks. At the moment it is still grounded, but NASA hopes to launch the spacecraft by the end of February.

*Japanese Akatsuki misses Venus*

In May last year the Japanese Aerospace Exploration Agency – or JAXA – launched a spacecraft, named *Akatsuki*, towards Venus, with the aim to get into orbit around the planet and study its sweltering atmosphere. However, when it arrived near Venus in early December, it failed to get into orbit. The Japanese hope to try again when the spacecraft approaches Venus next time, about six years from now.

LOOKING FORWARD TO 2011

*Last Shuttle flights*

Hopefully the shuttle *Discovery* will fly to the ISS next month. Then the shuttle *Endeavour* is planned to fly in April, probably bringing the shuttle-era to a close, although a really last flight in the course of this year is still being considered.

In the meantime new rockets and spacecraft are being developed in the USA, this time in the first place by private firms.

*Messenger in orbit around Mercury*

On 18th March the *Messenger* spacecraft will finally get into orbit around Mercury. It was launched in August 2004, so the journey took almost 7 years.

*Fifty years after Gagarin*

In April it will be 50 years since Yuri Gagarin was the first human in space.

*Eclipses*

There was a full lunar eclipse on 21/12 and a partial solar eclipse in the early morning of 4/1. On the 15th of June this year there will be a full lunar eclipse.

*Possible big surprises?*

There is, of course, always the possibility of *unexpected* events or discoveries. It is, for instance, possible that the LHC will in the course of this year discover really amazing things about what happened in the very first moment after the Big Bang and about the nature of dark or other matter.

And an even bigger discovery – probably the biggest ever made in the history of mankind - would be that of any form of extra-terrestrial life. Perhaps we'll still have to wait for many years for such a discovery – if it will ever be made – but it is also possible that it will be tomorrow or next week.

VENUS

For centuries, people have had the idea that our nearest neighbour was a very pleasant place, with a nice, warm, tropical environment, full of life under its blanket of clouds.
In 1962, however, Mariner-2 flew by Venus on its way to Mercury and discovered how hot the surface was. In 1970 a USSR Venera probe was the first spacecraft to land on Venus. Between 1978 and 1992 the US probes Pioneer Venus and Magellan orbited Venus and mapped 98% of the surface through the clouds by using radar. In October 2005 ESA launched the Venus Express, which came into orbit in April 2006. So now we know that::

- Its atmosphere consists for 96% of $CO_2$ and 3.5% of N, while the pressure at the surface is c. 90 atmosphere. Clouds consist mainly of sulphuric acid.
- As the result of an extreme greenhouse effect the average temperature on Venus is c. 460 degrees C. (= hot enough to melt lead).
- Only about 1-3% of the sunlight reaches the surface, so the days are always gloomy, with an orange-coloured sky (only long red wavelengths get through).

*Conclusion:* Venus is more like hell than like paradise!
Still, Venus is more or less Earth's twin sister: same age (some 4.5 bn years), about the same size (V. is somewhat smaller), orbiting the Sun at about the same speed, and in the beginning probably with very much the same sort of environment.
But in the course of time differences between the two planets became ever bigger:

- Venus orbits the Sun in almost 225 (Earth-)days, while it rotates around its axis in 243 days. So its 'day' lasts longer than its 'year' !
- Venus is the only planet that rotates clockwise as seen from 'above' .
- Venus has a small axial tilt (2.6 º instead of Earth's 23.5 º) and as a result there are no seasons (not really important given the permanent gloom!).
- Venus has no moon (together with Mercury the only exceptions in the SS).
- Venus has more than 1000 volcanoes larger than 20 km, and many more smaller ones. Big question now: is there still *active* volcanism?
- Its atmosphere rotates around Venus at enormous speeds, at the top of the clouds at about 370 km/h, while at the ground there is hardly any wind at all.
- There are no meteorite impact craters, as all meteorites burn up in the thick atmosphere.

How, When and Where do we see Venus in the sky?
Venus is always a very bright object (3rd after Sun and Moon), thanks to the fact that some 75-80% of the sunlight is reflected by its atmosphere. It also has phases, just like the Moon. However, the smaller the crescent, the nearer Venus is to Earth, so the absolute size of the part of the disc that we see, is then bigger then when we see some 100% of the disc when Venus is far away. At closest point (= c. 38 mln km) we see about 1/6th of the disc.
Galileo was the first person to observe the phases, which was another confirmation of Copernicus' theory that planets orbit the Sun.
*Morning-/Evening-'star'*: Being an inner planet, Venus is never far away from the Sun. So sometimes we see Venus in the evening sky after sunset, and sometimes in the early morning before sunrise.
Venus disappears from our view – either behind the Sun ('superior conjunction') or in front of the Sun, when the planet's dark side is turned towards us ('inferior conjunction') - every nine months, to reappear on the other side, changing from morning into evening star, or the other way round.
Sometimes V. passes exactly in front of the Sun during Inferior Conjunction: *Solar Transit.* They occur in pairs, 8 years apart with over a century in between: 2004 (7/6) and 2012, then 2117 and 2125. Earth and Venus don't orbit the Sun in exactly the same plane; otherwise we would have solar transits every 18 months or 1.5 year.

At the moment Venus is still visible before sunrise, and it will remain a morning star until it will disappear behind the Sun in July. After that it will slowly reappear as 'evening star', at first low in the sky, higher and brighter towards the end of the year.
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