

## U3Astronomy Meeting – 24 October 2008

### ***Latest News***

#### *Bad news about Hubble and the LHC*

On 27/9 the *Hubble Space Telescope* suddenly stopped sending images to the Earth. For more information about *Hubble*, see overleaf.

Mid-September problems also arose with the *Large Hadron Collider*, the fantastic machine in a 27 km long circular tunnel, 100 m below the surface at the French-Swiss border. In order to keep the beams of protons travelling through this tunnel at almost the speed of light on track, almost 10,000 super-conducting magnets were installed, and they can only work properly if they are cooled down - by 120 tonnes of liquid helium - to almost the absolute minimum temp. (- 271/-273).

The first tests were carried out successfully on 10/9, but one week later the temperature in part of the magnets began to rise, by about 100 degrees. At least 29 of these magnets will have to be replaced, and at the moment it is estimated that the repairs will take at least 8 months.

#### *Good news from China and India*

**China** made a 'big leap forward' on the 27/9 when an astronaut made the first Chinese spacewalk - an important step in their plans to build an orbiting station and to send men to the Moon in the not too distant future.

**India** launched its first spacecraft (unmanned) towards the Moon just 2 days ago – the *Chandrayaan-1*.

#### *Asteroid met the Earth*

A three meter wide asteroid exploded in the Earth's atmosphere above Northern Sudan in the early hours of 7<sup>th</sup> October. It had been spotted the day before by an observatory in Arizona. It is a solemn reminder of how an asteroid impact could take the Earth by surprise without any considerable warning.

### TELESCOPES

In 1609 Galileo Galilei for the first time used a telescope for astronomical purposes (hence the *International Year of Astronomy* celebrations in 2009), and made famous discoveries with it. In the course of that century astronomers started to build very long telescopes (20 to over 30 m), simply in order to get bigger images. Around 1670 came the switch from *refracting* to *reflecting* telescopes. Big advantages: chromatic aberration-free images (no dispersing into colours, as lenses do), and mirrors can be made much bigger, with support on its back (glass lenses could only be supported by a ring). Around 1950 mirrors of c. 5 metres were built.

Then – in the computer age - came the idea of building very large computer-controlled mirrors, made of interlocking hexagonal segments. A famous example is the *Keck Telescope* on top of the extinct Mauna Kea volcano on Hawaii, which has a 10-metre mirror.

The VLT or *Very Large Telescope* in the Atacama Desert (1999), has four mirrors, each 8.2 metres in diameter.

#### *The view from Space –*

The launch of the *Hubble Space Telescope* in 1990 was an enormous step forward, as the images are not disturbed by atmospheric movements.

A second big advantage is that from above the atmosphere we can also observe infrared and ultraviolet light, as well as X-rays and gamma-rays, which do not reach the Earth's surface.

Therefore *Hubble* is not the only space telescope. There are also the *Chandra* X-ray telescope, the *Spitzer* Infrared telescope (2003), the *GLAST* gamma-ray telescope, launched this year.

There are several plans for bigger and better telescopes to be built in the near future, for use on Earth (larger and larger) as well as in Space: *both* are needed!

## The Hubble Space Telescope

The HST was launched in 1990. The first pictures were of a very disappointing quality. The 2.4 m mirror had a flawed shape of just 2.2 microns (1 micron = 1/1,000<sup>th</sup> of a mm!), which led to blurred, nearly useless images. So a repair mission was carried out in 1993, when new optical components were installed and thereafter everything went well.

Fantastic results, not only in the form of breath-taking images, but also in the discovery of many new facts about the Universe: speed with which the Universe expands, light from infant galaxies (less than 1 bn years old), the age of the Universe (13.7 bn years), black holes, Dark Matter and Energy, etc. (see also <http://hubblesite.org/gallery/album>).

Recently the HST celebrated its 100,000<sup>th</sup> orbit around the Earth (at 575 km altitude), having travelled 2.7 bn miles – the equivalent of 5,700 times to the Moon and back. There were 3 servicing missions so far (with a shuttle connected to the HST), in 1997, 1999 and 2002.

A fourth mission should have been launched around 10/10.

BUT: on 27/9 a critical equipment failure happened aboard the HST and as a result it completely stopped sending images or information to Earth. It appeared that the *science data formatter* – an instrument to format the images taken by Hubble's telescope into data that can be transmitted to Earth, had failed. NASA's engineers tried to switch to spare instruments onboard of the HST. It is hoped that by doing so, *Hubble* will at least be partially operational again in a few weeks time.

Apart from these incidents, the service mission had anyway to be postponed, probably to mid-February. Why so long?

After the Columbia-disaster in 2003 (shuttle exploded shortly before landing) there were big worries about the safety of the astronauts going on a service mission to the HST, as there is no safe haven for them if something goes wrong, as there is on the International Space Station. It was therefore decided that a second shuttle should be on stand-by when the mission went up. So, indeed, in early October, one could see two shuttles on their launch-pads next to each other at Cape Canaveral, *Atlantis* and *Endeavour*. But, now that the mission had to be postponed, the two shuttles could not be kept operational for a long time (*Endeavour* will have to fly to the ISS again in mid-November). And apart from that, staff at Cape Canaveral will first have to find out what exactly went wrong with *Hubble* and how this has to be corrected. So it's February at its earliest, it may also be May.

In a way, however, NASA was lucky that the failure occurred on the eve of the launch, and not after the mission was over.

What was – and hopefully *is* - the crew of seven going to do anyway?

- Repair or replace some failing instruments, like gyroscopes (that stabilise instruments onboard) and batteries;
- Replace some instruments by better ones;
- Add some totally new instruments.

All of this will have to be done during five space walks, resulting into a much better Hubble telescope than it was before. It should be able to work then for an additional 5-8 years. By that time the new *James Webb Space Telescope* should be operational, but it is not the same as Hubble (infrared). So there remain a number of things which only *Hubble* can do with its excellent cameras high above Earth's atmosphere. And you can see how popular *Hubble* still is from its heavily over-subscribed observing time.

So the astronomical world is waiting anxiously what is going to happen in the months to come!

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