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Robotic spacecraft on their way

Over the past months a number of important and sometimes stunning messages were published about the results of unmanned spacecraft launched in recent years.

MOON

The Lunar Reconnaissance Orbiter (LRO)

The LRO was launched in June last year with the aim to look for water on the Moon and for sites where future manned missions could land. Last February, however, the Obama administration decided to abandon the idea of sending astronauts to the Moon again. So now the aim of the LRO has become purely scientific. At almost the same time, last month, it was announced that the LRO had discovered that the Moon is shrinking: some 100 metres over the past 800 mln years. The core cools and shrinks, so the mantle became too wide and began to crumple. Wrinkles – ‘scarps’ - were formed and these have been discovered by the LRO.

PLANETS

Cassini mission extended

NASA recently announced that the mission of the *Cassini* spacecraft to Saturn has been extended until 2017. *Cassini* - one of the great spaceflight success stories - was launched in 1997 and arrived around Saturn in 2004. Since then it has been orbiting the planet, sending back a wealth of information about the planet, its rings and its 49 moons.

In the coming 7 years it will continue to study not only Saturn and its rings, but especially also the largest moons – *Titan* and *Enceladus* (Water? Life?).

New Horizons

Launched in January 2006 to study Pluto. *New Horizons* was in this summer’s news because it had reached the halfway point in its long journey. NH covers nearly a million miles per day, and was in June almost 1.5 billion miles away from Earth. When it reaches Pluto in five years time, it will fly by at a distance of almost 12,500 km (nearest approach), take pictures of Pluto and its three moons and analyze its atmosphere and the chemical composition of the icy planet.

COMETS

Two spacecraft were launched in 2004 and '05 with the aim to study comets.

Rosetta

Launched by ESA in 2004. Its ultimate goal is to visit the comet *Churyumov-Gerasimenko*, which it will reach in 2014, when it will orbit the comet for over a year and place a lander on it. Important recent news about *Rosetta* was its flyby on the 10th of July of the large asteroid *Lutetia* (diameter of about 130 km). *Rosetta* flew by it and took some 400 pictures.

Deep Impact

Another comet-explorer, launched by NASA in January 2005, with the aim to fire a projectile into comet *Temple-1*, which it did in July 2005. It caused a big crater and an enormous cloud of dust, which was carefully observed by the passing *Deep Impact* spacecraft – and by as good as all scientific telescopes on and around the Earth. After that the *Deep Impact* spacecraft continued into a second mission, to study the comet Hartley-2, which it is expected to reach on 4/11.

EXOPLANETS

Kepler

Launched In March 2009. It orbits the Sun and focuses on some 150,000 stars in a relatively small part of the sky, looking for transits of planets. So far it discovered a handful of exoplanets, and in July NASA announced that Kepler had seen some 700 so-called ‘planet candidates’, which have to be observed into more detail before we’ll know for certain if they are planets. *Kepler* should see at least two or three transits to be sure about the existence of these planets, and for that it’s up there far too short.

THE UNIVERSE

WISE

The *Wide-field Infrared Survey Explorer* was launched by NASA last December with the aim to picture the whole of the sky in infrared wavelengths. Mid-July it finished this job, having taken 1.3 million pictures - in just over half a year. It discovered a number of unknown galaxies and stars and, closer to Earth, over a dozen comets and some 25,000 new asteroids.

NEWS

Soyuz / ISS

On 9/10 a Soyuz docked with the International Space Station, bringing 3 new crew members. The spacecraft used was an improved, digital version of the Soyuz, with a new flight computer with upgraded software, which enabled it to make a fully automated approach to the ISS.

Japanese 'solar sail'

The Japanese have successfully completed an experiment with a 'solar sail', called *Ikaros*. This is an unbelievably thin 'sail' – measuring about 15 by 15 metres while being more than 13 times thinner than the width of a human hair. It is accelerated by sunlight, using the energy of photons ('solar wind'), which can transfer small amounts of energy to the solar sail, which, as a result, accelerates. It is connected to a spacecraft on its way to Venus, where it will arrive in early December.

Boeing develops space capsule

In September it was announced that Boeing is developing a new space capsule, in which seven people can travel. It could both be used to ferry crews to and from the ISS, and for tourist flights. Boeing hopes to have the first test flights in 2014.

'Goldilocks' exoplanet discovered

For the first time an exoplanet has been discovered orbiting its star in the 'goldilocks' zone – not too hot or too cold for water to exist. It is orbiting the red dwarf star *Gliese 581*, which is 20 light years away from us. The planet in question has a diameter of about 1.3 times that of the Earth, and it orbits its star in 36.5 days (short year!). We won't know more about the presence of water and possible life on this planet before a telescope in space has analysed its spectrum to see which elements exist on it.

China's 'Chang'e 2' to the Moon

Just over two weeks ago we heard that the Chinese spacecraft *Chang'e 2* had come into orbit around the Moon. It was launched on 01/10 and reached the Moon in five days time. *Chang'e 2* orbits the Moon about 100 km above the surface, and eventually it will get as low as just 15 km, which will enable it to 'see' objects no more than 10 metres across.

One of its tasks will be to map possible landing sites for the next mission in China's lunar program, when a robot will touch down on the Moon in 2013.

Cooperation USA-China?

On 16/09 the NASA-administrator Charlie Bolden travelled to China, together with seven NASA-officials, invited by the Chinese Manned Space Engineering Office for a 5-day visit. The visit will have an introductory character – no specific proposals for cooperation (yet) – but depending on the results and the atmosphere, a return-visit may follow soon.

At the same time, Russia and Europe are thinking in the same direction, for instance of Chinese and Indian participation in the ISS.

NASA's budget approved

Three weeks ago the American House of Representatives accepted the Senate's version for NASA's 19 billion dollar budget for 2011. This means that there will be money for things like an extra shuttle flight to the ISS (probably in June), for the start of developing a new heavy-lift rocket for deep-space exploration, and for funding the development of commercial manned spacecraft (like Boeing).

In the longer term, Obama's administration thinks of manned space flights to nearby asteroids by 2025 and manned orbital Mars missions by the mid-2030's.

