

## U3Astronomy 25/03/2011

### **MESSENGER ARRIVES AT MERCURY**

On 18/03 the NASA spacecraft *Messenger*, 6½ years after launch (August '04), finally got into orbit around Mercury, the smallest of the planets. The journey had to take so long in order to reduce speed during 6 flyby's (1 of Earth, 2 of Venus and 3 of Mercury), in that way reducing the amount of propellant necessary to get into orbit around Mercury.

*Messenger* got into a very elliptical orbit (200 vs 15,000 km distance from the planet). That enables the spacecraft to cool down when it is further away from the hot surface of Mercury, and it gives the opportunity to observe the planet from different distances.

What makes Mercury a special planet?

- it's the nearest planet to the Sun. Its average distance to the Sun is 58 mln km., just over one third of the distance between Earth and Sun (AU = 150 mln km).
- it's the smallest of the *real* planets, only one-third larger than our Moon.
- of all planets, it has the shortest 'year': 88 days, while it has very long 'days': 59 Earth days; only Venus has longer 'days' (243 Earth days).
- it has enormous temperature differences: 430 C on the sunny side, - 170 C on the dark side (it is not only one of the hottest, but also one of the coldest planets. Explanation: very long 'days' and 'nights', + as good as no atmosphere → very different from Venus!).

In the mid-1970's NASA's *Mariner-10* spacecraft made three flyby's of Mercury. It flew, however, each time over the same part of the planet, so its pictures showed no more than 45% of the surface. That percentage increased considerably during the 3 fly-bys of *Messenger* – in 2008 and '09 – but, of course, fly-bys can never be compared to observations from orbit: from different distances, under different illumination etc.

So what is *MESSENGER* (*Mercury Surface, Space Environment, Geochemistry and Ranger*) hopefully going to discover?

- More details about the surface (geology). Mercury very much looks like our Moon, with large numbers of craters and plains filled with lava. There are some enormous craters, such as the *Caloris Basin* (diameter 1300 km). So we hope to learn more about Mercury's volcanism.
- Is there ice on Mercury? Observations from Earth have shown a highly reflective substance on the floors of craters which never receive sunlight. This could be ice!
- More about the planet's structure. We know already that Mercury has a high density, the result of a big, heavy core, probably mostly iron. This core covers some 60% of the planet's volume (much more than Earth's), which means that its mantle and crust are relatively thin. What was the cause of that – a heavy collision, or have the outer layers vaporised in the heat of the Sun?
- We know that Mercury has been cooling down and shrinking, and as a result there are very long scarps or ridges (just like on the Moon), and these ridges will also be studied in detail.
- The very thin atmosphere (or 'exosphere'): pressure at the surface is 10-14 bar. What does it consist of, and where did it come from?
- What is the nature of Mercury's magnetic field? Mercury and Earth are the only rocky planets with a magnetic field.

So there is obviously plenty to observe and to study, and we'll learn a lot more about our smallest planet. *Messenger* has a year to do this, and perhaps up to two years. It all depends on the use of its propellant. It will regularly have to use some of it to keep in orbit despite the gravitational pull of the Sun, and when it's all been used, it's finished!

## NEWS

### Discovery

Launched Thursday 24/02 (finally! – delay of almost 4 months). Returned to Florida on 09/03. It carried one of the last extensions to the ISS, together with scientific material, spare parts and goods to support the crew.

It was the 39<sup>th</sup> and final flight of the 30 year old shuttle.

### Soyuz

Exactly one week later, on 16/03, three astronauts who had worked at the ISS for about six months, returned to Earth by a *Soyuz* capsule. After a 3.5 hour plunge into the atmosphere, the capsule landed in the snow of icy Kazakhstan on a parachute.

### Endeavour

In the meantime, the shuttle *Endeavour* is standing on the launch platform in Florida. If all goes well, this shuttle will leave for the ISS – also for its last flight - on 19/04.

And after that there will probably be the really very last shuttle mission in June.

### Messenger

The *Messenger* spacecraft, launched in August 2004, finally got into orbit around Mercury on 18/03 after a 6½ year long journey. *See the main topic of this summary.*

### Voyager

Another craft in space, even longer than 6½ years, is NASA's *Voyager*. Two spacecraft, actually, *Voyager 1* and *2*, were launched in August and September 1977 with the aim to study the outskirts of the SS. They flew by Jupiter and Saturn, then went into different directions, Nr 1 leaving the ecliptic, Nr 2 flying by Uranus and Neptune, and then both towards different parts of the boundary of the 'heliosphere', .

Recently there was news about Nr 1, which is at the moment some 11 bn miles or over 17 bn km from Earth. It still sends scientific data to Earth (which take 16 hours to reach us). It is now in a region where the influence of the Sun is very weak, and where the solar wind (flow of charged particles) is slow and almost zero. In order to get a clearer view of this, it was necessary to change the orientation of the *Voyager*, so NASA ordered it to roll 70 degrees! More of such rolls are planned for the near future, and then, some months later, the results will be released.

### Pan-STARRS Telescope

It's not only instruments on board spacecraft that make important discoveries; big telescopes on Earth are still indispensable (and will remain so !). The *Pan-STARRS Telescope* in Hawaii recently discovered no less than 19 near-Earth asteroids during one night (29/01) – a new record. So we were reminded again of this ever present threat to Earth. All the asteroids this telescope sees, are carefully monitored in order to calculate their precise orbits around the Sun and see whether they may become dangerous in the future.

### WISE Telescope

This telescope was launched in December 2009 with the aim to map the whole of the sky in infrared light. After about 10 months, last October, its coolant (solid hydrogen) ran out, so *WISE* 'warmed up' from -260 to -200 C. (the craft warms up because the infrared light it receives is warm). After October it was still only able to take pictures of regions around the Solar System, and on 01/02 it took its last pictures.

It has taken some millions of pictures, the result of which will be published in about a year's time.

### Japan's earthquake

The terrible disaster in Japan also damaged the JAXA control centre for the ISS, some 50 km NE of central Tokyo. So NASA had to take over its task, especially monitoring the Japanese parts of the ISS (docking station, laboratory etc.).

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**NB – There will be NO MEETING in APRIL, so the next meeting is on 27/05.**