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The NASA probe, MESSENGER, flies past Mercury for the first time

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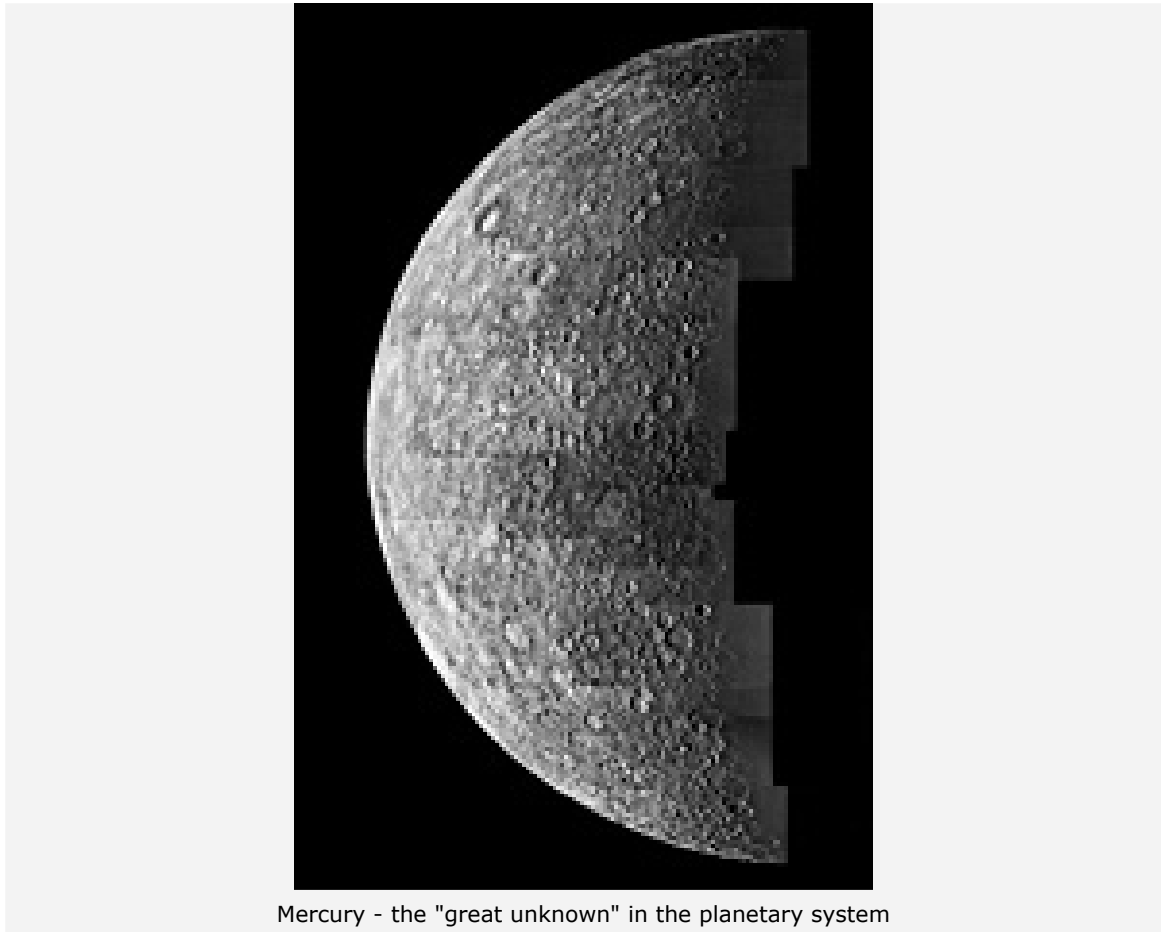
Exploring the "great unknown" in the Solar System



The MESSENGER space probe at Mercury

It comes within 90 million kilometres of Earth but is, nevertheless, the planet we know least about: Mercury. Now it is getting a visit from us. On the evening of 14 January 2008 at 20:04 CET, the American NASA mission, MESSENGER, will fly within 200 kilometres of Mercury for the first time after a journey that has taken almost four years. The probe will take 1200 pictures of previously unknown areas and perform a large number of experiments. The German Aerospace Center (DLR) is involved in the mission in a scientific capacity.

With MESSENGER (**ME**rcury **S**urface, **S**pace **EN**vironment, **GE**ochemistry and **R**anging) a probe is flying to Mercury again for the first time in more than 30 years. The planet, which is the smallest of the eight planets and the closest to the Sun has had a visit from a space probe before. The NASA probe, Mariner 10 flew past Mercury three times in all during 1974 and 1975. At that time only just under half of the planet could be photographed - the rest is "virgin territory" for planet research.



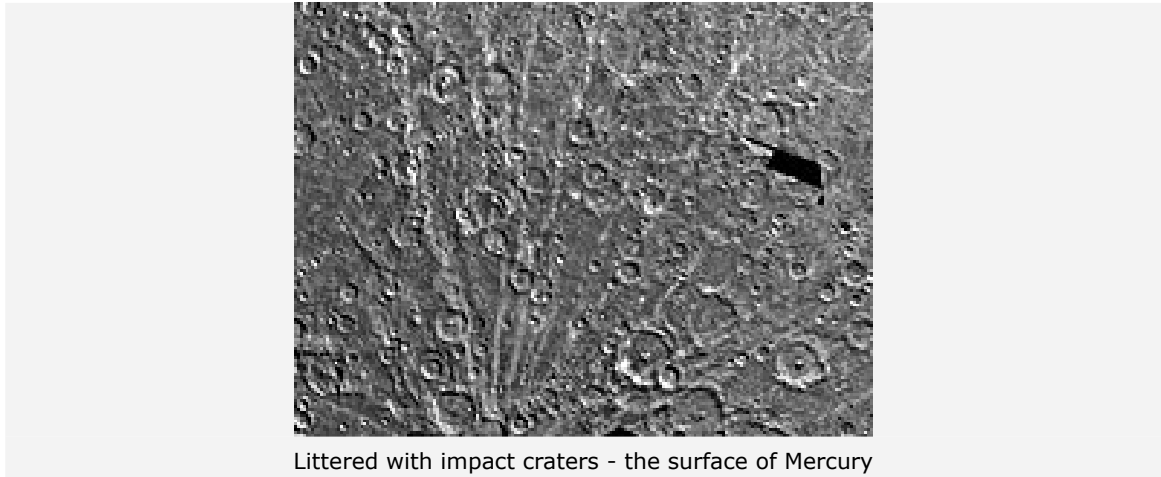
Mercury - the "great unknown" in the planetary system

First glimpse at the "dark side" of Mercury

MESSENGER is to record and explore the previously unknown hemisphere of the planet for the first time. "We will be scanning the surface of Mercury along the flight path with a laser beam. In this way we shall obtain a height profile and also record the reflective properties of the surface", explained Professor Jürgen Oberst from the DLR Institute for Planetary Research in Berlin. "With the data provided by the probe we will be able to determine the size and shape of the planet better and we shall also be able to calculate Mercury's gravitational field more accurately with the measurements from this fly past. This is absolutely necessary because we don't know enough about the size, shape, gravitational field and rotation of the planet". Oberst and his colleagues will help with the evaluation of the laser height measurements. With the measured height profiles and the photographs of the areas that have not yet been mapped we shall finally be able to expand and improve our knowledge of the planet's existing cartography.

There is still a great deal of uncertainty about the composition of Mercury's surface. "All our knowledge about the minerals on Mercury's surface is based on data provided more than 30 years ago by the Mariner 10 mission and observations taken from Earth. MESSENGER will advance our knowledge a great deal but will also certainly raise many more questions", explained Dr. Jörn Helbert from the Berlin DLR Institute. He and his team will help the America MESSENGER team to analyse the spectral data. To do this concomitant measurements will be taken in the DLR laboratory in Berlin . In the next two weeks Helbert will analyse the data from the first fly past at the Applied Physics Laboratory (APL) of John Hopkins University in Laurel, Maryland . The two DLR scientists are the only non-American scientists involved in this NASA mission..

A complicated manoeuvre: Three fly-bys before swinging into orbit



Because it is so close to the Sun it is very difficult for space probes to get to Mercury: The planet, that is not even five thousand kilometres in diameter, orbits the Sun at an average distance of just under 60 million kilometres. Therefore on the approach to Mercury both the gravitational pull of the Sun and also the enormously high level of radiation must be allowed for. After this initial fly past the probe will once more orbit the Sun until it flies past Mercury twice more - in October of this year and in September 2009. During these fly-by manoeuvres MESSENGER is slowed down by the planet's gravity to just the speed at which the probe will be able to go into orbit around the planet propelling itself with its own drive system. By this time it would have orbited the Sun a total of 15 times and have covered eight billion kilometres.

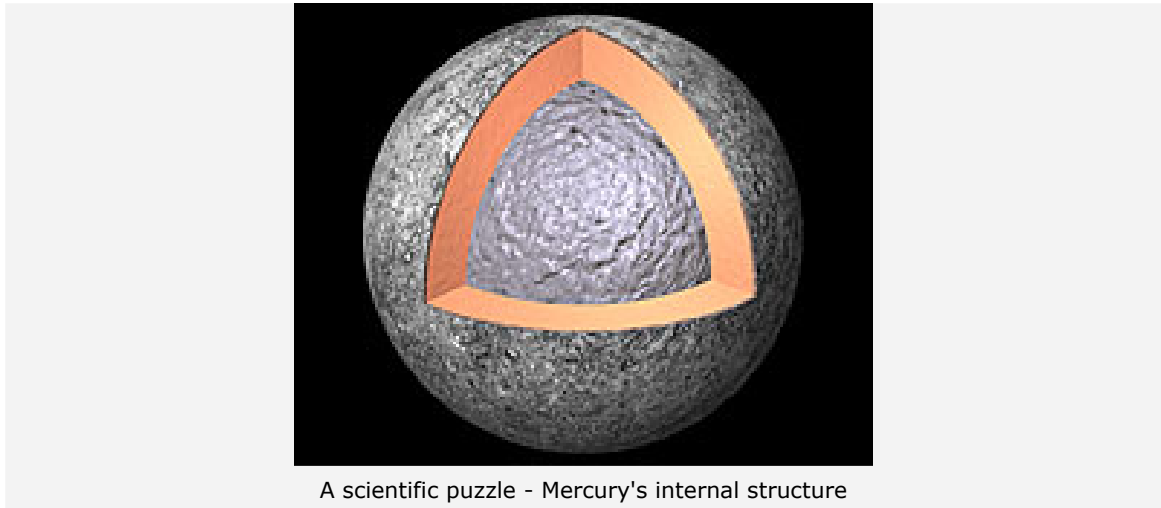
MESSENGER is a space probe from the Discovery programme set up by NASA in 1992 that gave science the opportunity to solve riddles in our Solar System with relatively cheap, innovative missions. MESSENGER was launched on 3 August 2004 and since then has been approaching its destination on a complicated flight path through the inner Solar System. The probe was built at John Hopkins University, the same institution that carried out the mission.

2013 - Start of the European - Japanese Mercury mission, BepiColombo

The BepiColombo mission to Mercury is currently being prepared by the European Space Agency (ESA) and the Japanese Space Agency, JAXA. This mission is named after the Italian mathematician, Giuseppe Colombo, who had helped to calculate the flight path for the NASA probe, Mariner 10 in the 1970's . BepiColombo will build on the results of MESSENGER. The DLR Institute for Planetary Research together with the University of Berne and the Max Planck Institute for Solar System Research in Katlenburg-Lindau developed the BELA laser altimeter (BepiColombo Laser Altimeter) for this mission. The LMA laser altimeter on the MESSENGER probe will supply valuable groundwork for BepiColombo for this. "It will be particularly interesting to obtain empirical values for the reflection properties of Mercury's surface, particularly on the laser wavelength, that could be incorporated into the design and development of BELA", explained Prof. Oberst. "Models and maps of Mercury's surface, such as are expected from MESSENGER, represent an important basis for planning BELA's operation and the operation of other instruments on board BepiColombo."

Dr. Helbert too is involved both in the NASA MESSENGER mission and the ESA BepiColombo mission. In the ESA mission Helbert will be responsible for the infra-red spectrometer, MERTIS (Mercury Thermal Infrared Spectrometer), that can record data in a spectral range that is not covered by any of the MESSENGER instruments. "Apart from supporting our American colleagues, we shall also gain important experience by our participation which will help us in preparing the BepiColombo mission," explained Helbert.

Mercury: "Terra Incognita" in the inner Solar System



A scientific puzzle - Mercury's internal structure

Up until now planet researchers have known very little about Mercury: Because the planet is so close to the Sun it is very difficult to see from Earth with telescopes and radar antennae. Apart from the three fly-bys with Mariner 10 in 1974 and 1975, it is little explored.

At first glance Mercury looks like our Moon: Its surface is littered with countless impact craters which leads us to conclude that the planet has not been changed by any of the geological processes activated from inside the core for billions of years. There are no significant indications that there were once volcanoes on the surface .

Like the Moon, Mercury is also incapable of retaining an atmosphere - however, the spectrometer on board Mariner 10 revealed a razor-thin gas envelope made up of hydrogen, helium and oxygen with traces of sodium and potassium. However, the total weight of these volatile elements is only about one thousand kilograms.

The origin of the particles is unknown and hopefully will be explained by MESSENGER; a great proportion of it probably comes directly from the Sun and only a little from the gas emissions from the inside of the planet itself. Because of its proximity to the Sun on the one hand and the absence of a significant, compensating gas envelope on the other, there are extreme differences in temperature on Mercury : on the side facing the Sun the temperature reaches 430° Celsius - only Venus is hotter. During the Mercury night temperatures drop to minus 170° Celsius. Therefore, it could be that there is ice in some deep craters at the poles of the planet because they do not get any Sun and are therefore permanently cold . Radar observations from Earth indicated this possibility.

Mercury conceals the greatest puzzle in its interior: Under the thin rock crust there is a comparatively thin mantle of silicate rock. However, in the centre of the planet there is an extraordinarily large core of iron that is also responsible for a relatively strong magnetic field. It is a mystery why this core makes up far more than half of the volume of the planet. One of the main aims of the MESSENGER mission is to find out why. Planetary researchers are also hoping for fundamental knowledge about the origin and early development of the five earth-like bodies in the inner Solar System.

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