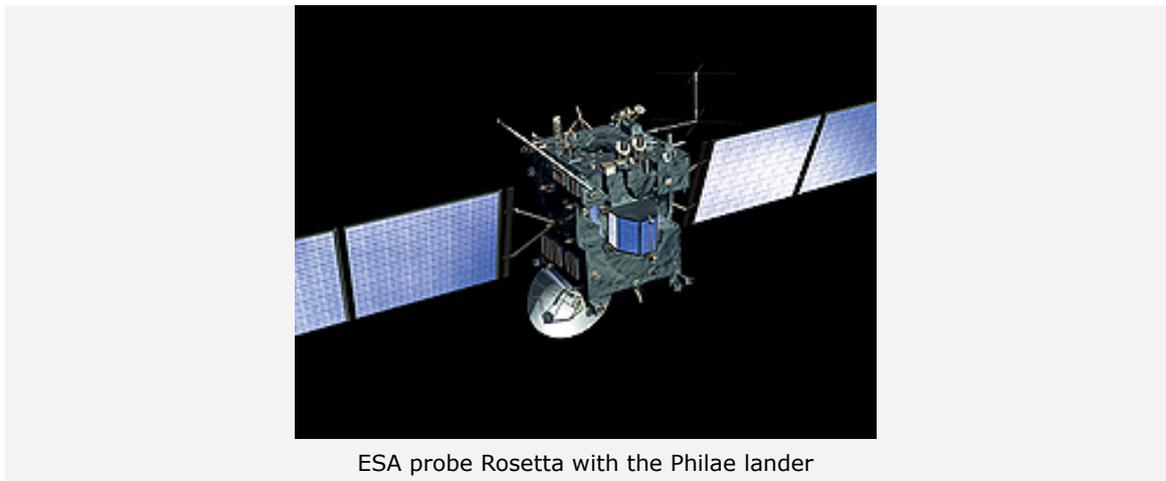


News-Archiv

Comet probe Rosetta explores Asteroid Steins

1 September 2008



DLR scientists in Berlin and Cologne involved with experiments on the mother probe and the lander Philae

After almost four and a half years in space, the European Rosetta comet mission will make a historic encounter with asteroid (2867) Steins at 20:58 Central European Summer Time (CEST) on 5 September 2008. It will pass Steins at a distance of 800 kilometres and explore the asteroid in depth. Before, during and after the approach, Rosetta will take many pictures and perform scientific experiments. The German Aerospace Center (DLR) is involved in a large way.

Launched on 2 March 2004, Rosetta's ultimate destination will be a periodic comet known as Comet 67P/Churyumov-Gerasimenko.

The Rosetta orbiter will rendezvous with Comet 67P/Churyumov-Gerasimenko and remain in close proximity to the icy nucleus as it plunges towards the warmer inner reaches of the Sun's domain. At the same time, a small lander called Philae will be released onto the surface of this mysterious cosmic iceberg.

More than a year will then pass before the remarkable mission draws to a close in December 2015. By then, both the spacecraft and the comet will have circled the Sun and be on their way out of the inner Solar System.

On the outward leg of its ten-year trek to Comet 67P/Churyumov-Gerasimenko, Rosetta makes two excursions into the main asteroid belt that lies between the orbits of Mars and Jupiter. Scientists have identified a number of target asteroids along Rosetta's path of which Steins is the first. Only a few asteroids have been observed thus far from so close. Rosetta will obtain spectacular images as it flies by within several thousand kilometres of these primordial rocks. The relative speed will be less than 15 kilometres per second.

Asteroids are very different in shape and size (ranging from a few kilometres to more than 100 kilometres) as well as in their composition. Rosetta will provide information on the mass and density of Steins as it approaches, thus telling us more about their composition. It will also measure their subsurface temperature and look for gases and dust around them.

Preparations for the fly-by of asteroid Steins are ongoing - and intensifying - for the men and women of the Rosetta Flight Control Team based at the European Space Agency (ESA) Control Centre in Darmstadt, Germany where spacecraft operations are controlled from the Rosetta Dedicated Control Room (DCR).

DLR is participating with many scientists in the mission. "Comets and asteroids can be considered as some of the remaining original elements in our 4.6 billion-years-old Solar System," said Professor Tilman Spohn, director of the DLR Institute for Planetary Research in Berlin-Adlershof "From its investigation, we expect from Rosetta some basic knowledge about the formation of the planets and moons. Some very complex analysis of these small bodies could also provide important clues to how life arose on Earth."

OSIRIS camera to provide spectacular images of the asteroid

Germany contributed much to the instrumentation on the mission. OSIRIS (**O**ptical, **S**pectroscopic, and **I**nfrared **R**emote **I**maging **S**ystem) is a wide-angle camera and a narrow-angle camera to obtain high-resolution images of the comet's nucleus and the asteroids that Rosetta passes on its voyage to Comet 67P/Churyumov-Gerasimenko. It will help in identifying the best landing sites. It was developed by the Max Planck Institute for Solar System Research in Katlenburg-Lindau. The images are of such a high resolution that individual craters and rock blocks on Steins's surface will be seen. Rosetta will pass the asteroid at a distance of about 360 million kilometres from Earth - about 20 light minutes for the signal to travel.

OSIRIS will also take this opportunity to obtain 'light curves' of Steins. Light curves tell us how the asteroid brightness varies with time, providing us with additional preparatory information about the asteroid, such as better knowledge of its shape and rotation characteristics.

Three German experiments on the Philae lander



Rosetta Lander Control Centre

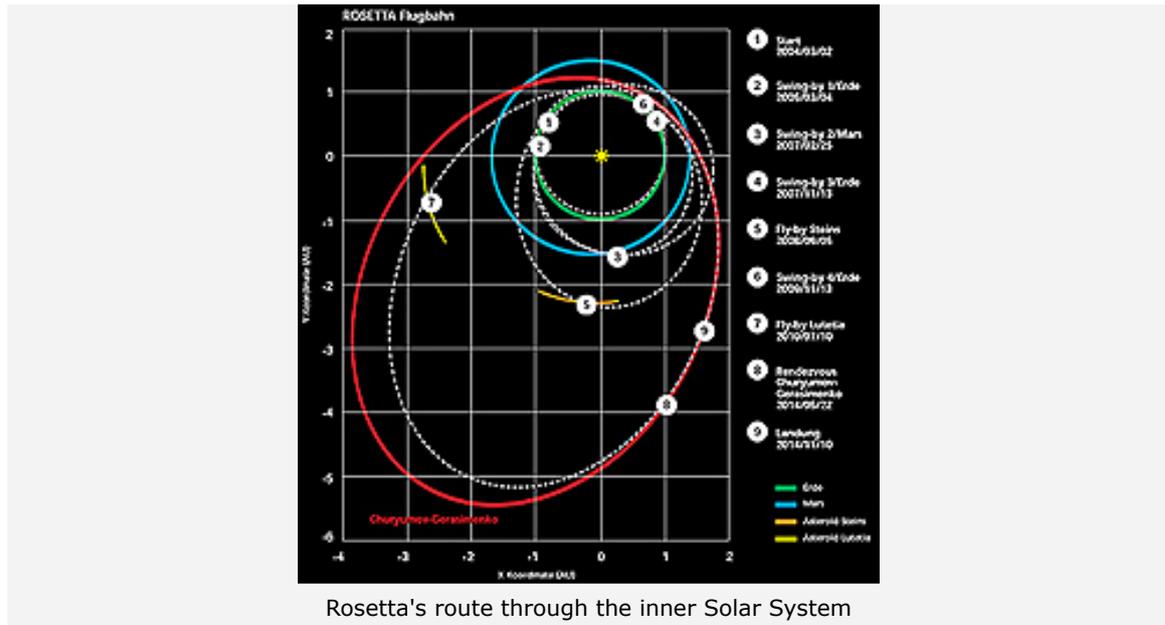
The 100-kilogram Rosetta lander is provided by a European consortium under the leadership of the German Aerospace Centre (DLR). Other members of the consortium are ESA and institutes from Austria, Finland, France, Hungary, Ireland, Italy and the UK. The Rosetta Lander Control Centre in Cologne monitors Philae between 3 and 6 September 2008. Three scientific experiments from Philae are operated and controlled from DLR Cologne. The landing probe Philae flies 'piggyback' on Rosetta.

The ROMAP (**R**osetta Lander **M**agnetometer and **P**lasma Monitor) experiment consists of a magnetometer and a plasma monitor. It will measure the magnetic field of asteroid Steins. It was provided by the Max Planck Institute for Extraterrestrial Physics in Garching and the Technical University of Braunschweig.

To calibrate the lander, the control centre at DLR Cologne will switch on two other instruments during the pass flight. On SESAME (**S**urface **E**lectrical, **S**eismic and **A**coustic **M**onitoring **E**xperiment), three instruments measure properties of the comet's outer layers. The Cometary Acoustic Sounding Surface Experiment measures the way in which sound travels through the surface. The Permittivity Probe investigates its electrical characteristics, and the Dust Impact Monitor measures dust falling back to the surface.

MUPUS (**M**Ulti **P**urpose **S**ensors for Surface and Subsurface Science) provided by the University of Münster, uses sensors on the Lander's anchor, probe and exterior to measure the density, thermal and mechanical properties of the surface.

SESAME and MUPUS are monitored from the DLR Institute for Planetary Research in Berlin.



Scientists from DLR in Berlin will help in the VIRTIS experiment. VIRTIS (**V**isible and **I**nfrared **T**hermal **I**maging **S**pectrometer) maps and studies the nature of the solids and the temperature on the surface of the nucleus. It also identifies comet gases, characterises the physical conditions of the coma and helps to identify the best landing sites.

At Steins, VIRTIS allows a determination of the chemical and mineralogical components, volume, shape and density of the asteroid. The influence of billions of years of solar wind on the asteroid surface will be investigated.

Steins is the first important scientific target of Rosetta

Rosetta's flight path through the inner Solar System and the study of asteroid Steins is the first comprehensive scientific task.

The irregularly-shaped, 5 kilometre-wide rock, with a rotation period of about six hours, was discovered in 1969 by the Russian astronomer Nicolai Chernykh. It is named after Karlis Šteins, a Latvian and Soviet astronomer.

Steins belongs to a rare class of so-called E-type asteroids, which has a brighter than average surface. The "E" stands for Enstatite in a silicate mineral group called Orthopyroxen. These minerals are found in volcanic basalt rocks, which are found often on Earth.

Scientists theorise E-type asteroids to be fragments of a larger small planet in a state of complex geological development with a mantle and core - and perhaps even for a short time volcanically active. Cosmic collisions destroyed the planet. "Among the tens of thousands of known asteroids, only 50 are classified as E-type," said Spohn of DLR Berlin-Adlershof. "The Rosetta fly-by for us is therefore a scientific stroke of luck. Dealing with the data from Steins may open up a whole series of questions to answer."



For these reasons, Steins has been selected as one of the two asteroids that Rosetta will study, from among those that were within reach of the mission. The knowledge gained from the measurements will add to our knowledge of the composition and evolution of E-type asteroids and will also supplement and help interpret future ground-based data on asteroids.

The fly-by will push Rosetta to its design limits, especially owing to the fast rotation of the spacecraft around the time of closest approach. The manoeuvre is necessary to ensure that the asteroid will stay in the field of view of the instruments. In view of this, a full in-flight simulation of the fly-by was performed on 24 March 2008. The tests were successful, confirming the spacecraft's robustness.

In November 2009, as part of its further journey, Rosetta will pass by the Earth again, before the probe in less than two years, on 10 July 2010, will pass an asteroid for a second time visiting the large minor planet Lutetia.

Rosetta: European mission with a large German share

Rosetta has been ESA's most complex undertaking in exploring the Solar System. Rosetta has a high German participation in the scientific payload: German scientists have the primary responsibility for half of all instruments and a total of three-quarters of the instruments. Of the total mission cost of around one billion euros, about 30% was raised by Germany - mainly DLR's German Space Agency: two thirds as Germany's ESA contribution and third by national resources, including the basic funding of participating institutes.

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