

# NASA Spacecraft Streams Back Surprises From Mercury

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This scene was imaged by MESSENGER's Narrow Angle Camera (NAC) on the Mercury Dual Imaging System (MDIS) during the spacecraft's flyby of Mercury on January 14, 2008. The scene is part of a mosaic that covers a portion of the hemisphere not viewed by Mariner 10 during any of its three flybys (1974-1975). The surface of Mercury is revealed at a resolution of about 250 meters/pixel (about 820 feet/pixel). For this image, the Sun is illuminating the scene from the top and north is to the left. The outer diameter of the large double ring crater at the center of the scene is about 260 km (about 160 miles). The crater appears to be filled with smooth plains material that may be volcanic in nature. Multiple chains of smaller secondary craters are also seen extending radially outward from the double ring crater. Double or multiple rings form in craters with very large diameters, often referred to as impact basins. On Mercury, double ring basins begin to form when the crater diameter exceeds about 200 km (about 125 miles); at such an onset diameter the inner rings are typically low, partial, or discontinuous. The transition diameter at which craters begin to form rings is not the same on all bodies and, although it depends primarily on the surface gravity of the planet or moon, the transition diameter

can also reveal important information about the physical characteristics of surface materials. Studying impact craters, such as this one, in the more than 1200 images returned from this flyby will provide clues to the physical properties of Mercury's surface and its geological history. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington

The recent flyby of Mercury by NASA's MESSENGER spacecraft has given scientists an entirely new look at a planet once thought to have characteristics similar to those of Earth's moon. Researchers are amazed by the wealth of images and data that show a unique world with a diversity of geological processes and a very different magnetosphere from the one discovered and sampled more than 30 years ago.

After a journey of more than 2 billion miles and three and a half years, NASA's MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) spacecraft made its first flyby on Jan. 14. MESSENGER is the first mission sent to orbit the planet closest to our sun. The spacecraft's cameras and other sophisticated, high-technology instruments collected more than 1,200 images and made other science observations. Data included the first up-close measurements of Mercury since the Mariner 10 spacecraft's third and final flyby on March 16, 1975.

"This flyby allowed us to see a part of the planet never before viewed by spacecraft, and our little craft has returned a gold mine of exciting data," said Sean Solomon, MESSENGER's principal investigator, Carnegie Institution of Washington. "From the perspectives of spacecraft performance and maneuver accuracy, this encounter was near-perfect, and we are delighted that all of the science data are now on the ground."

Unlike the moon, MESSENGER showed that Mercury has huge cliffs with structures snaking up hundreds of miles across the planet's face. These cliffs preserve a record of patterns of fault activity from early in the planet's history. The spacecraft also revealed impact craters that appear very different from lunar craters.

Instruments provided a topographic profile of craters and other geological features on the night side of Mercury. The spacecraft also discovered a unique feature that scientists dubbed "The Spider." This formation never has been seen on Mercury before and nothing like it has been observed on the moon. It lies in the middle of a large impact crater called the Caloris basin and consists of more than one hundred narrow, flat-floored troughs radiating from a complex central region.

"The Spider has a crater near its center, but whether that crater is related to the original formation or came later is not clear at this time," said James Head, science team co-investigator at Brown University, Providence, R.I.

Now that MESSENGER has shown scientists the full extent of the Caloris basin, its diameter has been revised upward from the Mariner 10 estimate of 800 miles to perhaps as large as 960 miles from rim to rim. The plains inside the Caloris basin are distinctive and more reflective than the exterior plains. Impact basins on the moon have opposite characteristics.

The magnetosphere and magnetic field of Mercury during the MESSENGER flyby appeared to be different from the Mariner 10 observations. MESSENGER found the planet's magnetic field was generally quiet but showed several signatures indicating significant pressure within the magnetosphere.

Magnetic fields like Earth's and their resulting magnetospheres are

generated by electrical dynamos in the form of a liquid metallic outer core deep in the planet's center. Of the four terrestrial planets, only Mercury and Earth exhibit such a phenomenon. The magnetic field deflects the solar wind from the sun, producing a protective bubble around Earth that shields the surface of our planet from those energetic particles and other sources farther out in the galaxy. Similar variations are expected for Mercury's magnetic field, but the precise nature of its field and the time scales for internal changes are unknown. The next two flybys and the yearlong orbital phase will shed more light on these processes.

MESSENGER's suite of instruments also has provided insight into the mineral makeup of the surface terrain and detected ultraviolet emissions from sodium, calcium and hydrogen in Mercury's exosphere. The spacecraft explored the sodium-rich exospheric "tail," which extends more than 25,000 miles from the planet.

"We should keep this treasure trove of data in perspective. With two flybys to come and an intensive orbital mission to follow, we are just getting started to go where no one has been before," said project scientist Ralph McNutt of the Applied Physics Laboratory, Laurel, Md.

Source: NASA

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