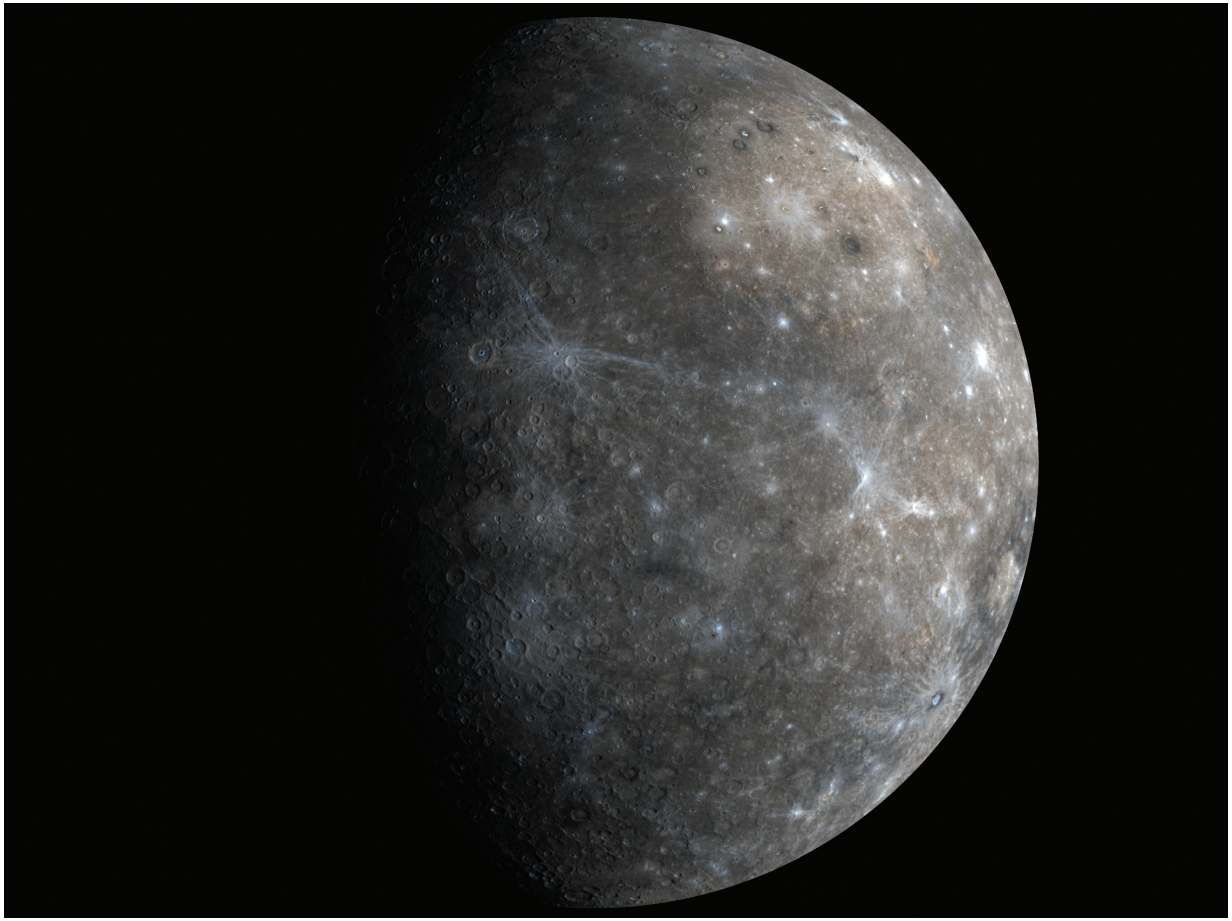

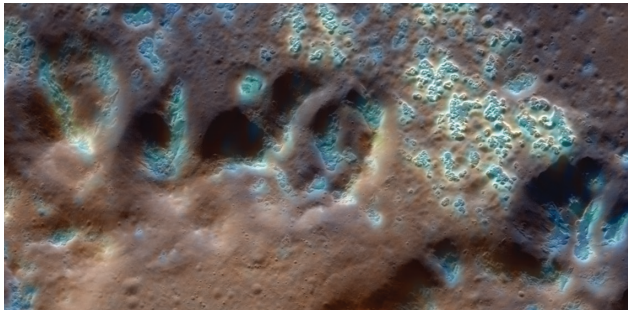

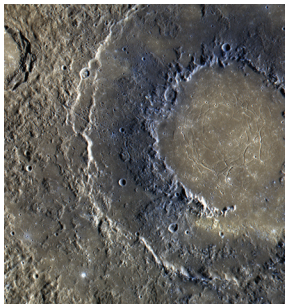

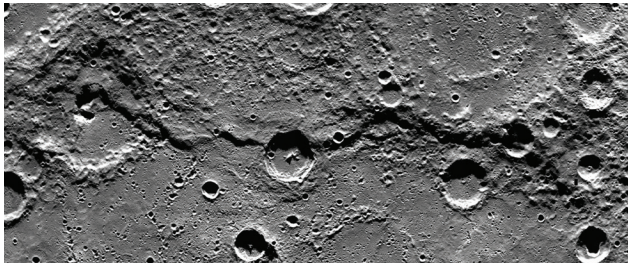

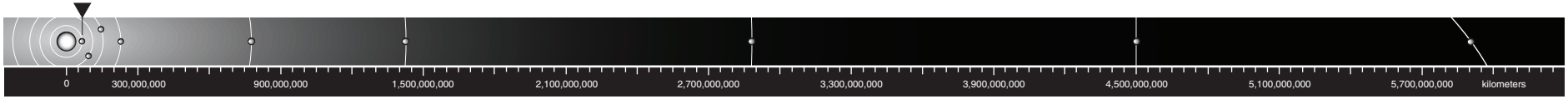
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kilometers

## Mercury

Mercury's eccentric orbit takes the small planet as close as 47 million kilometers (29 million miles) and as far as 70 million kilometers (43 million miles) from the Sun. If one could stand on the scorching surface of Mercury when it is at its closest point to the Sun, the Sun would appear more than three times as large as it does when viewed from Earth. Temperatures on Mercury's surface can reach 430 degrees Celsius (800 degrees Fahrenheit). Because the planet has no atmosphere to retain that heat, nighttime temperatures on the surface can drop to –180 degrees Celsius (–290 degrees Fahrenheit).

Because Mercury is so close to the Sun, it is hard to directly observe from Earth except during dawn or twilight. Mercury makes an appearance indirectly, however — 13 times each century, observers on Earth can watch Mercury pass across the face of the Sun, an event called a transit. These rare transits fall within several days of May 8 and November 10. The first two transits of Mercury in the 21st century occurred May 7, 2003, and November 8, 2006. The next are May 9, 2016, and November 11, 2019.

Mercury speeds around the Sun every 88 days, traveling through space at nearly 50 kilometers (31 miles) per second — faster than any other planet. One Mercury solar day equals 175.97 Earth days.

Instead of an atmosphere, Mercury possesses a thin "exosphere" made up of atoms blasted off the surface by the solar wind and striking micrometeoroids. Because of solar radiation pressure, the atoms quickly escape into space and form a "tail" of neutral particles. Though Mercury's magnetic field at the surface has just 1 percent the strength of Earth's, it interacts with the magnetic field of the solar wind to episodically create intense "magnetic tornadoes" that funnel the fast, hot solar wind plasma down to the surface. When the ions strike the surface, they knock off neutrally charged atoms and send them on a loop high into the sky.

Mercury's surface resembles that of Earth's Moon, scarred by many impact craters resulting from collisions with meteoroids and comets. Very large impact basins, including Caloris (1,550 kilometers, or 960 miles, in diameter) and Rachmaninoff (306 kilometers, or 190 miles), were created by asteroid impacts on the planet's surface early in the solar system's history. While there are large areas of smooth terrain, there are also lobe-shaped scarps or cliffs, some hundreds of miles long and soaring up to a mile high, formed as the planet's interior cooled and contracted over the billions of years since Mercury formed.

Mercury is the second densest planet after Earth, with a large metallic core having a radius of about 2,000 kilometers (1,240 miles), about 80 percent of the planet's radius. In 2007, researchers used ground-based radars to study the core, and found evidence that it is partly molten (liquid). Mercury's outer shell, comparable to Earth's outer shell (called the mantle and crust), is only about 400 kilometers (250 miles) thick.

The first spacecraft to visit Mercury was Mariner 10, which imaged about 45 percent of the surface. NASA's MErcury Surface, Space ENvironment, GEochemistry, and Ranging (MESSENGER) mission flew by Mercury three times in 2008–2009 and has been in orbit around the planet since March 18, 2011. Almost the entire planet has now been imaged, revealing a surface that has been shaped both by extensive volcanism and impacts.

Data from MESSENGER's scientific instruments have provided a trove of scientific discoveries. These include the identification of a new landform known as "hollows," measurements indicating that Mercury has a remarkably high abundance of the volatile elements sulfur and potassium, and the discoveries that Mercury's magnetic field is offset relative to the planet's equator and that the planet has a highly unusual internal structure. In 1991, astronomers on Earth using radar observations showed that Mercury may have water ice at its north and south poles inside deep craters. MESSENGER observations have shown that the materials identified by radar are present only in regions of permanent shadow, consistent with the idea that they are cold enough to preserve water ice, despite the extreme high temperatures experienced by sunlit parts of the planet.

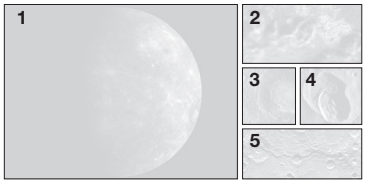
## FAST FACTS

| | |
|---|---|
| Namesake | Messenger of the Roman gods |
| Mean Distance from the Sun | 57.91 million km (35.98 million mi) |
| Orbit Period | 87.97 Earth days |
| Orbit Eccentricity (Circular Orbit = 0) | 0.206 |
| Orbit Inclination to Ecliptic | 7 deg |
| Inclination of Equator to Orbit | 0 deg |
| Rotation Period | 58.65 Earth days |
| Successive Sunrises | 175.97 days |
| Equatorial Radius | 2,440 km (1,516 mi) |
| Mass | 0.055 of Earth's |
| Density | 5.43 g/cm$^3$ (0.98 of Earth's) |
| Gravity | 0.38 of Earth's |
| Exosphere Components | hydrogen, helium, sodium, potassium, calcium, magnesium |
| Temperature Range | –180 to 430 deg C (–290 to 800 deg F) |
| Known Moons | 0 |
| Rings | 0 |

## SIGNIFICANT DATES

1609 — Thomas Harriott and Galileo Galilei observe Mercury with the newly invented telescope.
1631 — Pierre Gassendi uses a telescope to watch from Earth as Mercury crosses the face of the Sun.
1965 — Incorrectly believing for centuries that the same side of Mercury always faces the Sun, astronomers find that the planet rotates three times for every two orbits.
1974–1975 — Mariner 10 photographs roughly half of Mercury's surface in three flybys.
1991 — Scientists using Earth-based radar find signs of ice locked in permanently shadowed areas of craters in Mercury's polar regions.
2008–2009 — MESSENGER observes Mercury during three flybys.
2011 — MESSENGER begins its orbital mission of Mercury, yielding a treasure trove of images, compositional data, and scientific discoveries.

## ABOUT THE IMAGES




1 A MESSENGER visible–infrared mosaic translated to colors the eye can see to accentuate subtle differences in color on the surface.

2 A close-up, enhanced color view of "hollows" located on the peak-ring of Raditladi basin. The image is 20 kilometers (12 miles) tall. A peak-ring basin has two rings; the outer ring is the rim of the basin.

3 A MESSENGER visible–infrared color image of the peak-ring basin Rachmaninoff.

4 The object that formed crater Ailey partially destroyed an older impact crater. Ailey, 21 kilometers (13 miles) in diameter, was imaged by MESSENGER and named in 2012.

5 A mosaic of Victoria Rupes, a scarp nearly 500 kilometers (310 miles) long, imaged by MESSENGER.

## FOR MORE INFORMATION

*solarsystem.nasa.gov/mercury*

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