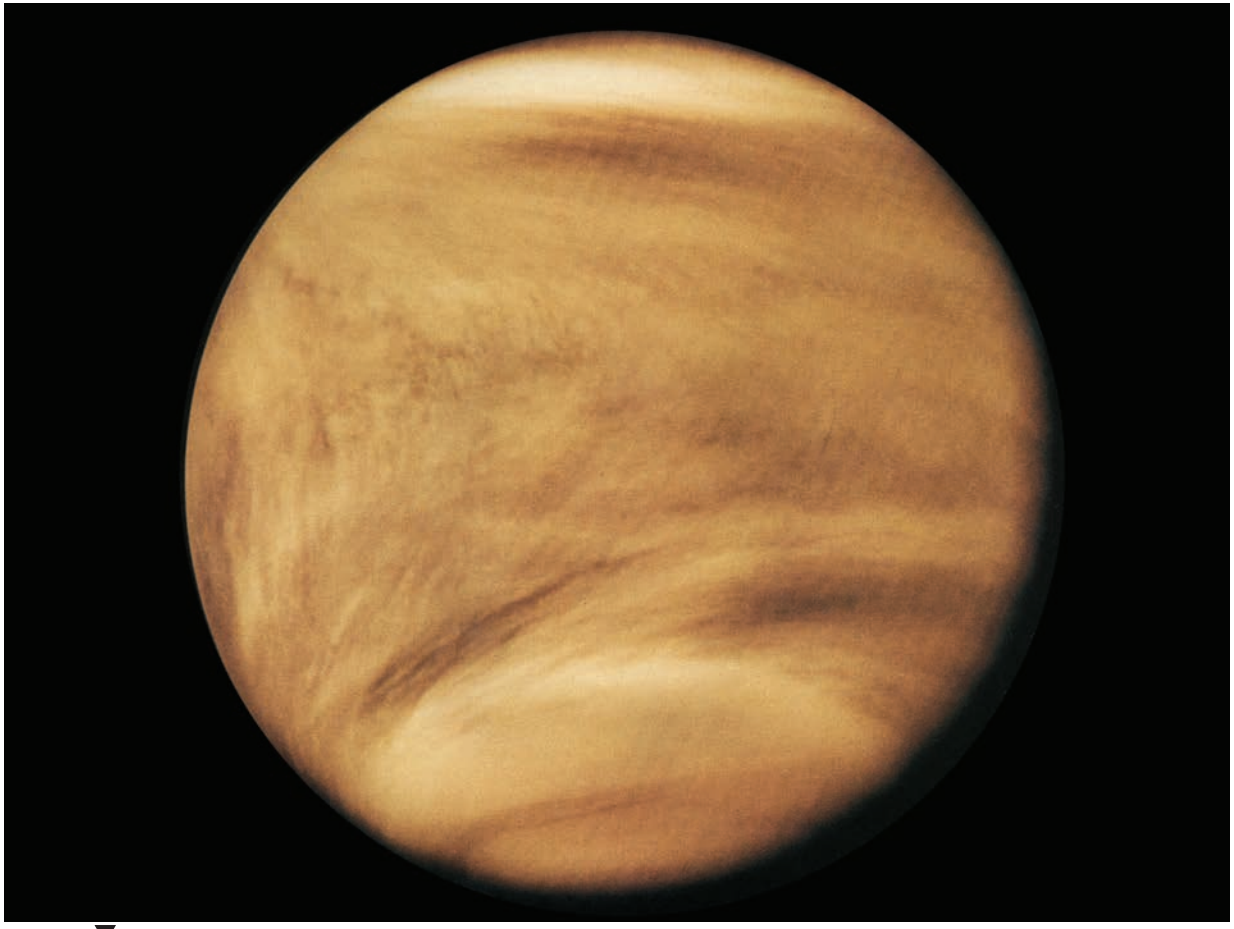
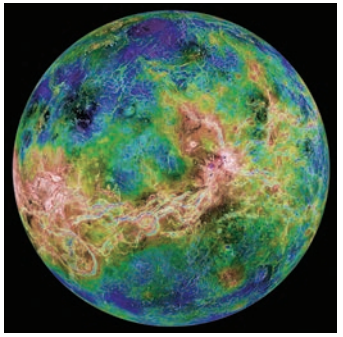
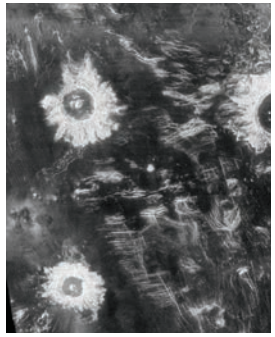
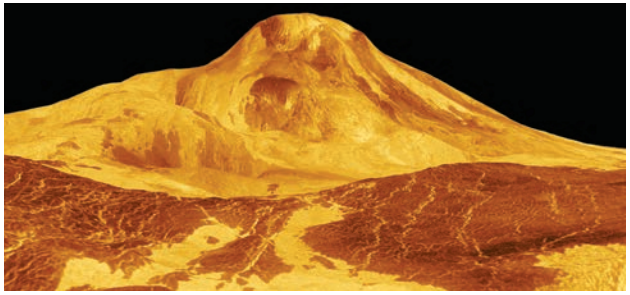
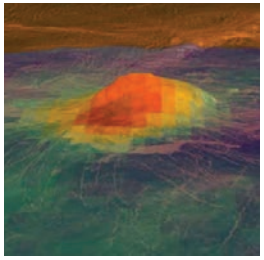
National Aeronautics and Space Administration

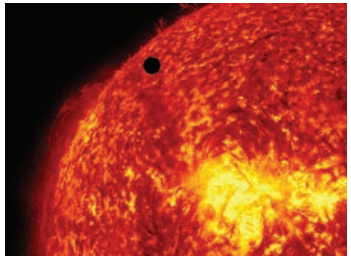


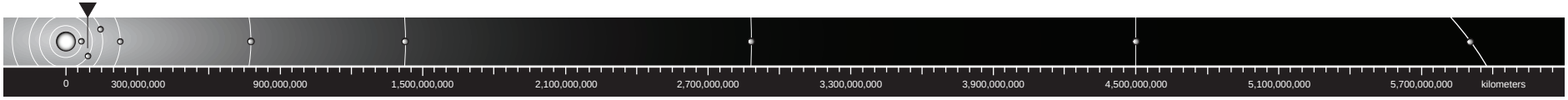












Venus

Venus and Earth are similar in size, mass, density, composition, and gravity. There, however, the similarities end. Venus is covered by a thick, rapidly spinning atmosphere, creating a scorched world with temperatures hot enough to melt lead and surface pressure 90 times that of Earth (similar to the bottom of a swimming pool 1-1/2 miles deep). Because of its proximity to Earth and the way its clouds reflect sunlight, Venus appears to be the brightest planet in the sky. We cannot normally see through Venus' thick atmosphere, but NASA's Magellan mission during the early 1990s used radar to image 98 percent of the surface, and the Galileo spacecraft used infrared mapping to view both the surface and mid-level cloud structure as it passed by Venus on the way to Jupiter. In 2010, infrared surface images by the European Space Agency's Venus Express provided evidence for recent volcanism within the past several hundred thousand years. Indeed, Venus may be volcanically active today.

Like Mercury, Venus can be seen periodically passing across the face of the Sun. These "transits" of Venus occur in pairs with more than a century separating each pair. Transits occurred in 1631, 1639; 1761, 1769; and 1874, 1882. On June 8, 2004, astronomers worldwide watched the tiny dot of Venus crawl across the Sun; and on June 6, 2012, the second in this pair of transits occurred. The next transit is December 11, 2117. Observing these transits helps us understand the capabilities and limitations of techniques used to find and characterize planets around other stars.

Venus' atmosphere consists mainly of carbon dioxide, with clouds of sulfuric acid droplets. Only trace amounts of water have been detected in the atmosphere. The thick atmosphere traps the Sun's heat, resulting in surface temperatures higher than 470 degrees Celsius (880 degrees Fahrenheit). The few probes that have landed on Venus have not survived longer than 2 hours in the intense heat. Sulfur compounds are abundant in Venus' clouds; the corrosive chemistry and dense, moving atmosphere cause significant surface weathering and erosion.

The Venusian year (orbital period) is about 225 Earth days long, while the planet's rotation period is 243 Earth days, making a Venus day about 117 Earth days long. Venus rotates retrograde (east to west) compared with Earth's prograde (west to east) rotation. Seen from Venus, the Sun would rise in the west and set in the east. As Venus moves forward in its solar orbit while slowly rotating "backwards" on its axis, the top level of cloud layers zips around the planet every four Earth days, driven by hurricane-force winds traveling at about 360 kilometers (224 miles) per hour. Speeds within the clouds decrease with cloud height, and at the surface are estimated to be just a few kilometers per hour. How this atmospheric "super-rotation" forms and is maintained continues to be a topic of scientific investigation.

Atmospheric lightning bursts, long suspected by scientists, were confirmed in 2007 by the European Venus Express orbiter. On Earth, Jupiter, and Saturn, lightning is associated with water clouds, but on Venus, it is associated with sulfuric acid clouds.

Craters smaller than 1.5 to 2 kilometers (0.9 to 1.2 miles) across do not exist on Venus, because small meteors burn up in the dense atmosphere before they can reach the surface. It is thought that Venus was completely resurfaced by volcanic activity 300 to 500 million years ago. More than 1,000 volcanoes or volcanic centers larger than 20 kilometers (12 miles) in diameter dot the surface. Volcanic flows have produced long, sinuous channels extending for hundreds of kilometers. Venus has two large highland areas — Ishtar Terra, about the size of Australia, in the north polar region; and Aphrodite Terra, about the size of South America, straddling the equator and extending for almost 10,000 kilometers (6,000 miles). Maxwell Montes, the highest mountain on Venus and comparable to Mount Everest on Earth, is at the eastern edge of Ishtar Terra.

Venus has an iron core that is approximately 3,000 kilometers (1,200 miles) in radius. Venus has no global magnetic field — though its core iron content is similar to that of Earth, Venus rotates too slowly to generate the type of magnetic field that Earth has.

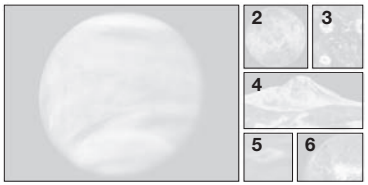
FAST FACTS

Namesake	Roman goddess of love and beauty
Mean Distance from the Sun	108.21 million km (67.24 million mi)
Orbit Period	224.70 Earth days
Orbit Eccentricity (Circular Orbit = 0)	0.0068
Orbit Inclination to Ecliptic	3.39 deg
Inclination of Equator to Orbit	177.3 deg
Rotation Period	243.02 Earth days (retrograde)
Successive Sunrises	116.75 days
Equatorial Radius	6,052 km (3,760 mi)
Mass	0.815 of Earth's
Density	5.24 g/cm^3 (0.95 of Earth's)
Gravity	0.91 of Earth's
Atmosphere Primary Component	carbon dioxide
Temperature at Surface	470 deg C (880 deg F)
Known Moons	0
Rings	0

SIGNIFICANT DATES

650 CE — Mayan astronomers make detailed observations of Venus, leading to a highly accurate calendar.
1761–1769 — Two European expeditions to watch Venus cross in front of the Sun lead to the first good estimate of the Sun's distance from Earth.
1962 — NASA's Mariner 2 reaches Venus and reveals the planet's extreme surface temperatures. It is the first spacecraft to send back information from another planet.
1970 — The Soviet Union's Venera 7 sends back 23 minutes of data from the surface of Venus. It is the first spacecraft to successfully land on another planet.
1990–1994 — NASA's Magellan spacecraft, in orbit around Venus, uses radar to map 98 percent of the planet's surface.
2005 — The European Space Agency launches Venus Express to study the atmosphere and surface. The orbiter reached Venus in April 2006, and will study the planet through at least December 31, 2014. Japan's Akatsuki ("Dawn") orbiter is en route to Venus, scheduled to arrive in 2015. Combining the Venus Express and Akatsuki datasets should greatly enhance our knowledge of the planet.

ABOUT THE IMAGES



1 A 1979 Pioneer Venus image of Venus' clouds seen in ultraviolet.

2 This composite global view created from Magellan radar images is color-coded to represent varying elevations.

3 This Magellan radar image reveals impact craters.

4 Magellan radar images were used to create this three-dimensional view of Venus' Maat Mons volcano (vertical scale is exaggerated 22.5 times).

5 This false-color composite image of Magellan radar and Venus Express infrared data show emissivity (orange) of the ground overlying a volcanic peak, characteristic of young, unweathered volcanic basalts less than a few hundred years old.

6 This view of Venus transiting the face of the Sun on June 6, 2012, was taken by NASA's Solar Dynamics Observatory.

FOR MORE INFORMATION

solarsystem.nasa.gov/venus

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