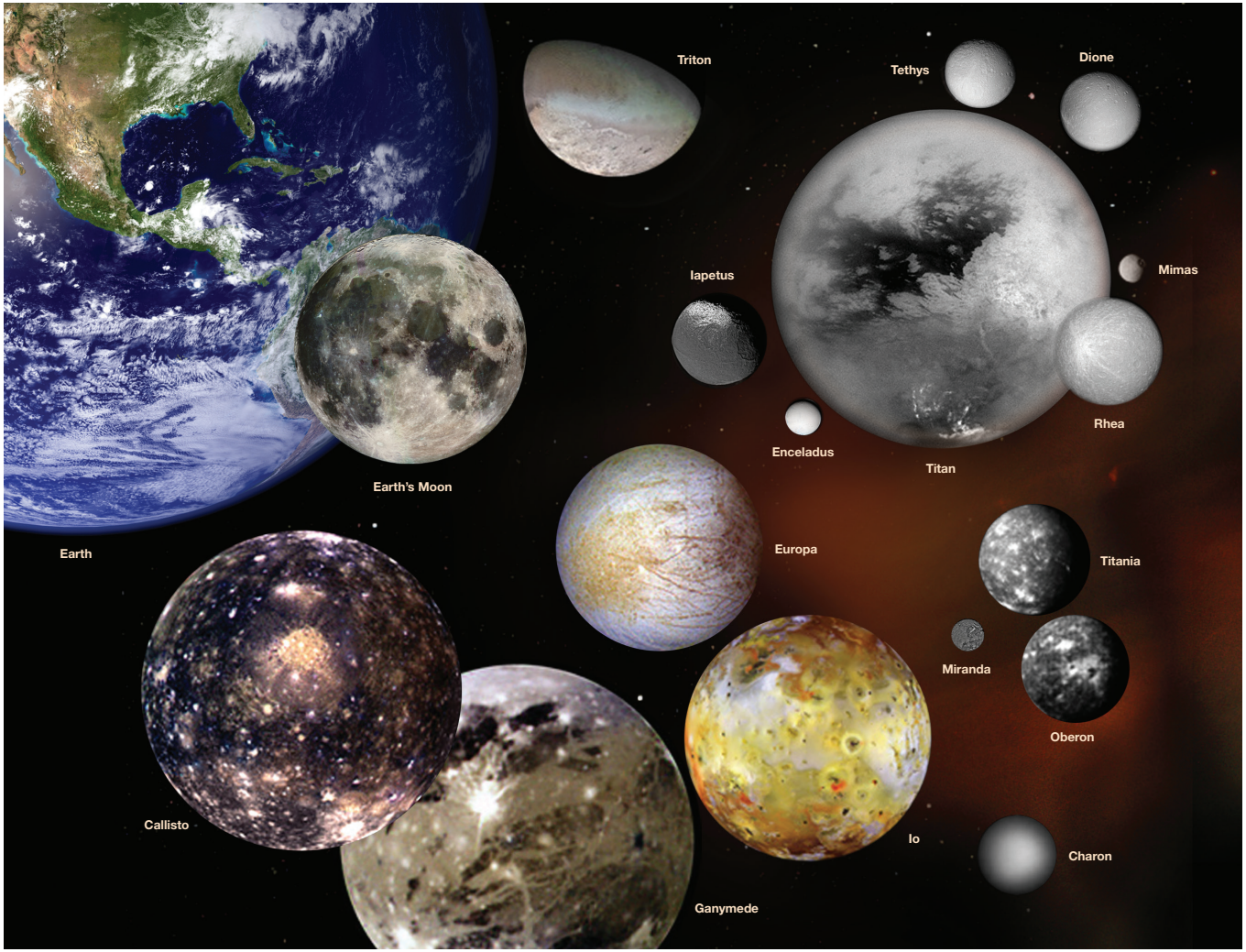
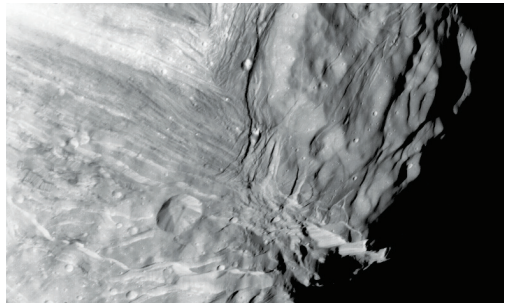
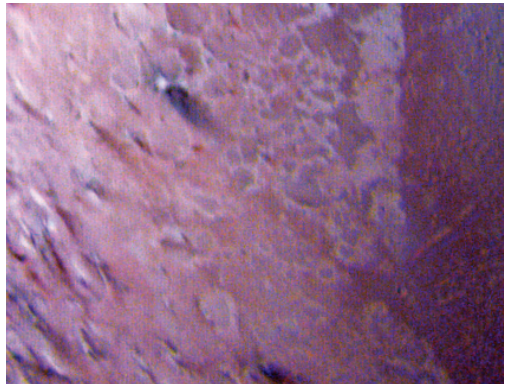
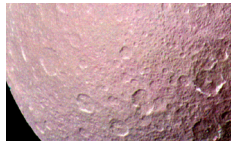
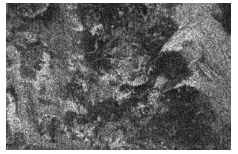










Moons of the Solar System

Moons — also called satellites — come in many shapes, sizes, and types. They are generally solid bodies, and few have atmospheres. Most of the planetary moons probably formed from the discs of gas and dust circulating around planets in the early solar system. Some moons are large enough for their gravity to cause them to be spherical, while smaller moons appear to be captured asteroids, not related to the formation and evolution of the body they orbit. The International Astronomical Union lists 146 moons orbiting planets in our solar system — this number does not include the moons awaiting official recognition and naming, the eight moons of the dwarf planets, nor the tiny satellites that orbit some asteroids and other celestial objects.

Of the terrestrial (rocky) planets of the inner solar system, neither Mercury nor Venus has any moons at all, Earth has one, and Mars has its two small moons. In the outer solar system, the gas giants (Jupiter, Saturn) and the ice giants (Uranus and Neptune) have numerous moons. As these huge planets grew in the early solar system, they were able to capture objects with their large gravitational fields.

Earth's Moon probably formed when a large body about the size of Mars collided with Earth, ejecting material from our planet into orbit. This material accumulated to form the Moon approximately 4.5 billion years ago (the age of the oldest collected lunar rocks). Twelve American astronauts landed on the Moon during NASA's Apollo program in 1969 to 1972, studying the Moon and bringing back rock samples.

Usually the term "moon" brings to mind a spherical object, like Earth's Moon. The two moons of Mars, Phobos and Deimos, are somewhat different. Both have nearly circular orbits and travel close to the plane of the planet's equator, and they are lumpy and dark. Phobos is slowly drawing closer to Mars, and could crash into Mars in 40 or 50 million years, or the planet's gravity might break Phobos apart, creating a thin ring around Mars.

Jupiter has 50 known moons (plus 17 awaiting official confirmation), including the largest moon in the solar system, Ganymede. Many of Jupiter's outer moons have highly elliptical orbits and orbit "backwards" (opposite to the spin of the planet). Saturn, Uranus, and Neptune also have some "irregular" moons, which orbit far from their respective planets.

Saturn has 53 known moons (plus 9 awaiting official confirmation). The chunks of ice and rock in Saturn's rings (and the particles in the rings of the other outer planets) are not considered moons, yet embedded in Saturn's rings are distinct moons or "moonlets." Small "shepherd" moons help keep the rings in line. Saturn's moon Titan, the second largest in the solar system, is the only moon with a thick atmosphere.

Beyond Saturn, Uranus has 27 known moons. The inner moons appear to be about half water ice and half rock. Miranda is the most unusual; its chopped-up appearance shows the scars of impacts of large rocky bodies. Neptune's moon Triton is as big as the dwarf planet Pluto, and orbits backwards compared with Neptune's direction of rotation. Neptune has 13 known moons plus a 14th awaiting official confirmation.

Pluto's large moon, Charon, is about half the size of Pluto, and some scientists consider Pluto/Charon to be a double system. Like Earth's Moon, Charon may have formed from debris from an early collision of an impactor with Pluto. Scientists using the Hubble Space Telescope to study Pluto have found five additional smaller moons. Eris, a dwarf planet even more distant than Pluto, has a small moon of its own, named Dysnomia. Haumea, another dwarf planet, has two satellites, Hi'iaka and Namaka.

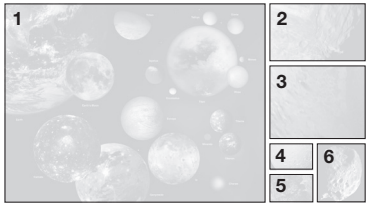
FAST FACTS — PLANETS AND SELECTED MOONS

Planet	Moon	Mean Radius (km)	Mean Radius (mi)
Earth	Moon	1,737.4	1,079.6
Mars	Phobos	11.1	6.9
Mars	Deimos	6.2	3.9
Jupiter	Io	1,821.6	1,131.9
Jupiter	Europa	1,560.8	969.8
Jupiter	Callisto	2,410	1,498
Jupiter	Ganymede	2,631	1,635
Saturn	Mimas	198.6	123.4
Saturn	Enceladus	249.4	154.9
Saturn	Tethys	529.9	329.3
Saturn	Dione	560	348
Saturn	Rhea	764	475
Saturn	Titan	2,575	1,600
Saturn	Iapetus	718	446
Uranus	Miranda	235.8	146.5
Uranus	Ariel	578.9	359.7
Uranus	Umbriel	584.7	363.3
Uranus	Titania	788.9	490.2
Uranus	Oberon	761.4	473.1
Neptune	Triton	1,353.4	841
Neptune	Nereid	170	106

SIGNIFICANT DATES

1610 — Galileo Galilei and Simon Marius independently discover four moons orbiting Jupiter. Galileo is credited and the moons are called "Galilean." This discovery changed the way the solar system was perceived.
1877 — Asaph Hall discovers Mars' moons Phobos and Deimos.
1969 — Astronaut Neil Armstrong is the first of 12 humans to walk on the surface of Earth's Moon.
1979 — Voyager 1 photographs an erupting volcano on Jupiter's moon Io; the first ever seen anywhere other than Earth.
1980 — Voyager 1 instruments detect signs of surface features beneath the hazy atmosphere of Saturn's largest moon, Titan.
2005 — The Cassini spacecraft discovers jets or geysers of water ice particles venting from Saturn's moon Enceladus.
2000–present — Using improved ground-based telescopes, the Hubble Space Telescope, and spacecraft observations, scientists have found dozens of new moons in our solar system. Newly discovered moons (as well as other solar system objects) are given temporary designations until they are confirmed by subsequent observations and receive permanent names from the International Astronomical Union.

ABOUT THE IMAGES



1 Selected solar system moons, displaying a variety of surface features, are shown at correct relative sizes to each other and to Earth.

2 Miranda, a moon of Uranus, has many rugged features: canyons, grooved structures, ridges, and broken terrain. The large cliff in this image is a 12-mile-high vertical drop.

3 This false-color image of Neptune's moon Triton shows what appear to be volcanic deposits.

4 This Voyager 1 close-up of Saturn's moon Rhea shows the moon's ancient, cratered surface.

5 A portion of a Cassini radar image of Saturn's largest moon, Titan, showing the complexity of the surface.

6 Cassini imaged the small irregular moon Phoebe when the spacecraft was inbound for Saturn orbit insertion in June 2004.

FOR MORE INFORMATION

solarsystem.nasa.gov/planets/profile.cfm?Object=SolarSys&Display=Sats

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