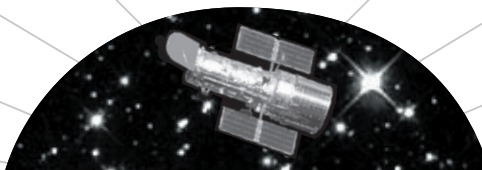




# THE STAR ★ WITNESS



A P U B L I C A T I O N O F N A S A ' S " A M A Z I N G S P A C E " E D U C A T I O N P R O G R A M

## Special Feature

# Dawn Spacecraft Will Go Asteroid-Hopping

By NASA's Amazing Space reporters  
Sept. 2007

**A**T LEAST 100,000 ROCKY objects called asteroids reside between Mars and Jupiter. Scientists believe that asteroids are the leftover building blocks of our solar system planets. These space rocks orbit the Sun in a large, circular region called the asteroid belt. Locked inside these small bodies are clues to how our planets formed 4.5 billion years ago. Now, for the first time, a NASA spacecraft is speeding toward the asteroid belt to tour two of its most massive members.

Astronomers had dreamed since the 1940s about launching a visible-light telescope into space. Ground-based telescopes are hampered by our Earth's atmosphere, which blurs the light from stars and makes them appear to twinkle.

The unmanned spacecraft, called Dawn, is on a four-year journey to the asteroids Vesta and Ceres. Dawn was launched on a rocket on September 27. This "asteroid-hopping" mission marks the first time a satellite will orbit two



IMAGE: NASA, UCLA

**The Dawn spacecraft:** This artist's illustration shows Dawn leaving Earth.

objects. The Dawn spacecraft will first visit Vesta in 2011. After orbiting Vesta for nine months, Dawn then will travel to Ceres, arriving in 2015.

The Texas-sized Ceres is one of three dwarf planets in the solar system. The International Astronomical Union (IAU), a professional society for astronomers, created the dwarf-planet category in 2006. The three dwarf planets have many characteristics of planets. For example, they are round

and orbit the Sun. Unlike planets, however, they have not cleared away all the rocks in their orbit. The Dawn mission will be the first to get a close-up view of a dwarf planet.

### Why travel to Vesta and Ceres?

Scientists think the asteroids were budding planets that stopped growing because of Jupiter's powerful gravity.

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These objects have lost even more mass over billions of years through collisions with other asteroids. Vesta and Ceres are unique because they have not had many close encounters with other space rocks. The only evidence of a major collision is a large crater in Vesta's southern hemisphere. The impact broke off chunks of rock, producing more than 50 smaller asteroids which astronomers have nicknamed "vestoids."

Although the two asteroids orbit together in the same region, they have very different physical makeups. Astronomers, therefore, think the pair must have formed differently. Vesta is shaped like a mushroom and appears to be dry. Its varied landscape ranges from lava flows to the deep crater near its southern pole. Ceres, by contrast, is round and has a thin, dusty outer crust. Water may even be locked beneath the crust. Ceres also contains 30 to 40 percent of the asteroid belt's mass.

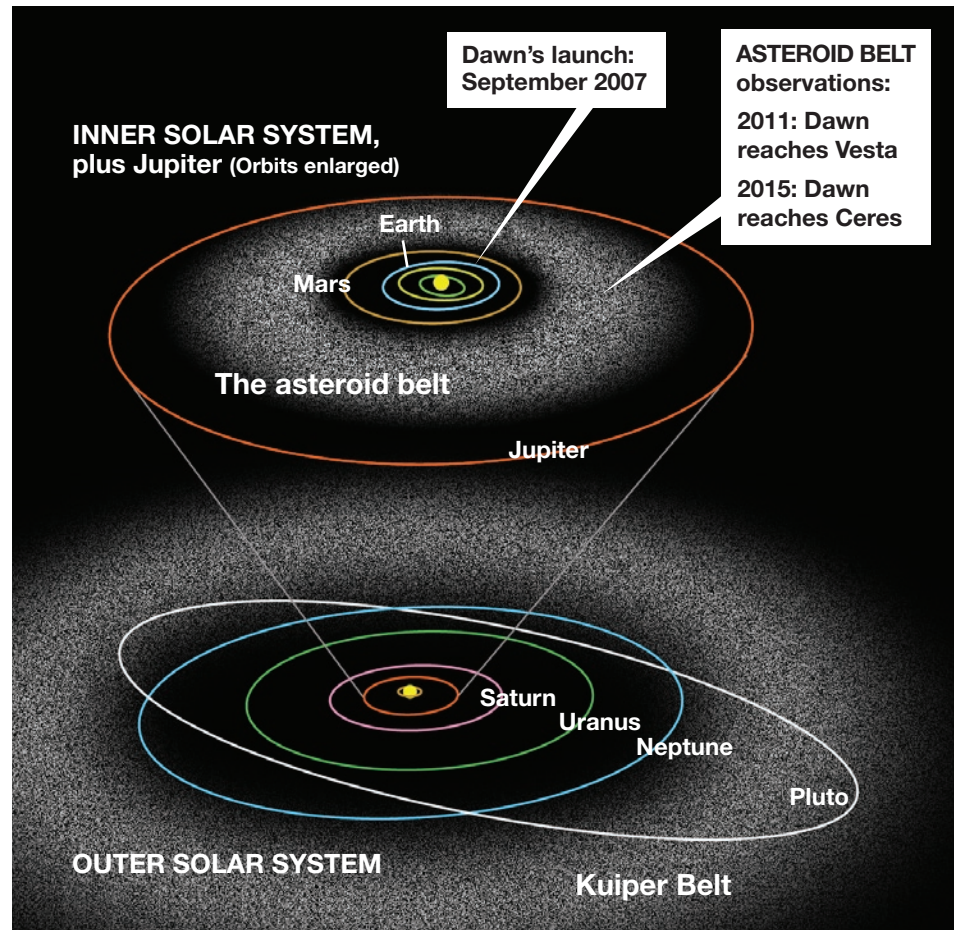
Vesta's physical characteristics are like those of the inner rocky planets, like Earth, whereas Ceres resembles the icy moons of the outer planets. By exploring these two asteroids, the Dawn mission will help scientists understand the early stages of planet development. Scientists hope, for example, to gain insight into why the inner region of our solar system is composed of rocky planets and the outer, icy region is made up of gas giant planets.

### The spacecraft's mission

The spacecraft's many science instruments will study the asteroids' surface features, their varied landscapes, and perhaps even their

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## Dawn's destination: The asteroid belt



Space Telescope Science Institute, Graphics Dept.

The asteroid belt lies between the orbits of Mars and Jupiter, straddling the inner and outer solar system. The inner solar system orbits (enlarged, at top) are, in order from the Sun: Mercury, Venus, Earth, and Mars. Jupiter is part of the outer solar system. The outer solar system orbits are, in order: Jupiter, Saturn, Uranus, Neptune, and Pluto. The Kuiper Belt, a realm of icy, rocky objects that often become comets, begins near the orbit of Neptune and continues beyond Pluto.

## Relative sizes of dwarf planets



NASA, ESA; image of Eris is an artist's conception by Adolf Schaller

Diagram compares objects in order of size. The diagram does not display the order of their orbits. Eris and Pluto are Kuiper Belt objects and Ceres is an asteroid.

internal structure. By examining these ancient worlds, scientists hope to answer questions such as “What role did size have in determining how planets evolved throughout the solar system?” and “How did water affect the process of planetary formation?”

Dawn is powered by a unique solar-electric engine that uses the Sun’s rays to make electricity, which keeps the spacecraft speeding through space. This engine has never been used in scientific exploration.

### Hubble’s supporting role

The Hubble Space Telescope is playing a supporting role in the Dawn mission by snapping several images of Vesta

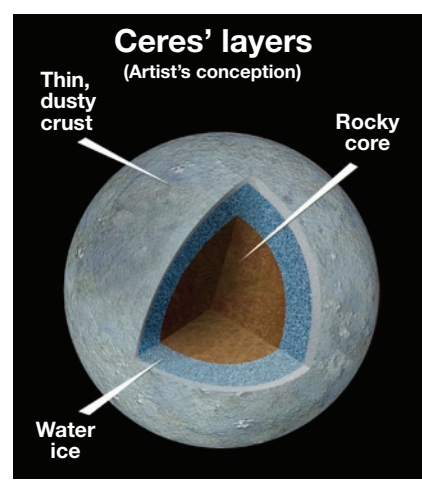
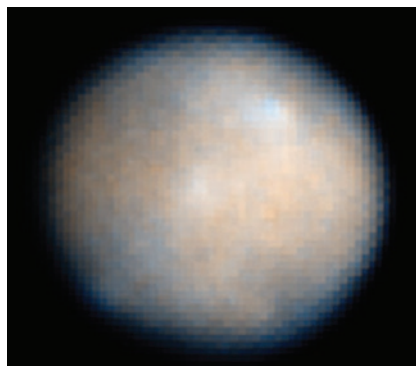
in May 2007 and Ceres in 2003 and 2004. Although Hubble has taken photos of Vesta before, these new images are the best views of the asteroid’s Southern Hemisphere. The photos clearly show the large impact basin created from a collision billions of years ago. The huge crater is 285 miles (456 kilometers) across, which is nearly equal to Vesta’s 330-mile (530-kilometer) diameter. Vesta is about as wide as Arizona. If Earth had a crater of similar size, it would fill the Pacific Ocean basin.

The Hubble images of Ceres revealed bright and dark regions on the asteroid’s surface, which may be craters that were created from collisions. The

asteroid’s surface may also be made up of different types of material.

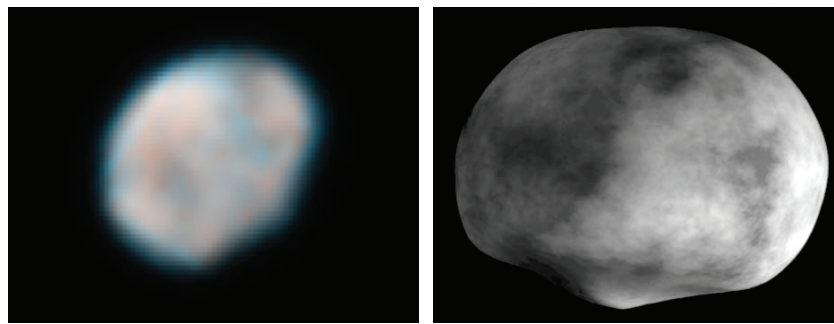
These sharp Hubble images of Ceres and Vesta are helping astronomers prepare for Dawn’s visit to the asteroid belt. The snapshots offer two unique stories from our solar system’s past. Who knows what surprises await us when Dawn takes a close-up look at Ceres and Vesta. ★

## Asteroid Ceres



Top (HST image): NASA, ESA, J. Parker (Southwest Research Inst.), and L. McFadden (Univ. of Md.);  
Bottom: Ann Feild, STScI Graphics Dept.

## Asteroid Vesta



HST image, above, left: NASA, ESA, J. Parker (Southwest Research Inst.), and L. McFadden (Univ. of Md.); Computer model, above, right: P. Thomas (Cornell Univ.), B. Zellner (Georgia Southern Univ.), NASA

**Above: Vesta** is shaped like a mushroom and appears to be dry. Its varied landscape ranges from lava flows to a deep crater near its southern pole, which resulted from a major collision. Vesta’s physical characteristics are like those of the inner rocky planets, like Earth. Hubble’s image of Vesta is at left, in box above. The lower surface of the computer model of Vesta, at right, above, shows evidence of the collision.

**Left: Ceres** is round and has a thin, dusty outer crust. Water may even be locked beneath the crust. Ceres’ physical characteristics are like those of the icy moons of the outer planets. The artist’s conception, at lower left, shows the layers of Ceres. Hubble’s image is at top, far left.

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