

# Asteroids



IDA, discovered in 1993 by the Galileo spacecraft, was the first known asteroid to possess its own tiny moon, dubbed Dactyl. (In 1997 astronomers found that the asteroid Djonysus may also have a moon.) Some 52 kilometers (32 miles) long, Ida also appears to have its own magnetic field. Its craters point to an age for Ida of about one billion years.



GASPRA became the first asteroid to pose for a close-up, when the spacecraft Galileo passed nearby on its way to Jupiter.

# Comets

COMET SHOEMAKER-LEVY 9 (at right) smashed into Jupiter in July 1994 in the greatest collisions ever witnessed by humanity. Of the more than 20 fragments, moving at 60 kilometers per second, the largest pieces produced energies equivalent to millions of megaton nuclear warheads.



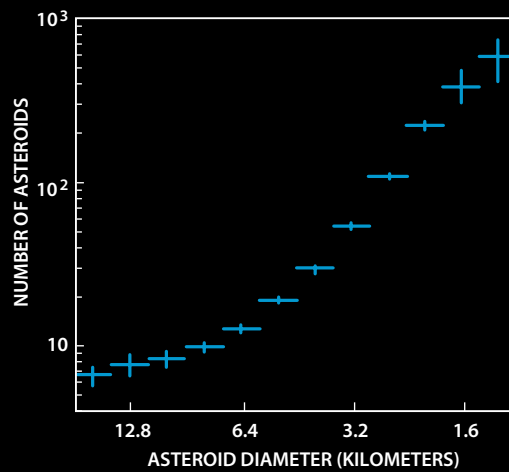
## GREAT COMET OF 1680

was determined by Isaac Newton to have an almost parabolic orbit. In our century, in 1995, the Hubble Space Telescope discovered a belt of perhaps 200 million comets encircling the solar system.





**EXTREMELY LARGE ASTEROIDS,** with diameters greater than 10 kilometers, are rare. The graph illustrates the relative numbers of small asteroids compared with large ones.



**PEEKSKILL METEORITE** (*below*) smashed into this parked Chevrolet Malibu on October 9, 1992. Thousands in the New York area saw the fireball, and some witnesses actually videotaped it streaking across the night sky. Using those tapes, astronomers have calculated the trajectory and original orbit of the meteorite. Some even speculate that the meteorite's orbit and composition point to its having originated as part of the asteroid 6 Hebe.



**C**oncentrated between the orbits of Mars and Jupiter float thousands of what astronomers often call minor planets, or asteroids. These might have coalesced to form a small planet had they not been under the immense gravitational influence of Jupiter, which accelerated them. Low-velocity collisions of small bodies can build a planet, but bodies moving at five kilometers per second, the average for asteroids, collide violently. Such collisions can send chunks of asteroids out of their typical orbit between Mars and Jupiter. Some fragments take up stable orbits, part of which brings them closer to Earth or, on occasion, to the surface of our planet as meteorites. Our knowledge of asteroids should increase significantly early in 1999, when a probe called Near Earth Asteroid Rendezvous approaches within 48 kilometers of the asteroid Eros.

**T**he word "comet," from the Greek, means "long-haired," an apt description for what may appear to be a blur or smudge in the heavens. Visitors from the farthest reaches of the solar system, comets consist of a solid nucleus of dust and ice, which has led them to be called "dirty snowballs." Interactions with the sun produce the nebulous coma and one or more tails that smear the comet against the sky. It was most likely a comet (although an asteroid remains a candidate) that smashed into Earth 65 million years ago, causing the mass extinction that killed the dinosaurs and paved the way for our own evolution.

Calculations by Dutch astronomer Jan Hendrick Oort in the 1950s showed that there must be a huge swarm of comets, since then dubbed the Oort Cloud, some 40,000 to 50,000 times farther away from the sun than is Earth.

**HALE-BOPP,** the brightest comet since 1811, was clearly visible to the naked eye even in large cities flooded with artificial light. It featured three distinct tails—of dust, ionized gas and sodium atoms.



**HALLEY'S COMET** visits on regular intervals of about 75 years. Its orbit and the time between visits are slightly variable because of perturbations by the planets Jupiter and Saturn. In the 17th century Edmund Halley analyzed known comet data and discovered the repeat visitor, which now bears his name. Copyright 1998 Scientific American, Inc.



JOHNNY JOHNSON (graph); AFTER ROBERT JEDICKE University of Arizona; WALT RADOMSKI R. A. Langhainreich Meteorites (car, meteorite); HUBBLE SPACE TELESCOPE COMET TEAM AND NASA (Shoemaker-Levy 9); BILL WHIDDON AND NINA WHIDDON (Hale-Bopp); ROYAL GREENWICH OBSERVATORY SPLY/Photo Researchers, Inc. (Halley)