

Asteroids (15.3)

Asteroid (minor planets): A small, planet-like solar system body. Most asteroids are rocky and have orbits of low eccentricity.



1000's of Asteroids orbit the Sun within the planetary system, ranging from a few kilometers in diameter to nearly a thousand.

The first asteroid, Ceres, was discovered by Giuseppe Piazzi on 1/1/1801

Asteroids show up as streaks on the image of long-exposure photography.

Over 50,000 asteroids have been cataloged, but hundreds of thousands of asteroids have been seen but not well enough to determine their orbits.

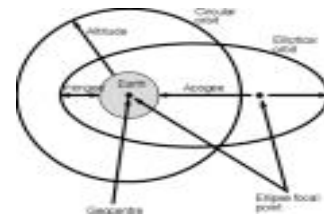
Asteroid Names: if you discover and determine the orbit you name the asteroid

Orbits of Asteroids:

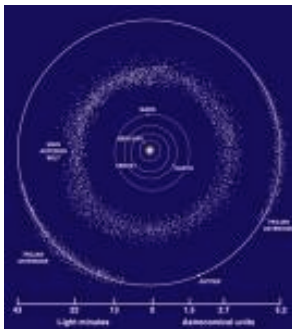
Need three points to determine orbit

Nearly all orbit the Sun in the same direction as the Earth

However they have more eccentric orbits



The asteroid belt, located 2.1 – 3.3 AU from the sun – between Mars and Jupiter, contains most of the asteroids.



More than 7000 asteroids have been charted.

If there were 100,000 asteroids in this belt, the average distance between them would be 5 million km. (more than 1000 times the separation of the Earth and the Moon.)

Largest known in the asteroid belt is Ceres, nearly 1000 km in diameter.

Pallas and Vesta are around 500 km.

Ida has a satellite of its own – found because the light of the asteroid is partially blocked at regular intervals of time.

NEAR spacecraft flew by asteroid Mathilde on way to Eros 1997-1999.

Asteroids have poor **albedo**'s due. Albedo is the fraction of light striking a body that gets reflected. 0.0 absorbs all light, fresh ice is 1. Most rocks are around 0.1-0.2.

Mathilde (1997) has an Albedo of 0.04.



Trojan asteroids: swarms of asteroids that share Jupiter's orbit, albeit eccentric, around the sun.

1. 500 known of, estimated that there are $\frac{1}{2}$ as many as in the asteroid belt!
2. Largest 150 by 300 km (Hector)

Earth-Crossing Asteroids: asteroids that cross the path of Earth's orbit around the sun

Amor asteroid: pass inside Mars's orbit, but don't cross the orbit.

Aten asteroids: cross Earth's orbit when aphelion.
Est. 100

Apollo asteroids: Perihelia inside the Earth orbit and Aphelia beyond Earth's orbit, so they are called Earth-crossing asteroids. Est 700.

Additional . . . "rogue" asteroids . . . such as one that passed within the moon's orbital distance in 1990.

Over 800 Earth crossing asteroids have been discovered, the largest Amor asteroid is 40 km in diameter, and the largest Apollo is 8 km in diameter.



Asteroid Collisions: Large asteroids collide more frequently than small ones.

A typical asteroid 10 km in diameter collides approximately once every 6 billion years.

An asteroid 100 km in diameter collides approximately once every 60 million years.

Results: craters, shattered, disruption . . . shattering doesn't always lead to disruption.

Classes of Asteroids based on Reflectance spectra

C-type: very dark, reflects only a few percent.

S-type: absorption due to mineral olivine.

M-type: reflectance like metallic iron and nickel

V-type: strong absorption due to pyroxene, a common mineral in basaltic lava flows.



Asteroids and Meteorites

Carbonaceous chondrites look like smaller versions of C-type asteroids

Iron meteorites resemble M-type asteroids.

The types of meteorites falling today are very different from those that fell a million years ago. Why?



Willamette meteorite from Oregon, US. It is exhibited at the United States Natural History Museum in New York

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1000's of Asteroids

The first asteroid,

Asteroids show up as photography.

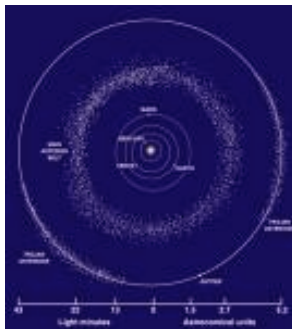
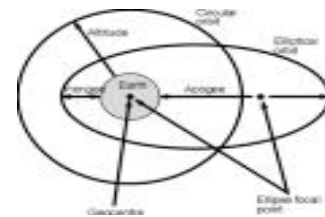
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Asteroid Names:

Orbits of Asteroids:

-
-
-

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Ida has a

NEAR spacecraft

Asteroids have poor



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- 1.
- 2.

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