# Small Bodies in our Solar System

**Asteroids**

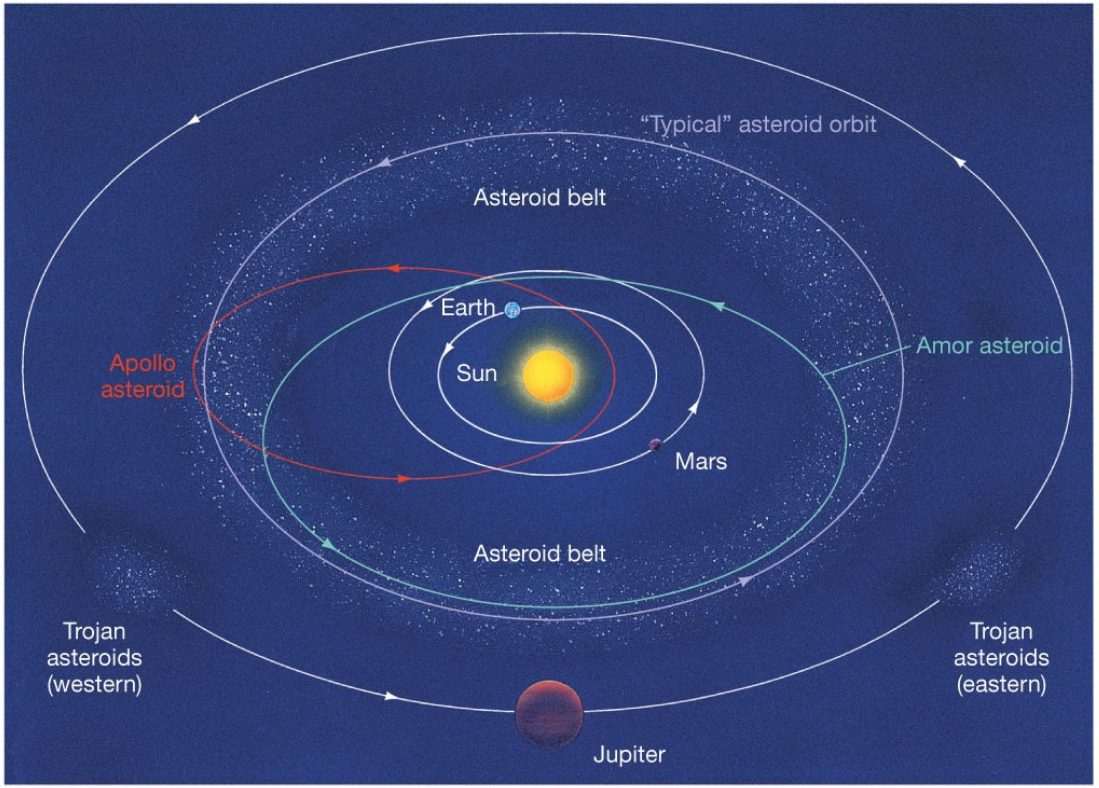
**Comets**

**Trans-Neptunian Objects**

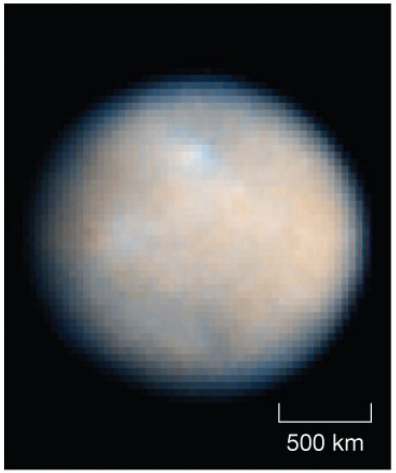
Small but not insignificant – they are leftover “planetesimals” from the formation of the solar system.

# 14.1 Asteroids

Asteroids are quite small, and most have eccentric orbits in the asteroid belt between Mars and Jupiter. The inset shows Ceres, the largest known asteroid.




(a)

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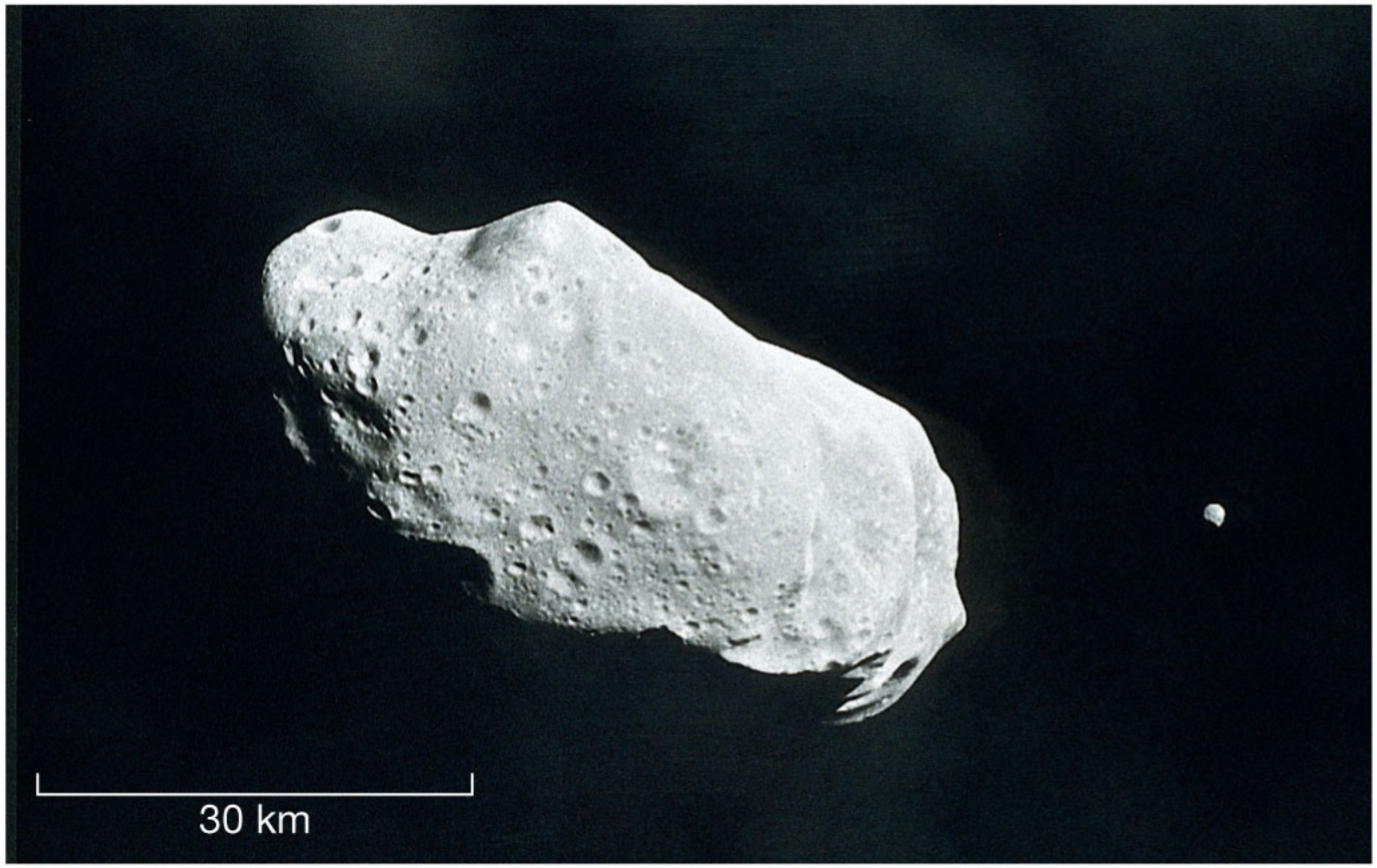
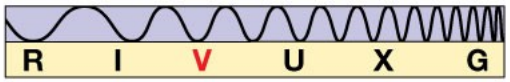
# Asteroids




(b)






**Ida and its moon Dactyl. As seen from Galileo.**

# 14.1 Asteroids

**Asteroids are classified in types:**

**C-type: carbonaceous, dark**

**S-type: silicate (rocky)**

**M-type: metallic; iron and nickel**

**These correlate with classes of meteorites found on Earth:**

**Carbonaceous chondrites**

**Stony (including chondrites and achondrites)**

**Stony-iron**

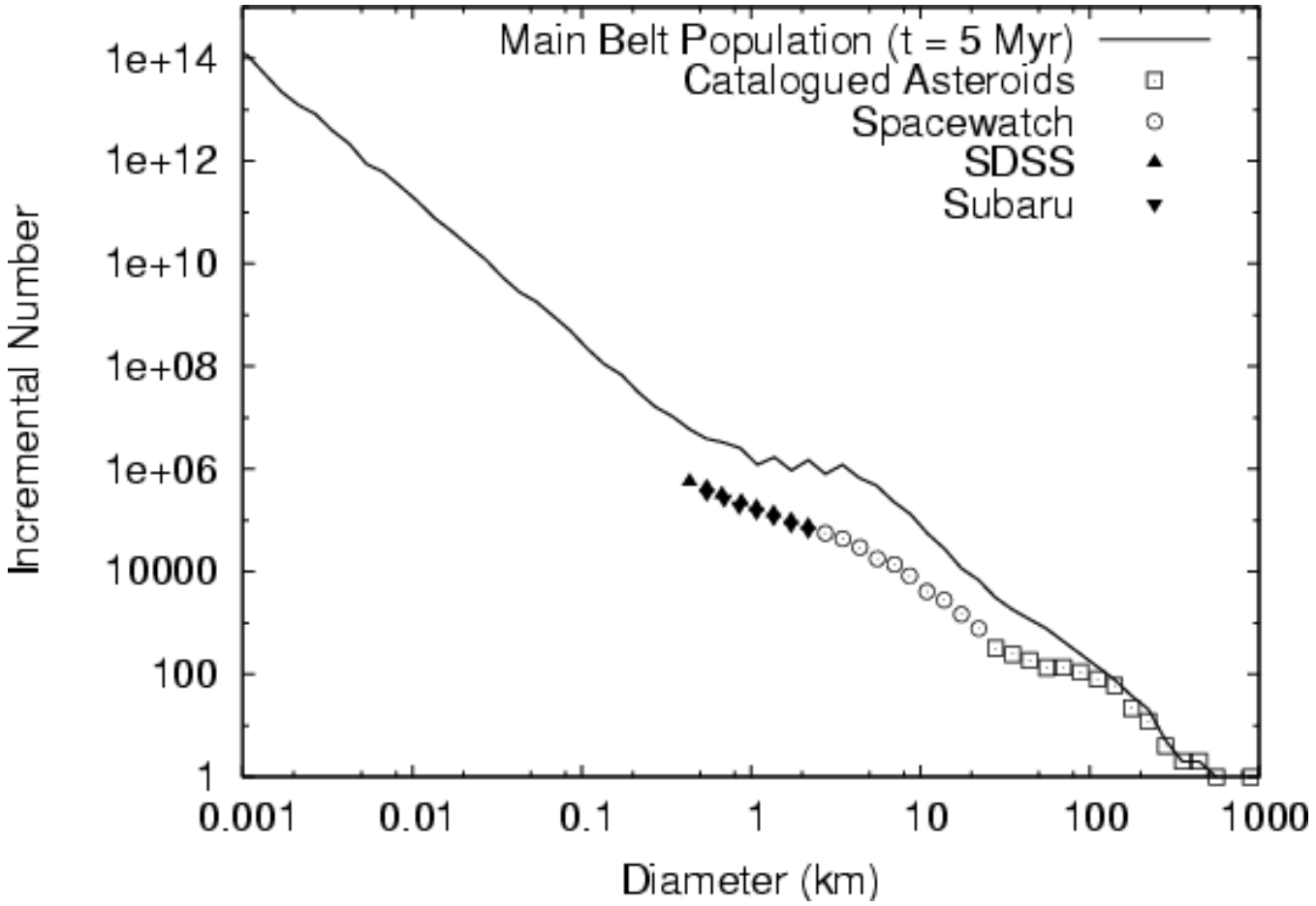
**Iron**

# 14.1 Asteroids

**Asteroids as a threat to life on Earth.**

**NEAs, PHA, Amor (cross Mars), Apollo (cross Earth), Aten (inside Earth's orbit).**

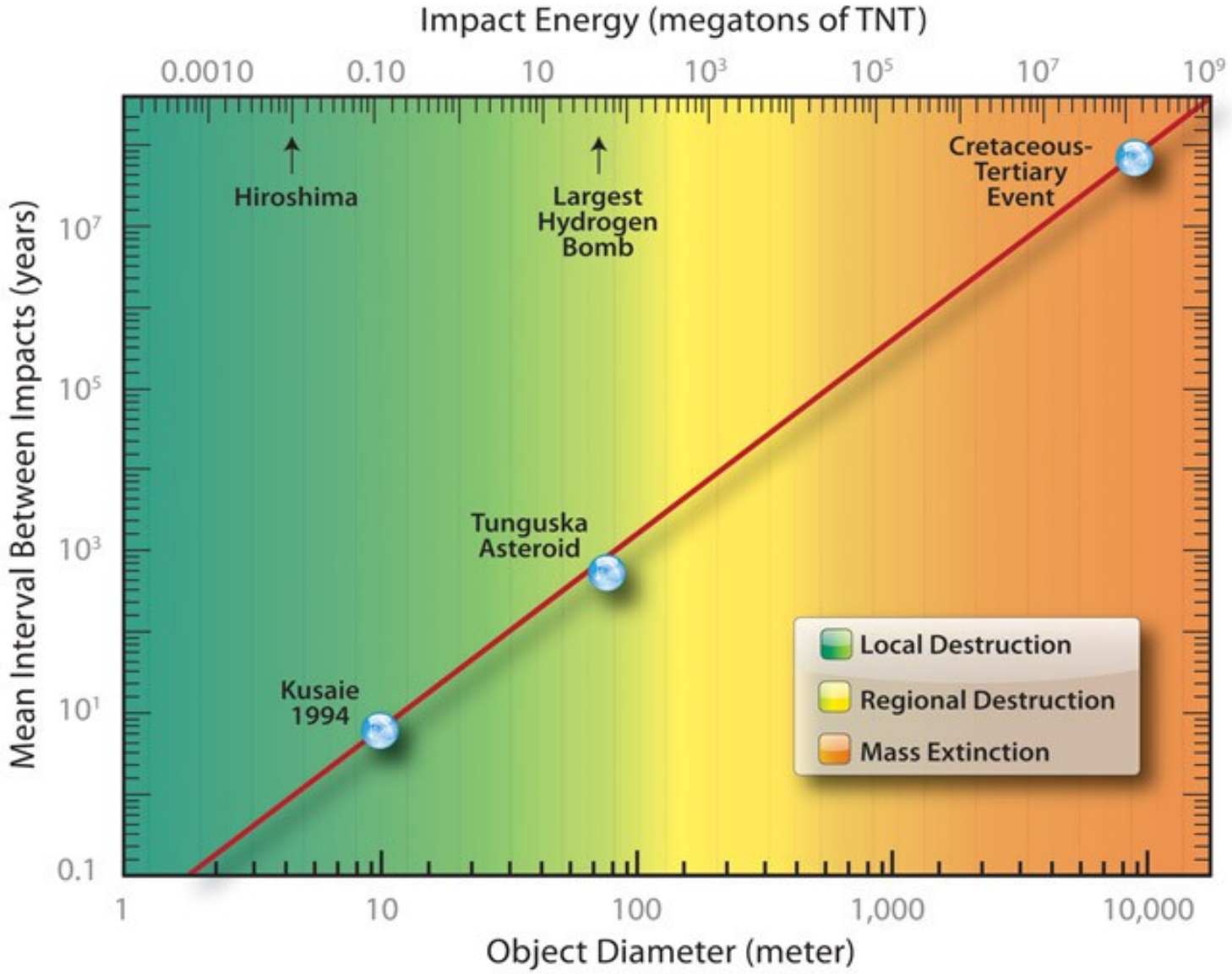
**Size distribution:**



# 14.1 Asteroids

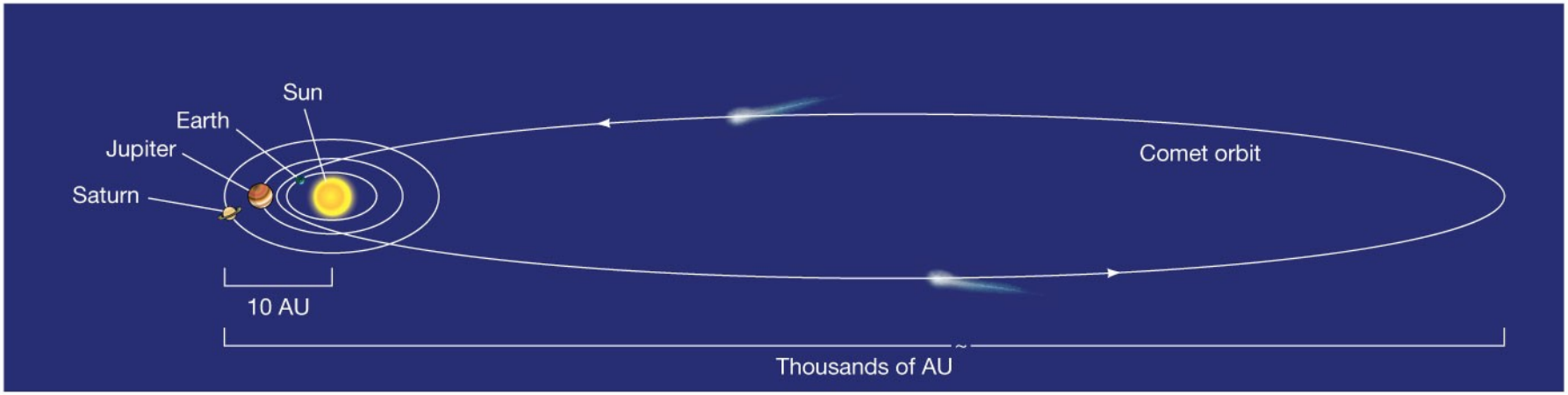
**Asteroids as a threat to life on Earth.**

**Frequency of collision:**



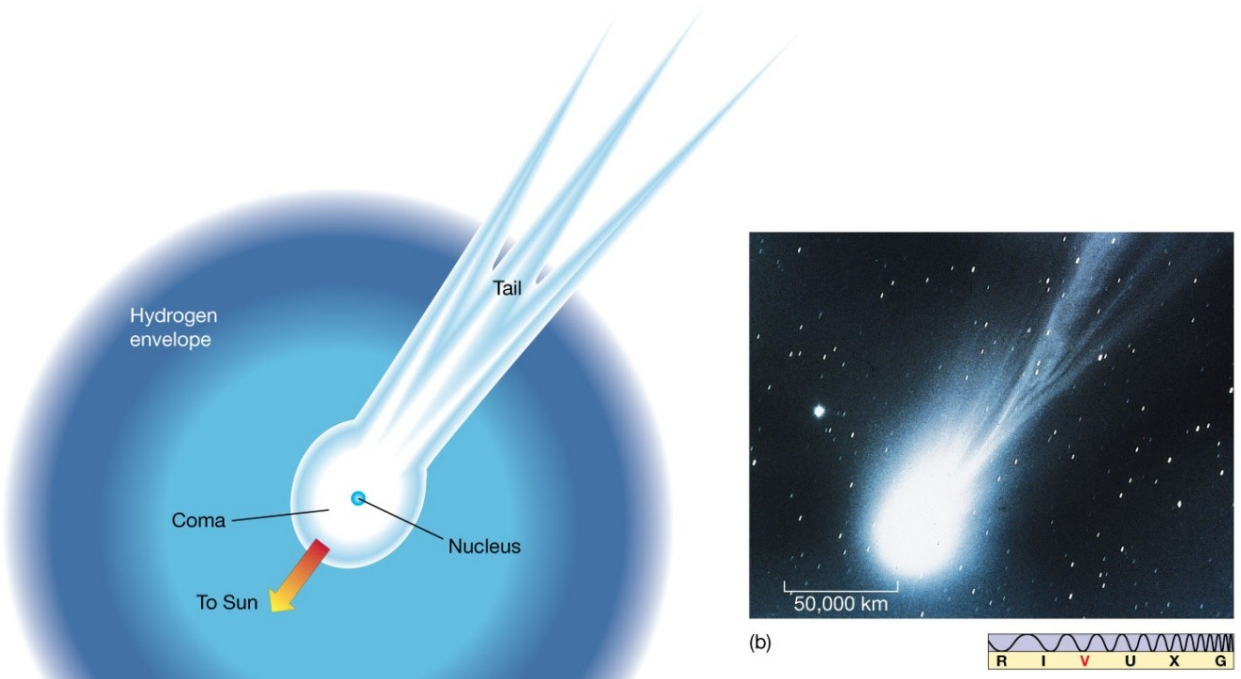
# 14.2 Comets

Comets that come close enough to the Sun to look bright from Earth have very eccentric orbits



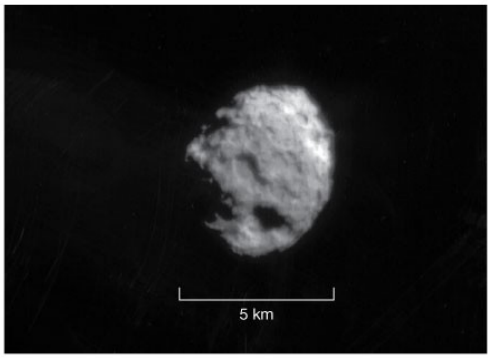
# 14.2 Comets

Comets have a very small nucleus, a coma of gas and dust that is the most visible part and can be very large, a hydrogen envelope, a dust tail, and an ion tail



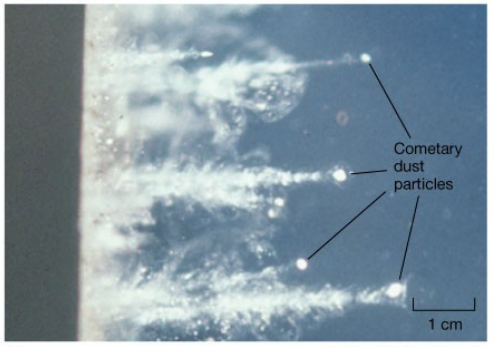
# 14.2 Comets

The *Stardust* mission flew through the tail of comet Wild-2, gathering dust particles in detectors made of aerogel and returning them to Earth.




(a)

(b)

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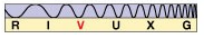
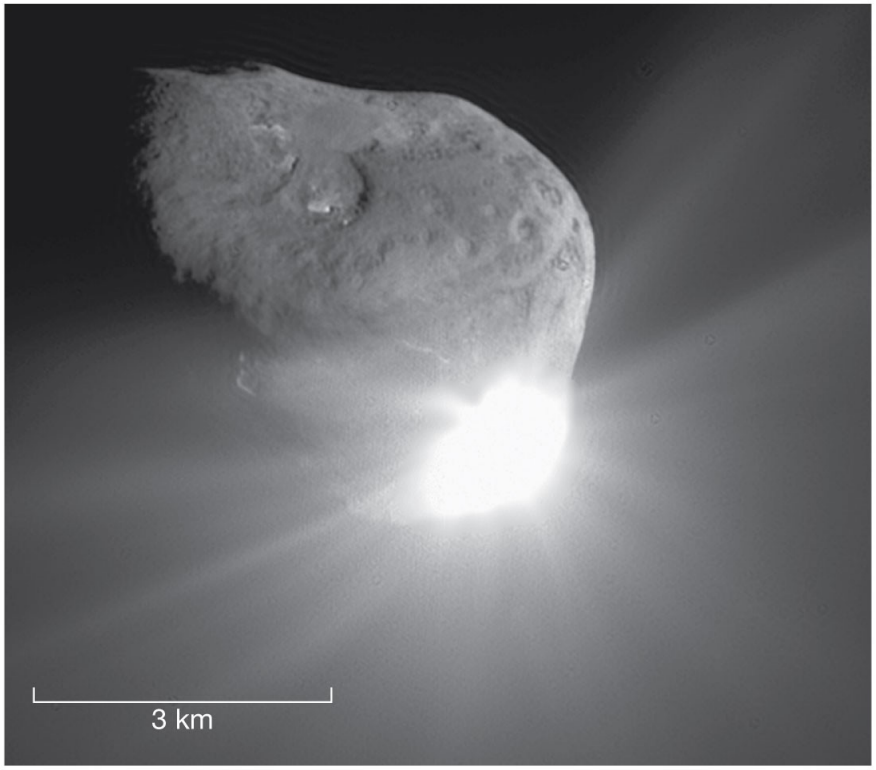


# 14.2 Comets

**The Deep Impact mission slammed a projectile into comet Tempel 1 and studied the material expelled in order to analyze the composition of the comet**

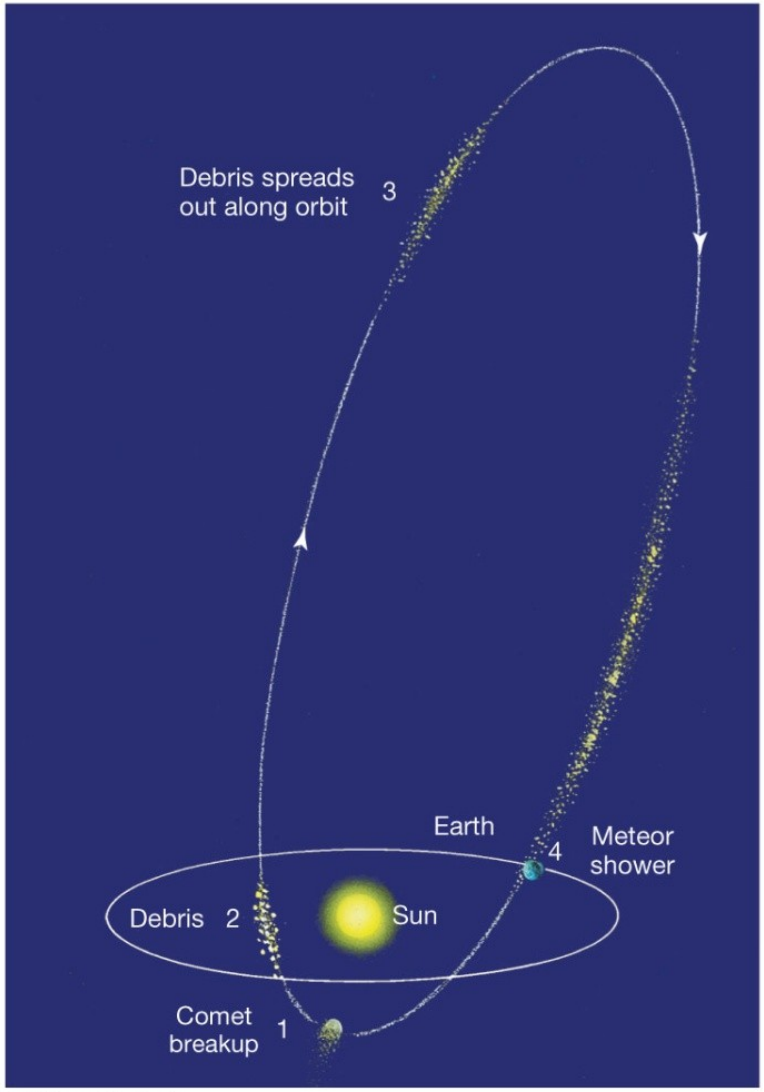


# 14.4 Meteoroids

**Meteoroids** are defined as being less than 100 m in diameter.

Most of the smaller ones are the remnants of **comets**.

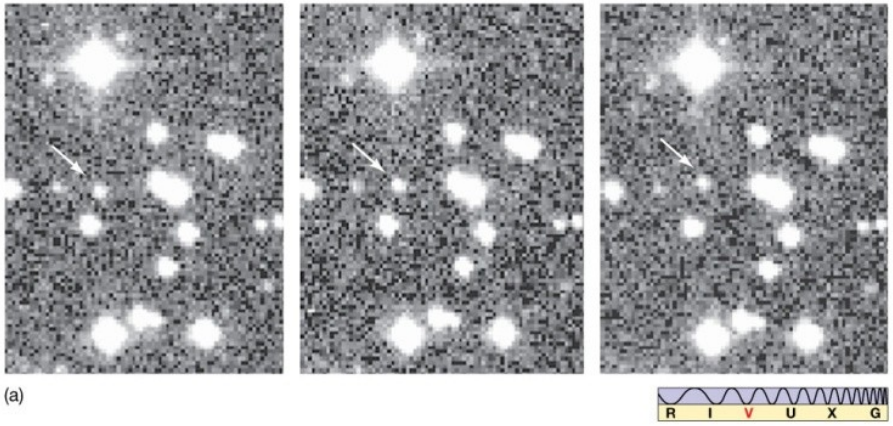
If the Earth's orbit intersects the comet's, **meteor showers** will occur every year on the same date.

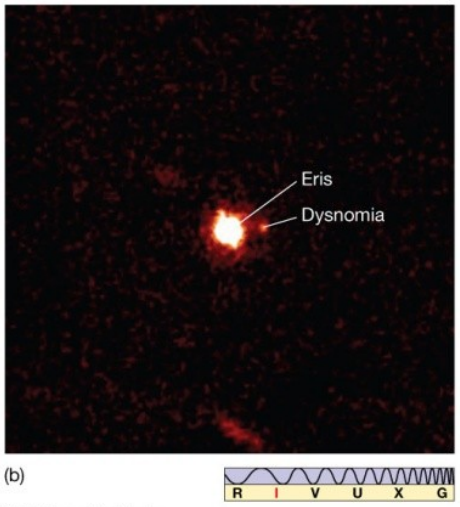


# 14.3 Beyond Neptune

No objects have been observed in the Oort cloud—it is simply too far away.

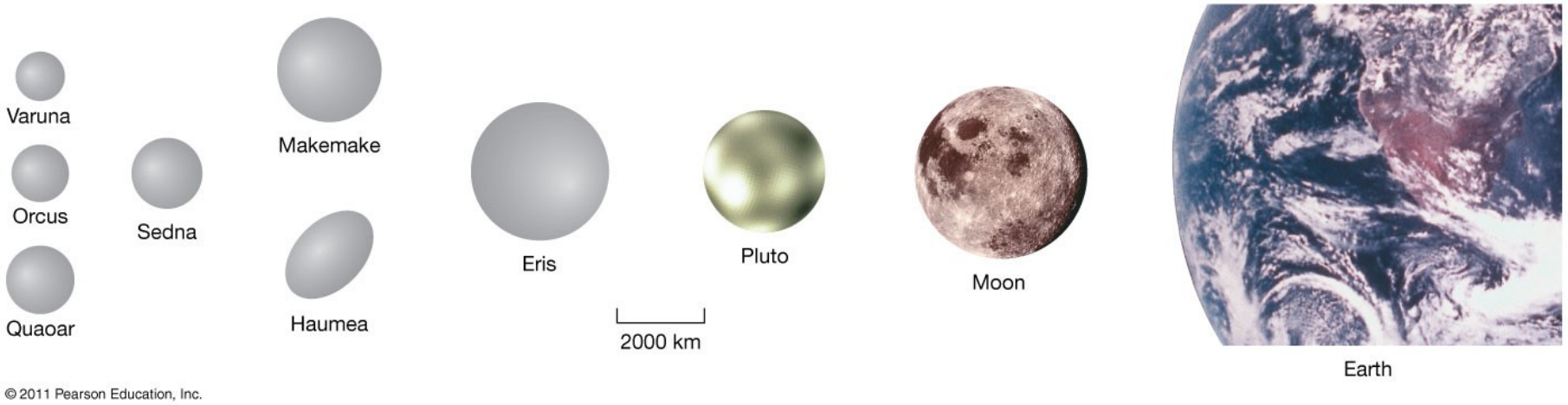
However, some Kuiper belt objects (KBOs) have been observed—over 1000 so far. Here are Pholus and Eris.



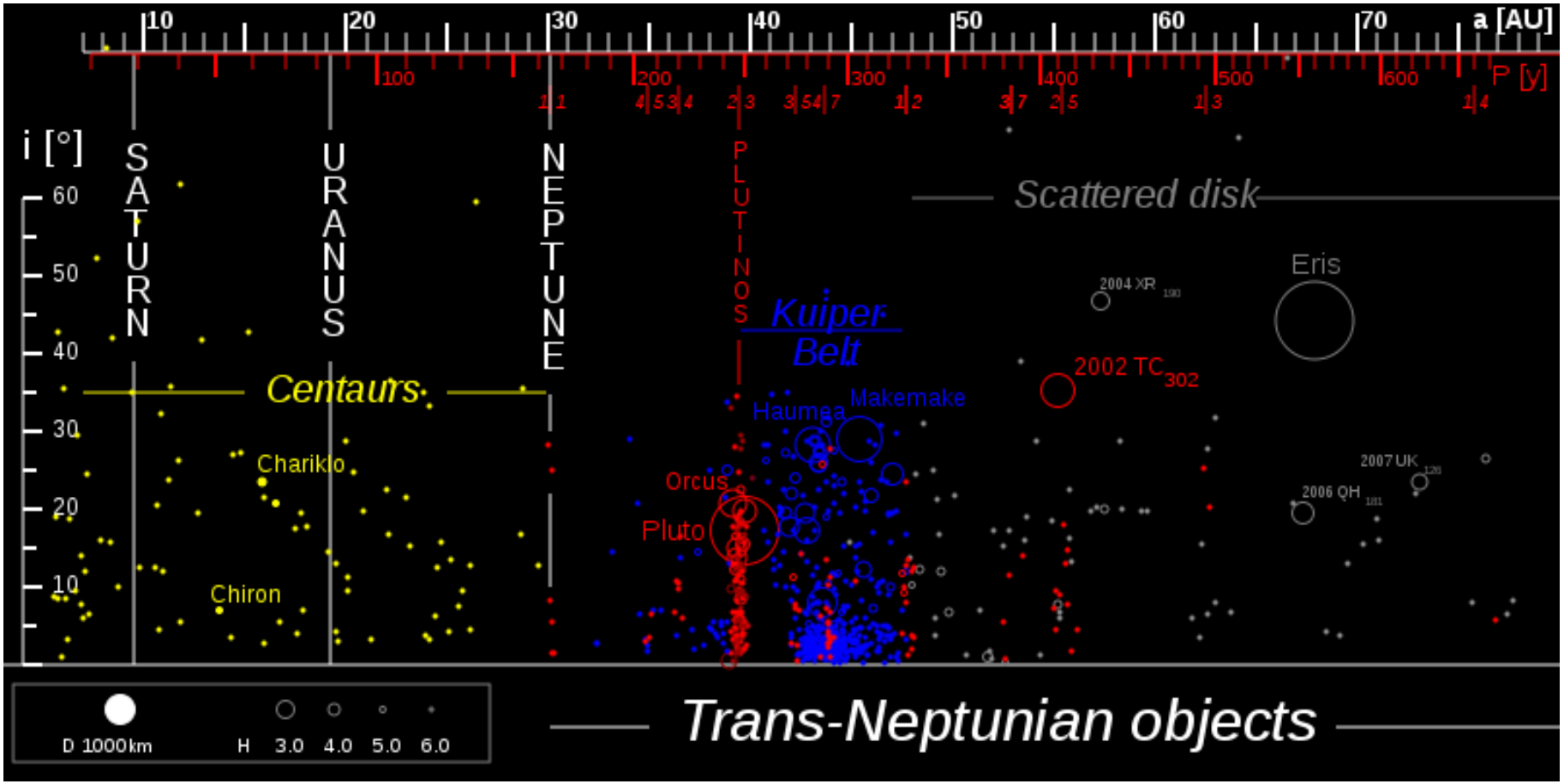



# 14.3 Beyond Neptune

**Comparison of several trans-Neptunian objects with Earth and its moon**



# 14.3 Beyond Neptune




*From Wikipedia. 2012.*

# Extraterrestrial Life

We only know of one place with life, so far.

The predominate opinion among scientists on UFO's is that they are not ETs.

Promising sites in the solar system:
Mars, Europa, Titan.

Promising sites in the Galaxy:
Exoplanets found within the "habitable zone" of stars.

We have research programs to "listen" for intelligent life with radio telescopes.
SETI = Search for Extraterrestrial Intelligence

Drake equation: estimates the number of intelligent life-bearing worlds in Milky Way.