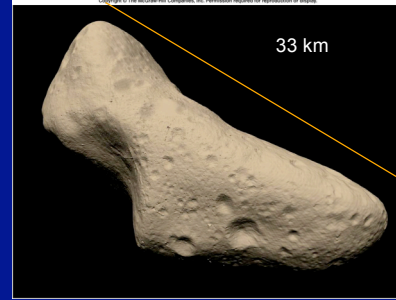


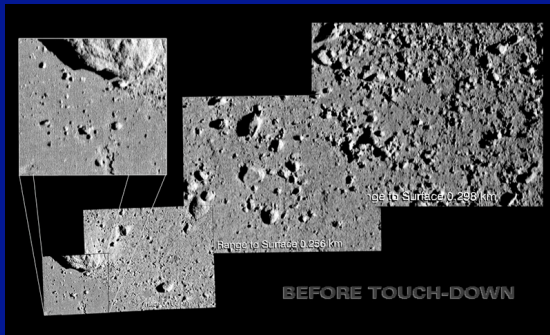
Asteroids and consequences for Earth



Eros...an asteroid with a lander (NEAR)

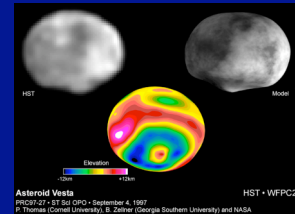


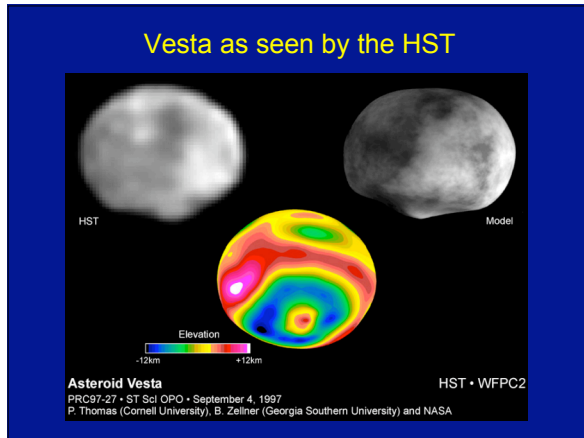
NEAR lands on asteroid Eros



The big asteroids (none visited yet by spacecraft)

- Ceres 930 km
- Vesta 520 km
- Pallas 520 km
- Juno 480 km





Aspects of Vesta

- At opposition is almost naked eye brightness (was at opposition in February)
- Go visit it at the Smithsonian Museum of Natural History (!#*)
- HST has observed it
[rotation of Vesta](#)



Classes of asteroids (hey, this is a science course, you've got to have classes!)

- S type; albedo of 7-23 percent; main class in inner and middle belt
- C type; albedos of 2-7 percent (or less); main type in outer belt
- M type: metallic (mainly in central belt)
- V for Vesta; albedo of 38 percent, reflectance spectrum of pyroxine

The reason for emphasizing classes of asteroids...

There is a correspondence with the classes of meteorites. Meteorites are literally “chips of the old block”

Geology of asteroids determined by collisions

- Surfaces are cratered, but not as much as would be expected for an unaltered object
- Images show stress fractures on the object
- Collisional fracturing of a *differentiated* object could account for the different classes
- There are lots of double asteroids

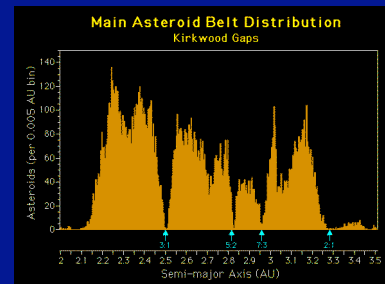
The orbits of asteroids

What do we see if we study the distribution of semimajor axes of asteroids



Think about what we might expect to see

What we do see



Kirkwood's Gaps: orbital resonances with Jupiter

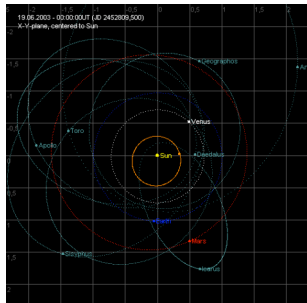
The physics of orbital resonance...like Cassini's Division in Saturn's ring

➡ Remember demo with forced oscillator

What happens to the asteroids which were in resonant orbits?



Earth-orbit-crossing asteroids (Apollo and Aten asteroids)



If little asteroids hit the Earth all the time, big ones will hit us once in a while

[Big Impact Home Page](#)

Note Ries and Steinheim in Germany...
Double impact

Some impact craters of particular interest

- Chicxulub (possibly caused extinction of dinosaurs)
- Manson (here in the Hawkeye State; 74 million years ago, similar in size to Chicxulub)
- Barringer Crater (Arizona; one of the best-preserved on Earth)
- Ries and Steinholm (Germany; same age, probably binary asteroid)