Rocky Debris: Asteroids, Comets, and Meteors

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Asteroids

- Typically non-spherical objects (solid space rocks)
- Not unique to own solar system (Prof. Knuth’s slides)
- Found in a belt between orbits of Jupiter and Mars
  - Planet failed to form due to orbital resonance set up
- But can travel of course: pushed and pulled around by the gravitational forces of the various planets
- Similar objects found in Kuiper belt (edge of system)
  - Includes Pluto, Eris, other dwarf planets and SSSBs (which both also exist between Mars and Jupiter too)
- Typical “small.” (But enough to destroy civilization!)
Asteroid 243 Ida is a massive resident of the asteroid belt. Large asteroids are easily spotted. But it's smaller, still potentially devastating, objects that worry scientists more because we can not easily detect them. -http://www.pbs.org/wgbh/nova/next/space/asteroid-detection-and-deflection/
Activity: How to Stop an Asteroid?

- What would YOU do about one on a collision course with the Earth? What can humanity realistically do?
Comets (Harbingers of Doom in Past)

- Icy body producing a “tail,” a plume of vapor/gas as the water or other ice evaporates off it because of Sun
  - “Dirty snowballs,” made up also of dirt, dust, gas, rock
  - Melting of ice from impacts could explain ocean origins
- Are cause of the regularly-occurring meteor showers
- Highly elliptical (yet of course still predictable) orbits
  - Halley’s comet: every ~75 years. Halley first realized comet already noticed thrice was same one. Only one possible for one to see twice (Halley didn’t see once)
  - One time only fast pass-by comets: hyperbolic orbits
- Live among billions of their brothers: the Oort cloud
  - “Dark matter” may gravitationally stir up this cloud regularly and send comets our way (wild, new-ish idea)
- We’ve actually managed to land spacecraft on them!
Upper right: INTERNATIONAL METEOR ORGANIZATION
Meteoroids, Meteors, & Meteorites

- Meteoroid is simply a small asteroid
- When enters atmosphere and starts to heat up and burn up (melt, vaporize, sublimate) then becomes the fireball we call a shooting star or a meteor
- Once falls to Earth becomes a meteorite, and can produce a significant impact crater, depending on size
- Can have meteorites on Earth that were originally pieces of other planets, such as Mars famously
- Constantly hitting us. Air makes short work of most
- Big hit anywhere from $1,000-10^9$ years
A stunning slice of the Glorieta pallasite meteorite cut thin enough to allow light to shine through its many olivine crystals. Credit: Mike Miller, for universetoday.com
The 1908 Tunguska Event

Credit: the Leonid Kulik Expedition
Homework

- Quiz #11
- Only ONE try this week

- Will reveal the answers before the midterm
  - Cannot immediately because must avoid sharing

- Quiz still tells you what you got wrong, so take as many times as you like even though not counted
Honoré Daumier, “Mr. Babinet, warned by his concierge of the arrival of the comet”, illustration for Le Charivari, 22 September 1858.