

Small Bodies, Asteroids

11-16-2005

Opening Discussion

- Have you seen anything interesting in the news?
- Europa has the least H₂O of the large moons (excluding Io), but none of the others are as likely to have it in liquid form. Composition of moons and rings.
- There are lots of retrograde moons. With the exception of Triton they are all small.
- What do I think about life on Europa and possibly having humans live on Europa?
- Photodissociation. Light breaking apart molecules.

More Minute Essays

- Anything that ends in a long O will rhyme with Io.
- What did I think about 2010: A space odyssey?
- Why doesn't our moon have a cool name?
- Image of motion of Neptune and Triton.
- Atmospheric loss processes.

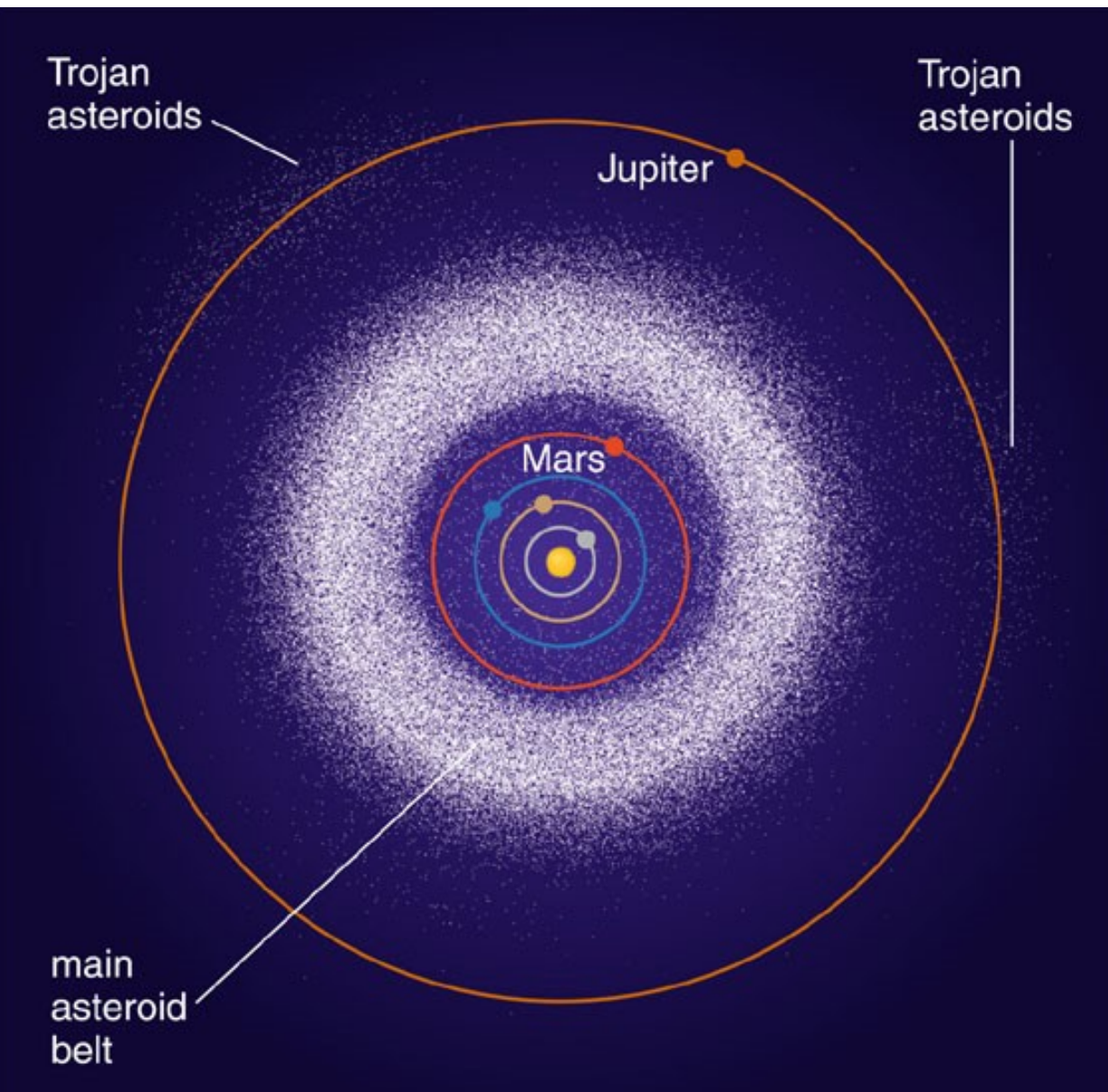
Small Bodies in our Solar System

- There are three major populations of small bodies in our Solar System. We care about these small bodies because they are our best link to the early history of our Solar System.
- Asteroids mostly orbit between Mars and Jupiter with lower inclinations in the normal direction. They are typically rocky or carbonatious.
- Kupiter belt objects orbit close to the plane of the Solar System out beyond the orbit of Neptune. These bodies are icy.
- Oort cloud objects have huge orbits going in all directions.

Meteors and Meteorites

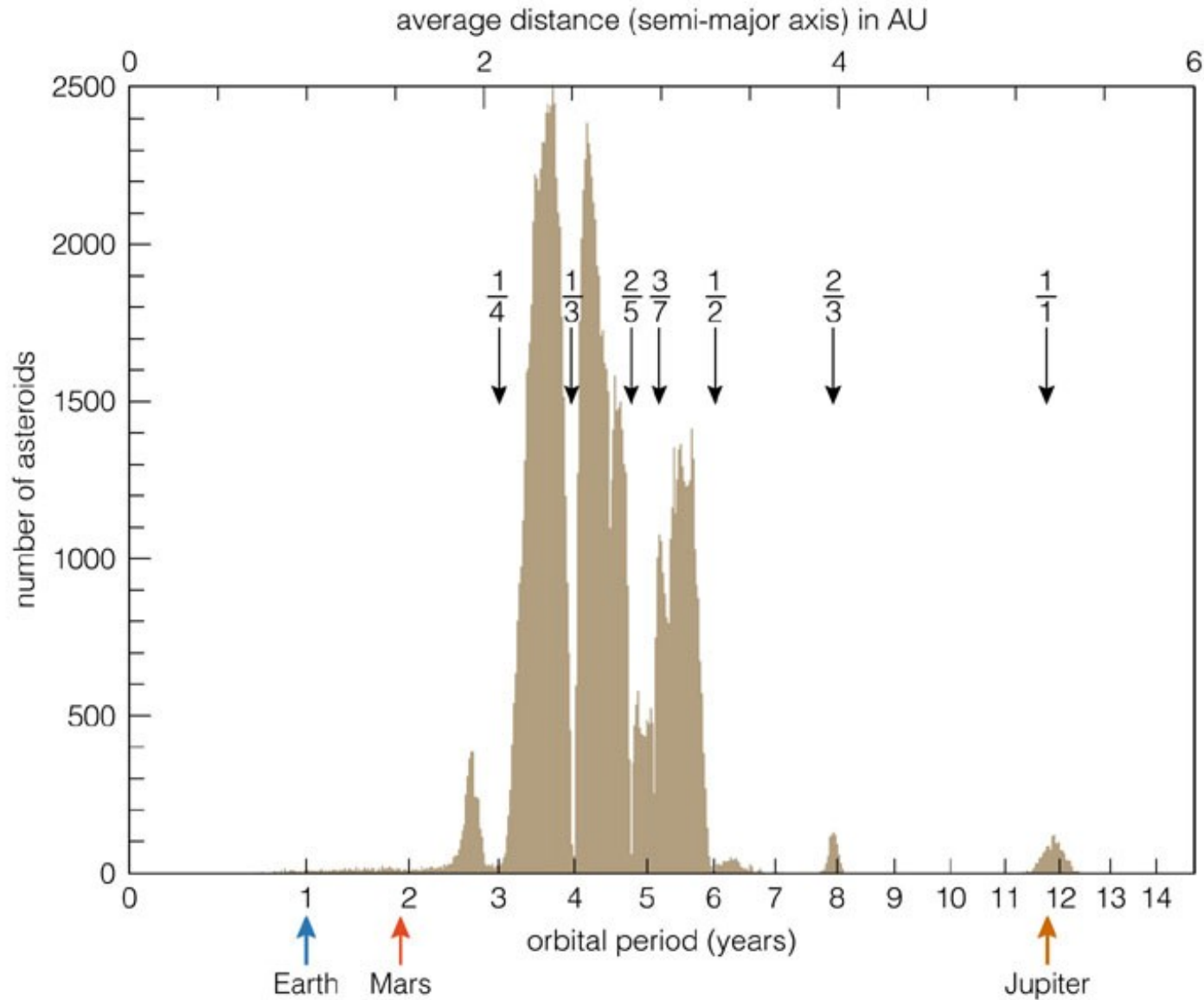
- Just to be clear on terms, a meteor is the bright streak out see going through the air that is often called a shooting star. A meteorite is the chunk that hits the ground assuming it is big enough to get that far.
- In general, asteroids are small rocky objects and comets are small icy objects. Comets only have tails when they are near the Sun, but we will still call them comets even without the tails based on composition.
- Basically, asteroids formed inside the frost line while comets formed outside of it.

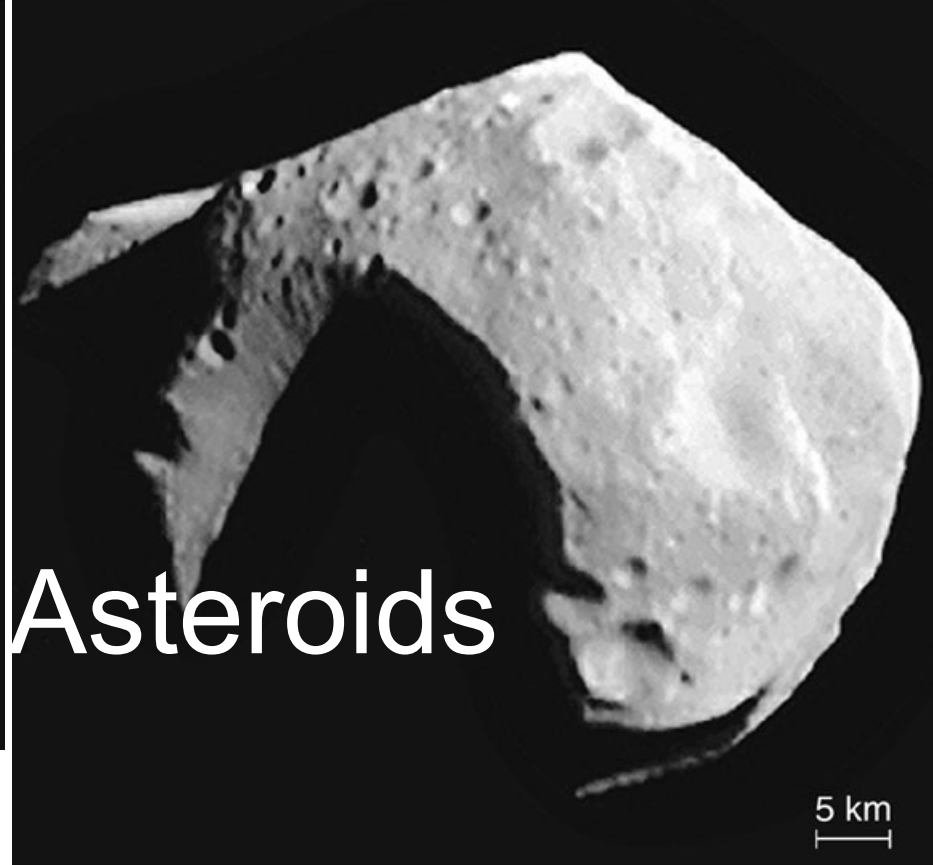
Where and Why of Asteroids



- Why is there an asteroid belt instead of another planet? The reason is likely Jupiter which made collisions more destructive.
- Ceres, the largest asteroid, is only 1000 km in diameter. Most others are much smaller. All together they would make a body less than 2000 km in diameter.

Resonances





Images of Asteroids

Measuring Asteroid Properties

- Spacecraft have only gone near a select few asteroids. Even with the biggest ground telescopes most asteroids are little more than tiny dots. Because of this, some ingenuity is required to determine their properties.
- Orbit – repeated observations of asteroids allow us to determine their orbits. This gives us semimajor axis, eccentricity and inclination.
- Size and reflectivity – If we know the orbit we know how far the asteroid is from us. Measuring how bright it is tells us a combination of size and reflectivity. Observing brightness in IR lets us separate the two.

More Properties

- Masses and densities – Measuring the mass asteroids is hard. We have to measure their gravitational effect on another body. It really helps us understand composition. Mathilde has a density of 1.5 g/cm^3 . Eros has a density of 2.4 g/cm^3 .
- Shapes – Light curves and radio observations can tell us shape. Ceres is the only asteroid that is round from gravity.
- Compositions – Spectroscopy can tell us surface composition. Most distant asteroids are dark and carbon rich. Nearer asteroids have rocky composition. Some asteroids appear to be made of metals.

Minute Essay

- What was the role of Jupiter in today's lecture?
- Remember to turn in assignment #6 before you leave.