

Introduction to Astronomy

Summary Questions Week 4

28 October 2019

1. Which are the main ways in which the internal structure of the giant planets has been probed?

Solution:

Most information comes from the calculated *density* of the planets and the *expected chemical composition* derived from that. Combined with the mass of the planets, this allows the calculation of a *pressure gradient*, which affects the phases of the matter internal to the planets. *Dynamical flattening* is another useful observable and the *strength and orientation of the magnetic field* provides information on possible planetary dynamo structures internal to the planets. Finally, the existence of excess heat coming from Jupiter and Saturn, implies *internal heat production*, which has consequences for the very core of these planets.

2. Where do the asteroids reside?

Solution:

The vast majority of asteroids live on orbits that are constrained *between the orbits of Mars and Jupiter* (2.2 AU to 3.3 AU approximately). However, large numbers of asteroids roam elsewhere, including the *Near-Earth Asteroids*, which spend (part or all of) their time inside Mars' orbit, often even crossing the Earth's orbit. Specific groups of asteroids called *Trojans* also exist, which share the orbit of Jupiter (and Mars), specifically in the Lagrange points 4 and 5 (i.e. trailing or leading the planet by 60 degrees in their orbit around the Sun).

3. How do we know the composition of asteroids?

Solution:

Mostly from the study of *meteorites*. Spectroscopy could also work in principle but asteroids are typically far too faint for this to work.

4. What was special about the Philae spacecraft and what did it teach us?

Solution:

Philae was the first man-made object to *land on a comet*. It dramatically changed our understanding of these bodies, amongst other things pointing out that the surface is very hard, rocky and *very* dry. Water ice does not seem to exist on the surface, though it may exist on the interior.

5. Why do some comets have two tails and why do some only have one?

Solution:

All comets have two tails, but in some cases one of the tails may not be very clearly visible. The main tail is a *dust tail* that trails the comet in its orbit through the Solar System, the other tail is an *ion tail* composed of lightweight, ionised particles that are being pushed by the Solar wind and consequently this tail points away from the Sun. Depending on the motion of the comet and the angle from which we see it, the tails may appear very close.