Topics: Finish up TNOs and comets, dust and radiation pressure, comparative planetology, origin of the Solar System, begin exoplanets

Reading:

- Finish reading Ch. 11 (pp. 280 - 288) in Ryden and Peterson.
- Read sec. 1 and 2 of Ch. 12 in Ryden and Peterson (pp. 290 - 294).
- Optionally begin reading sec. 3 of Ch. 12. We'll be covering that material in the following class, but might begin it on Thursday.

Summary of work to submit:

- Nothing to submit for Thursday's class – work on the homework instead!

Overview:

Now that we have knowledge of the different components of the Solar System, we can compare and contrast the important properties of the planets (comparative planetology) and use that information to draw some over-arching conclusions about the nature of the Solar System (the numbered "lessons" in §12.1). Then we can recap what we learned in Ch. 8 about the theory of the Solar System's formation in the context of these lessons (§12.2). And finally, we can compare the properties of our Solar System to the properties of other (exo-)planetary systems (§12.3). Doubling back to the end of Ch. 11, dust is ubiquitous in outer space, including in our solar system. Dust interacts strongly with light (it's good at absorbing and reflecting light) and so light can actually push dust around (as in forming the tail of a comet). We'll start class by discussing this phenomenon of "radiation pressure."

Commentary on the reading, viewing, and other preparation:

Pay very close attention to the derivation of eqn. 11.7: "since pressure is equivalent to momentum flux" – convince yourself these two quantities have the same units. Momentum of a photon is given by E/c (do those units give you momentum?). Does that indeed imply eqn. 11.7? Hint: what we call "flux" (as in the inverse square law of light) is *energy* flux. We can define the flux and anything that flows (flux of water at the mouth of a river, for example, is a well-defined quantity: water per unit area per unit time). So *momentum flux* is a well-posed quantity: momentum per unit area per unit time.

Poynting-Robertson effect: like running in a rain storm. If this effect is real, what does it imply about the small grains of dust that we observe in our Solar System (e.g. those that produce the zodiacal light)?

Sections 1 and 2 of chapter 12 are so compact, that they almost read like summaries themselves, so I won't summarize their points here. Read those sections carefully – they're short but packed with information.

As you read section 3 of Ch. 12, note that it first discusses the more intuitive ways of potentially detecting exoplanets (directly imaging them) and then explains why that is so difficult. The main focus of exoplanet detection and characterization is two-fold: the radial-velocity method, which uses Doppler shift measurements of the *host star* to infer the presence of an unseen planet (and also determine the planet's mass via Kepler's third law) and the transit method, which uses measurement of the amount of dimming of the host star when the exoplanet passes in front of it in order to measure the size (radius) of the exoplanet.