Astronomy 16 – Modern Astrophysics

Fall 2014

Week 13

We'll look at exoplanets from the point of view of the methods for studying them (making an analogy with binary stars but also in the context of the solar system and our expectations for what planetary systems look like). Then we'll move on to the Milky Way as a whole (which will lead us into galaxies for our final class next week). Galaxies are in some sense the primary units in astronomy (maybe stars are like cells and galaxies are like organisms?).

Topics:

Exoplanets: detection methods
Exoplanets: results (what's out there?)
The Milky Way
Dark matter in the Milky Way
The central, supermassive black hole

Reading:

Read Ch. 12 for Tuesday. Definitely read the brief first two sections, as they describe the salient properties of our Solar System. But focus on Sec. 3 – how exoplanets are detected and their properties measured and Sec. 4 – what the properties of the exoplanets so far detected are.

For Thursday, read Ch. 19, Secs. 1, 2, 3, and 7, while skimming Secs. 4 – 6 (but spend some time looking at the figures in those sections and reading their captions).

A few things to note as you're reading Ch. 12:

Pay special attention to what can be learned from radial velocity measurements of an exoplanet host star (so, where does eq. 12.21 come from?).

Make sure you understand what controls the features of a transit light curve and what can be learned about the exoplanet from the transit light curve's characteristics.

And what about when radial velocity measurements are combined with transit measurements?

Why are planets on close-in orbits more likely to show transits? Make sure you can explain Fig. 12.8.

How would you summarize the main few trends seen in the first few hundred exoplanets that have been detected?

Why does the unexpected numbers of "hot Jupiters" explain why so many exoplanets have been so quickly detected?

A few things to note as you're reading Ch. 19:

The overall structure: disk, halo, bulge – and also the spiral structure – is important, but pay special attention to Population I vs. Population II stars.

How would you summarize the evidence for dark matter in the Galaxy presented in Sec. 2?

Are you convinced by the evidence in Sec. 7 for the existence of a ~3 million solar mass black hole at the center of the Milky Way?