Problem Set 5
due 02/18 in class

1. *Equation 23 of Giant planet formation, SS 319*: Instead of deriving Equation 23 by plugging Equation 22 into Equation 21, start from first principles, carefully explaining each step and assumption.

2. Talk summary assignment
   a. Using your first talk summary assignment, identify a true problem or open question that the talk addressed, rather than a topic. If the talk addressed multiple problems or open questions, choose one. For example, for 02/10 colloquium, you could say something like, “In order to test our cosmological models, we need to know the redshift distribution of galaxy growth via mergers. Dusty star formation galaxies are interpreted to have recently undergone mergers, but it is very challenging to measure their optical redshifts because they are highly obscured.” We should be able to judge whether the question was answered or the problem solved by the work presented, whereas a topic cannot be solved or answered.
   b. Re-write your press release version so that it’s truly understandable by the general public. See the XKCD up-goer for inspiration. You will receive an individual note with some suggestions, including jargon underlined.

3. Use the *Accio* charm (or, for muggles, ADS) to find articles about your disk.
   a. Locate a plot/figure showing the first discovery of your disk. How was the presence of the disk inferred from this plot and what features/properties of the disk were inferred?
   b. Locate the most recent detection of your disk. What new features of your disk did it reveal?
   c. What feature in your disk has been attributed to a planet sculpting the disk and describe briefly how the planet would create that feature.

4. Research on your own: what are the three four classes of young stellar objects? Sketch their SEDs. How do the two types of disks (proto-planetary and debris) relate to these classes?

5. Planet Migration, SS 347
   a. What is the difference between Type I and Type II migration?
   b. Equations 18 and 25 both give equations for torques on a planet that cause Type I migration. Under which circumstances does Equation 18 dominate? Equation 25?
   c. What are Lindblad resonances and what role do they play in migration?

6. Rosenfeld+ 14
   a. This is a more complicated, technical paper that we have read so far, so set aside sufficient time to read it, understand it, and develop questions to discuss.
   b. What is a transition disk? What problematic aspect of transition disks would fast radial flow solve?
   c. Why do the authors observe the particular emission lines in Figure 7 left and right panel?
   d. What alternative explanation (besides fast radial flow) do the authors provide for the signature they observe in the HD 142527 disk and briefly describe why this alternative explanation creates a similar signal.