

Homework #11
Due Thursday, November 17, 2011

1. *In your own words*, define and explain the astronomical significance of the following terms in complete sentences. Be sure to define them as they apply to what we've discussed in class. DO NOT just type the words into a dictionary and write down the first thing that comes up.
 - a. Ice/Snow Line
 - b. Habitable Zone
 - c. Interstellar/Interplanetary "Dust"
 - d. Differentiation
 - e. Infrared Excess
 - f. Protoplanetary Disk
 - g. Late Heavy Bombardment
 - h. Resonance

2. Below you will find tables of information about 4 real (exo)solar systems. You are tasked with making two scale models. The first should show the relative sizes of the planets relative to each other (you may space them out however you please – the point is to show the difference in sizes between them regardless of where they "live" around their star). The second should show the distances between them relative to our own solar system (this time ignoring planet size and focusing on distance). The simplest version of these would be just drawn on paper, where you would decide a scale (for example 1cm=1AU or 1cm =1 earth radius) that utilizes the space on the paper wisely. If you would like to be more creative with your models than simply drawing them on paper, you are welcome to (and will likely be rewarded with some extra credit!). In any case you need to SPECIFY YOUR SCALE on your model and show your work in scaling at least one exosystem.

Tips/further instructions

- In model 1, the planets should be circles (or spheres), but note that you are given the **radius** in the table and will need to turn that into a properly sized circle.
- You may wish to "embed" your planets inside one another in Model 1 (draw one circle inside another) in order to utilize the space on your paper wisely. Make sure to label each circle with the name of the planet.
- Your solar systems should be separated in Model 2, but you should line them up so that they're easily comparable. For example, you might wish to place the star on one (same) edge of the page for each system and space them out vertically. Make sure to label each scaled solar system with it's name and the names of each planet (For 2-4 it's ok to just label them b, c, d etc.).

System 1: Our Solar System

Planet	Semimajor Axis (AU)	Planet Radius (Earth Radii)
Mercury	0.4	0.39
Venus	0.7	0.95
Earth	1	1
Mars	1.5	0.53
Jupiter	5.2	11.2
Saturn	9.5	9.5
Uranus	19.2	4.0
Neptune	30.1	3.9

System 2: Kepler 11

Planet	Semimajor Axis (AU)	Planet Radius (Earth Radii)
b	0.09	1.97
c	0.11	3.15
d	0.16	3.43
e	0.19	4.52
f	0.25	2.61
g	0.46	3.66

System 3: Upsilon Andromedae

The radii of the planets in this system are unknown, so you'll have to leave them out of Model 1. We do know that they are all more massive than Jupiter though, so this system is definitely very different from our solar system. We'll discuss why we know the mass but not the radius of the planets in this system in class next week.

Planet	Semimajor Axis (AU)
b	0.06
c	0.83
d	2.53
e	5.25

System 4: HR 8799

Planet	Semimajor Axis (AU)	Planet Radius (Earth Radii)
e	14	12.3
d	24	14.6
c	38	13.4
b	68	unknown

3. What do your scale models tell you about each system? For each, discuss how the planets are different from those in our own solar system. If you think that they may be able to harbor life, describe how. If not, describe why not.