Earth 351 – Forming a Habirable Planet Name:_____
Problem Set #**7: Exoplanets** Due: **Wed.**, May **17**, 2017

Consult the European exoplanet database: http://exoplanet.eu
What is today's current count for exoplanets? How many planetary systems? Date?

1.) Use the "Diagrams" tool to plot the dataset with planetary mass on the x-axis and planetary radius on the y-axis (try log scale for mass).
To compare, hand-plot Earth and Jupiter for our solar system. Where would brown dwarfs lie?

What does the observed pattern show? Draw and label a line of constant density on this plot.
How would you explain the empty regions without planets?

2.) Similarly, plot semi-major axis on the x-axis and mass on the y-axis (use a log scale for both axes), adding Earth and Jupiter to this diagram.

Pulsar timing is sensitive to extremely low-mass planets orbiting these stellar cinders. Identify the pulsar planet, separated from the others, on the plot.

Radial Velocity and Transit planet searches must observe a system for at least one full orbit of the planet. What is the orbital period of a planet orbiting a Sun-like star at 100 AU (use Kepler's 3rd Law)? Explain the technique used to discover the planets in the top-right of this scatter plot.

2.) cont. What other patterns do you observe? Why are there no objects near the diagram top? Is this a “real” effect, or an observational bias? Why do no planets fall in the bottom right?

3.) Using the dataset's “Catalog”, how many earthlike planets (Mass 0.5-3.0 Earth mass) locate within habitable zones (0.8-1.5 AU) of sun-type stars (Star-type G)?

4.) In “Kepler constraints on planets near hot Jupiters”, Steffen et al., PNAS, 2012 'Exoplanets' on class website) analyze Kepler's discoveries of exoplanets. What characterizes 'Hot Jupiters'? Hot Jupiters abound. Develop a graphic (plot) to illustrate their prevalence among exoplanets.

5. For an alien civilization remotely viewing and studying Earth, how would our planet's atmosphere reveal the existence of life on Earth? (Ward and Brownlee, Chapter 11).

6. An important aspect of space missions is the long-term commitment involved in planning and carrying them out. To get a sense of this, listen to
http://www.npr.org/2017/04/30/526250837/saturn-cassinis-final-chapter?sc=17&f=10&utm_source=iosnewsapp&utm_medium=Email&utm_campaign=app

What insights does this interview give you?