ASTR 401 Final Assignment
Due Wednesday Dec 9, 2020, 11:59pm

(1) Using the exoplanet database (https://exoplanetarchive.ipac.caltech.edu/), identify the sample of *confirmed* planets that have independent measurements of both their mass and radius. Make a plot of the mass versus radius, with a point on the plot representing each planet. On this same plot, make simple curves that represent the mass versus radius for planets that are composed entirely of rock, water, and ice. Finally, on this same plot, indicate the mass and radii of the solar system planets. (50)

In a one-page write-up (11pt, single-spaced font), discuss your analysis method and results. Your write-up should include:

1. State the number of planets in your sample, and your methods for obtaining this number.
2. Does the mass and the radius correlate as you would expect?
3. How do the densities of exoplanets compare the those of Solar system planets?
4. Are exoplanets are more consistent with being composed entirely of rock or ice? More generally, discuss the importance of characterizing planets according to their densities.

(2) Define m as the number of planets around a star, so that $m = 1, 2, 3, 4, 5, 6, ...$ The exoplanet *multiplicity function* gives the distribution of m for the stars that are known to host planets. Using the exoplanet database, for the sample of confirmed planets, make a histogram of the exoplanet multiplicity function. What is the mean and the variance of this distribution? Select any subsample of stars or planets of your choosing, and then plot the corresponding multiplicity function for this sample. (50)

In a one-page write-up (11pt, single-spaced font), discuss your analysis method and results. Your write-up should include:

1. Your methods for obtaining the multiplicity function
2. The importance of understanding the planet multiplicity function.
3. The biases and the problem in extracting the planet multiplicity function from observations.
4. Explain your choice of subsample, and the behavior of this subsample relative to the entire sample.