

Worksheet 2

Radial Velocity Code

1. Starting with the code you wrote for homework 2, calculate the following values and make any associated plots. Discuss your figures with at least one other student.
 - (a) Calculate the velocity of the planet (\vec{x}, \vec{y}) at each time step t . Plot the magnitude of this velocity as a function of time for orbits with $e = [0, 0.3, 0.5, 0.9]$. Indicate the time of pericenter and apocenter passage, and make sure to include appropriate units on your axes.
 - (b) Now calculate the velocity of the star at each time step t . You can do this directly from the velocity of the planet. Make the same plot as in part a.
 - (c) Calculate the radial line-of-sight velocity for the star. Make sure to think about where pericenter passage occurs. Now, plot the radial velocity as a function of time for the same eccentricities, but with $\omega = [0, \pi/4, \pi/2, 3\pi/4]$. Also, experiment with and understand how these plots change with a , M_* , and m_p .
2. If you finish part 1, think about how you would need to adapt your code for two planets, both with masses much less than the stellar mass, and far enough apart to not interact with each other. Make some plots to visualize different planetary configurations.

You can also think about how you would need to modify your code for two bodies with similar mass (e.g. a stellar binary). At what point did the assumption $M_* \gg m_p$ come in?