Problem Set 4

Problem 1: Head-on collision

Using the Newtonian equations of motion, compute the gravitational wave polarizations h_+ and $h_\times$ produced by the head-on collision of a small body of mass μ on a larger body of mass $M \gg \mu$. Assume that the small body was initially at rest when it was at a large distance from the large body, and that the two bodies collide at time $t = 0$. Assume that the observer at distance r views the collition from an inclination angle ι from the axis of motion.

Problem 2: Chirp time of a binary neutron star system

Compute the amount of time (in seconds) it would take until the coalescence of a binary neutron star system if it begins in a circular orbit with with a gravitational wave frequency (which is twice the orbital frequency) of 10 Hz. Take $m_1 = m_2 = 1.4\, M_\odot$.