PHYS 480/581
General Relativity

Homework Assignment 13

Due date: Monday 11/23/2026 8pm, submitted electronically on UNM Canvas

Question 1 (4 points).

Moore Problem 31.1

Question 2 (4 points).

Moore Problem 32.3

Question 3 (6 points).

Consider two inspiraling black holes with mass $10M_\odot$, where $M_\odot$ is the mass of the sun. Assume the system is located at the centre of our galaxy; let's call this distance to the black holes $r_{\rm gal}$. Assume that the initial separation is $100\,r_s$, where r_s is the Schwarzschild radius. In the weak field approximation, compute the gravitational wave amplitude $h(t)$ at the LIGO site as a function of time, making use of the quadrupole radiation formula. Assume that we are seeing the system face on. Then, using the formula for the radiated power derived in class, compute the gradual decay of the orbital radius $r(t)$ (using Newtonian physics to relate the energy density radiated to the change in the orbital radius). The approximations cease to be valid once $r(t)$ approaches r_s, so stop the calculation before that point.