

Gravitational waves — Exercise sheet n.5

Matteo Breschi
matteo.breschi@uni-jena.de

13.05.2021

Exercise 5.1: Circular binary system

Consider two point-particles with different masses in Newtonian circular orbit. In this approximation, the orbital frequency can be written as

$$\Omega = \sqrt{\frac{GM}{R^3}}, \quad (1)$$

according to the Kepler's third law.

- Compute the inertia tensor and the quadrupole moment of the system;
- Compute the radiated GWs using the quadrupole approximation;
- Compute the Fourier transform of the GW polarizations, i.e.

$$\tilde{h}_{+,\times}(\omega) = \int_{-\infty}^{+\infty} h_{+,\times}(t) e^{-i\omega t} dt. \quad (2)$$