

Gravitational waves — Exercise sheet n.4

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Exercise 4.1: Effect of GWs

Consider two point-particles test-masses in a locally-flat spacetime (typically labeled as *detector frame*). Show explicitly that the effects of GWs can be described in terms of a Newtonian force at the leading order.

Exercise 4.2: Tidal forces

Suppose that an astronaut is able to reach the surface of a neutron star ($m = 1.4 M_\odot$ and $R = 12$ km).

- Compute the relative tidal acceleration between the head and the toes of the astronaut in Newtonian approximation, knowing that the astronaut is 1.6 m tall. The reader can assume spherical symmetry and ignore rotation effects.
- Repeat the previous estimation in GR using Schwarzschild metric.
- What do the results suggest?