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Gravitational waves from inspiralling compact binaries in Dilatonic-Einstein-Gauss-Bonnet theory

Abstract

For the first direct detection of gravitational waves by the LIGO collaboration, it was mandatory to compare the data to highly accurate waveforms. Therefore several analytical and numerical techniques are needed to calculate the inspiral, merger and ringdown phase. One analytic approach to describe waveforms of inspiralling black hole binaries, is the Effective-One-Body formalism developed by Buonanno and Damour in 1999. The basic idea is to relate the relativistic dynamics of two bodies to a test particle with reduced mass propagating in an effective one-body metric. In lowest order in General Relativity this metric coincides with a Schwarzschild metric deformed by the symmetric mass ratio. The basic ingredient for this formalism is a high order Post-Newtonian Hamiltonian for the relativistic two-body problem expressed in terms of the radial action variable.

In this talk we present this formalism using the example of Dilatonic-Einstein-Gauss-Bonnet theory. For the description of the conservative dynamics we derive the two-body Hamiltonian in the second Post-Newtonian approximation and find a relation to the effective one-body Hamiltonian. In addition we introduce a radiation reaction force to describe the non-conservative dynamics and use the canonical equations to describe the effective motion and the gravitational waveforms of the inspiral phase. Finally we match the inspiral phase to the ringdown at the merger time and present full gravitational waveforms, which in principle can be compared to observations.