Gravitational radiation from the inspiral of compact binaries based on a Yukawa-type addition to the Newtonian potential

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Although the predictions of both, Newton's gravitational theory and the general theory of relativity, match with many observations, in some cases the results are not completely satisfactory. Such discrepancies range from solar-system scales to astrophysical and cosmological scenarios, such as the flyby anomaly, the Saturn perihelion anomaly, the Pioneer anomaly, satellite dynamics and dark matter [1, 2].

Since many of the recent theories of particle physics predict forces coupled to gravitation, the interest in Newton's gravity and general relativity deviations in recent investigations is completely justified [1, 3] and the aim in many cases is to include them to compare their predictions with experimental data. Some of the studied theoretical frameworks are braneworld models, scalar-tensor or scalar-tensor-vector theories, Brans-Dicke theory and f(R) gravity [4, 5]. The weak-limit of many of these extended theories of gravity are Yukawa-like terms corrections that may explain several of astrophysical observations [4]. For example, some authors considered a Yukawa-like term to the Newtonian potential to study the pericenter precession for the orbits of planets in the solar system or for the orbits of the S-stars in the Galactic Center [6, 7]. Furthermore, Haranas has been working in this direction to obtain the anomalistic period of celestial bodies, the radar signal delays in the vicinity of the Sun and the mean motion of an orbiting body [1, 8, 9]. In particular, numerical results for the orbit of the companion star of the pulsar PSR 1913+16 have been revised by Haranas, obtaining a periodic Yukawa effect that affects the mean motion of the pulsar. Because this binary system gave the first indirect measurement of gravitational waves, it is of interest to include the Yukawa-type modification perspective in the emission of these waves. Therefore, in this work we analyze the influence of a Yukawa-type correction to the Newtonian potential to obtain the waveform pattern of the gravitational radiation produced by the inspiral phase of a compact binary merger.

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