Scattering of scalar, electromagnetic, and gravitational waves from binary systems

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The direct detection of gravitational waves crowns decades of efforts in the modelling of sources and of increasing detectors' sensitivity. With future third-generation Earth-based detectors or space-based observatories, gravitational-wave astronomy will be at its full bloom. Previously brushed-aside questions on environmental or other systematic effects in the generation and propagation of gravitational waves are now begging for a systematic treatment. Here, we study how electromagnetic and gravitational radiation is scattered by a binary system. Scattering cross-sections, resonances and the effect of an impinging wave on a gravitational-bound binary are worked out for the first time. The ratio between the scattered-wave amplitude and the incident wave can be of order 10^{-5} for known pulsars, bringing this into the realm of future gravitational-wave observatories [1]. For currently realistic distribution of compact-object binaries, the interaction cross-section is too small to be of relevance.

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[1] L. Annulli, L. Bernard, D. Blas, and V. Cardoso, Phys. Rev. **D98**, 084001 (2018), arXiv:1809.05108 [gr-qc].