

Eternal Binaries

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The two-body problem is extensively studied in open systems and asymptotically flat spacetimes. However, there are many systems where radiation is trapped: they range from radiating charges in cavities to low-energy excitations of massive degrees of freedom, to anti-de Sitter spacetimes. Here, we study the problem of motion of a pointlike particle orbiting a massive compact object inside a cavity. We first show that - assuming circular motion - there are initial conditions for which the self-force vanishes and the binary is eternal. We then consider the evolution of the system under radiation reaction in a toy model which we argue captures the essentials of orbiting particles. We show that eternal circular binaries may exist. We also show that the presence of cavity modes leads to chaos in regimes of strong coupling or when the system is initialized close enough to a resonance. Our results have implications for physics in anti-de Sitter spacetimes and possibly for binaries evolving within dark matter haloes, if it consists on massive fundamental fields.

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