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Title: Scalar fields and gravitational molecules

Abstract: We will explore the dynamics of scalar fields in the presence of black holes and show that light scalars can form quasibound states around black hole binaries. In the nonrelativistic regime, these states are formally described by the quantum-mechanical Schrödinger equation for a one-electron heteronuclear diatomic molecule. We performed extensive numerical simulations of scalar fields around black hole binaries showing that a scalar structure condenses around the binary – we dub these states "gravitational molecules". We further show that these are well described by the perturbative, nonrelativistic description.