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Perturbing binary black holes with effective field theory

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Effective field theories (EFTs) facilitate what might otherwise be completely untenable calculations by helping us focus on only the most relevant physics at hand. Applied to general relativity, these techniques have famously improved our handle on post-Newtonian theory over the last decade, and extensions of these ideas are now also being developed to study how binary systems evolve when they are not isolated in empty space but subjected to external perturbations. One scenario of particular interest is the "gravitational molecule," wherein a light bosonic field (like a string-theory axion) forms a cloud that is gravitationally bound to a binary black hole. In this talk, I will sketch how an EFT allows us to solve for the evolution of this system analytically (under certain approximations), and will discuss a number of its key predictions: beating patterns, a partial upscattering of the cloud into radiation, and a novel guise of superradiance.

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