Numerical Studies of Superradiant Instability of Kerr-AdS

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Abstract

In the framework of General Relativity, when a wave scatters off a rotating black hole (also called Kerr BH) with sufficiently large angular velocity, the BH can transfer a portion of its energy to the wave by the so-called *superradiance* effect. Furthermore, asymptotically anti-de Sitter (AdS) spacetimes have timelike boundaries at infinity that work as mirrors, i.e. they reflect waves forcing them to re-enter the bulk. Therefore, in an asymptotically AdS spacetime with a Kerr BH, gravitational waves might be repeatedly amplified by BH superradiance, which would make the BH eventually lose all its energy and disappear. In other words, Kerr-AdS might be unstable under arbitrary perturbations. To investigate the end-state of perturbed Kerr-AdS, a numerical code able to evolve asymptotically AdS spacetimes for a sufficiently long time is needed. Due to the challenges presented by the presence of the timelike AdS boundary, a suitable numerical technique has been found only in recent years by Bantilan, Pretorius and Gubser. The poster will describe superradiance in more details, explain the method that allows to circumvent difficulties in evolving asymptotically AdS spacetimes, and discuss some preliminary results on the stability of Schwarzschild-AdS and Kerr-AdS black holes in 4 dimensions.

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