EFFECTIVE STABILITY AGAINST SUPERRADIANCE OF KERR BLACK HOLES WITH SYNCHRONISED HAIR

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Kerr black holes with synchronised hair [1, 2] are a counter example to the no hair conjecture, in General Relativity minimally coupled to simple matter fields (with mass μ) obeying all energy conditions. Since these solutions have, like Kerr, an ergoregion it has been a lingering possibility that they are afflicted by the superradiant instability, the same process that leads to their dynamical formation from Kerr. A recent breakthrough [3] confirmed this instability and computed the corresponding timescales for a sample of solutions. We discuss how these results and other observations support two conclusions: 1) starting from the Kerr limit, the increase of hair for fixed coupling μM (where M is the BH mass) increases the timescale of the instability; 2) there are hairy solutions for which this timescale, for astrophysical black hole masses, is larger than the age of the Universe. The latter conclusion introduces the limited, but physically relevant concept of effective stability. The former conclusion, allows us to identify an astrophysically viable domain of such effectively stable hairy black holes, occurring, conservatively, for Mμ. 0.25. These are hairy BHs that form dynamically, from the superradiant instability of Kerr, within an astrophysical timescale, but whose own superradiant instability occurs only in a cosmological timescale.