Superradiant Darwinism: survival of the lightest axion

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Abstract

We explore the dynamics of superradiant instabilities with multiple, non-interacting scalar fields of comparable mass, motivated by the string axiverse scenario. We show, in particular, that a spinning black hole can grow multiple superradiant clouds around it, with heavier axion clouds growing earlier but being necessarily reabsorbed by the black hole once lighter axion clouds start to form. We discuss the dynamical effects of accretion and gravitational wave emission, and show that the existence of axions of similar masses can have an observable effect on the stochastic gravitational wave background resulting from axion superradiant clouds around remnants from stellar black hole mergers.

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