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Aspects of Nonlinear Effect on Black Hole Superradiance

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Under some conditions, light boson fields grow exponentially around a rotating black hole, called the superradiance instability. We discuss effects of nonlinear interactions of the boson on the instability. In particular, we focus on the effect of the particle production and show that the growth of the boson cloud may be saturated much before the black hole spin is extracted by the boson cloud, while the nonlinear interactions also induce the boson emission. For application, we revisit the superradiant instability of the standard model photon, axion and hidden photon.

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