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General limitations on trajectories suitable for super-Penrose process

Zaslavskii O.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© CopyrightEPLA, 2015. Collisions of particles near a rotating black hole can lead to unbound energies E c.m. in their centre-of-mass frame. There are indications that the Killing energy of debris at infinity can also be unbound for some scenarios of collisions near the extremal black-hole horizon (the so-called super-Penrose process). They include the participation of a particle that i) has generic (not fine-tuned) parameters and ii) moves away from a black hole before collision. We show that for any finite particle's mass, such a particle cannot be obtained as a result of the preceding collision. However, this can be done if one of the initial infalling particles has the mass of the order that generalizes previous observations made in the literature for radial infall in the Kerr background.

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