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The transformation of the rotational energy of a Kerr BH

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We analyze the “ballistic method” of rotational energy extraction from an (extreme) Kerr black hole (BH) by massive particle decay in the BH ergosphere pioneered by Roger Penrose. We focus on the negative energy counterrotating particles in-going to the horizon and evaluate the feedback on the BH irreducible mass ($\Delta Mirr > |E1|$). The change in irreducible mass is a function of the ratio of the particle mass $\mu 1$ to the mass of BH. In the limit $\mu 1/M \longrightarrow 0$, $\Delta Mirr/|E1| \longrightarrow \infty$, all the reduced extractable energy goes into the irreducible mass, resulting in high irreversibility.

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