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Black-hole bomb and confined Penrose process

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We consider the decay of a particle with some energy E_0 > 0 inside the ergosphere of a black hole. After the first decay, one of particles with the energy E_1 < 0 falls towards a black hole while the second one with E_2 > E_0 moves in the outward direction. It bounces back from a reflecting shell and, afterwards, the process repeats. For radial motion of charged particles in the Reissner-Nordstom metric, the result depends strongly on a concrete scenario. In particular, an indefinitely large growth of energy inside a shell is possible that gives rise to a black-hole bomb. We also consider a similar multiple process with neutral particles in the background of a rotating axially symmetric stationary black hole. We demonstrate that, if particle decay occurs in the turning point, a black-hole bomb in this case is impossible at all. For a generic point inside the ergoregion, there is a condition for a black-hole bomb to exist. It relates the ratio of masses before and after decay and the velocity of a fragment in the center of mass frame.

Primary author: ZASLAVSKII, Oleg (Kharkov V. N. Karazin National University)

Presenter: ZASLAVSKII, Oleg (Kharkov V. N. Karazin National University)

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