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General Relativity and Quantum Cosmology

Acceleration of particles by rotating black holes: near-horizon geometry and kinematics

O. B. Zaslavskii

Nowadays, the effect of infinite energy in the centre of mass frame due to near-horizon collisions attracts much attention.We show generality of the effect combining two seemingly completely different approaches based on properties of a particle with respect to its local light cone and calculating its velocity in the locally nonrotaing frame directly. In doing so, we do not assume that particles move along geodesics. Usually, a particle reaches a horizon having the velocity equals that of light. However, there is also case of "critical" particles for which this is not so. It is just the pair of usual and critical particles that leads to the effect under discussion. The similar analysis is carried out for massless particles. Then, critical particles are distinguishable due to the finiteness of local frequency. Thus, both approach based on geometrical and kinematic properties of particles moving near the horizon, reveal the universal character of the effect.

Submission history

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