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Energy Extraction from Black Holes via Penrose Process and BSW Mechanism

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The theory of general relativity successfully describes a huge variety of phenomena at large scales. This study is focused on one of the most interesting structures allowed by this theory: black holes.
To understand the relation between the geometry of a spacetime and the physics of its black holes, it is important to study the orbits of test particles. This work was previously performed for several general relativity black hole solutions. It is also essential to understand how the black holes spacetime structure affects the energy of the surrounding particles. In particular, it can be shown that charged black holes and rotating black holes have regions of negative energy, allowing energy extraction from the black hole to particles, via Penrose process. Particle collisions near black hole horizons can also, under some circumstances, amplify the energy in the center of mass frame, via Bañados-Silk-West mechanism, BSW mechanism for short.
Some new theories beyond general relativity involve a larger number of space dimensions. In order to test those theories, it is important to check the stability of orbits for these d-dimensional spacetimes. Calculations have been previously done for Schwarzschild and Reissner-Nordström spacetimes. In this study, we want to extend this procedure for charged particles, rotating black holes and spacetimes with cosmological constant, investigating also the energy extraction mechanisms in those spacetimes.

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