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Particle dynamics and new horizon structure around Kerr-Newman singularity

In this talk, the particle motion around the naked singularity and black hole of Kerr-Newman spacetime will be discussed with a special attention on the closed timelike orbits. For KN black hole, the Cauchy surface is always located inside the inner horizon where particles with positive angular momentum that co-rotate with the spacetime can only pass through. It is found that in both the naked singularity and black hole, the singularity is covered by causality violating regions and only particles with positive angular momentum can traverse within the closed timelike curves. In both the cases, test particles are confined at a distance significantly far from the singular point such that there always exists an empty region surrounding the singularity which prevents particles from interacting with it. The radius of the empty surface that depends on the source parameters and the particle characteristics, is investigated with a precise expression. This study provides a thorough insight on the intricate dynamics of particles near singularities in Kerr-Newman geometry.

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