Title: Chronology Protection Problem in Modified Kerr Newman Spacetimes.

Authors:

Vaishak Prasad, IUCAA, Pune, India.

Rahul Srinivasan, BITS Pilani Hyderabad Campus, Hyderabad, India

Sashideep Gutti, BITS Pilani Hyderabad Campus, Hyderabad, India

Abstract: In this talk, we discuss the problem of chronology protection in the context of modified Kerr-Newman solutions. We choose, for the above problem, the causality violation due to the existence of closed timelike curves in the Kerr-Newman black hole. We first revisit and quantify the details of the causality violation in the Kerr-Newman spacetime. We then show that the issue also extends onto two of the modified Kerr-Newman solutions: the noncommutative geometry–inspired solution and the f(R)-gravity modified solution. The geodesic connectivity of the causality violating region is discussed in both the scenarios, and the existence of null geodesics that contain points from the region is demonstrated. We also explore the possibility of mechanisms present within the model that can prevent causality violation. It is shown that although in both the models the model parameters can be chosen such that the causality violating region is eliminated, the resolution in the f(R) case is not consistent with cosmological observations. In the case of the noncommutative geometry–inspired solution, we argue that the chronology protection can be ensured by choosing suitable values for the noncommutative parameter, thereby eliminating the causality violating region. We also discuss the causal aspects of Kerr-Newman–de Sitter/anti–de Sitter spacetimes.

Reference: Phys. Rev. D **99**, 024023 – Published 14 January 2019