



IV Amazonian Workshop on Black Holes and Analogue Models of Gravity

May 11th - 15th 2015
Federal University of Pará

Scalar waves interacting with regular black holes

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Accretion of fields by black holes is a subject of great interest in physics. It is known that accretion plays a fundamental role in active galactic nuclei and in the evolution of black holes. Accretion of fundamental fields is often related to the study of absorption cross section. Basically all black holes for which absorption of fields has been studied so far present singularities. However, even within general relativity, it is possible to construct regular black holes: objects with event horizons but without singularities. Many physically motivated regular black hole solutions have been proposed in the past years, demanding the understanding of their absorption properties. We study the absorption of planar massless scalar waves by Bardeen regular black holes. We compare the absorption cross section of Bardeen and Reissner–Nordström black holes, showing that the former always have a bigger absorption cross section for fixed values of the field frequency and of the normalized black hole charge. We also show that it is possible for a Bardeen black hole to have the same high-frequency absorption cross section of a Reissner–Nordström black hole. Our results suggest that, in mid-to-high-frequency regimes, regular black holes can have compatible properties with black holes with singularities, as far as absorption is concerned.