

Invited Speaker

Name: Pedro Cunha

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Title: Testing the Kerr hypothesis using the black hole shadow and gravitational lensing

Abstract: The image of M87* by the Event Horizon Telescope (EHT) has created a valuable opportunity to test the nature of Black Hole (BH) candidates in the cosmos. The Kerr hypothesis, which is motivated by multiple uniqueness theorems, states that astrophysical BHs are well described by the Kerr metric. However, alternative Kerr objects with possible astrophysical relevance can be constructed by circumventing these theorems. This talk will discuss the prospect of testing the Kerr hypothesis using shadow observations of the EHT. Notably, promising high-energy theories feature hypothetical ultralight bosonic fields that could spontaneously form macroscopic bosonic halos around black holes, via superradiance, transferring part of the mass and angular momentum of the black hole into the halo. By studying the shadows of such "hairy" black holes, we can constrain the amount of hair which is compatible with the EHT observations of M87*. We will also discuss a recent theorem establishing that an equilibrium Black Hole must admit, under generic conditions, at least one circular Light Ring orbit outside the horizon. These orbits are critical to determine the BH shadow edge. The proof relies on a topological argument and makes virtually no assumptions on the matter content or gravity model.