CIDMA CENTRO DE I&D EM MATEMÁTICA E APLICAÇÕES
CENTER FOR R&D IN MATHEMATICS AND APPLICATIONS

universidade de aveiro

# Gravitational Geometry and Dynamics Group Seminar

Thu., May 8, 2025, at 11h00.

**Room: 10.3.7** and **Zoom ID:** 955 4130 8539

(*Password: contact jnicoules@ua.pt*)


## Galin Gyulchev

Sofia University "St. Kliment Ohridski", Faculty of Physics, Department of Theoretical Physics


## Visual Signatures of Scalar Hair in the Images of Accretion Disks and Shadows of Rotating Hairy Black Holes


We examine the images and shadows of thin accretion disks around rotating hairy black holes characterized by two non-trivial, time-periodic scalar fields, whose target space possesses non-flat Gaussian curvature. These black holes represent a viable alternative to the Kerr solution, exhibiting a significantly richer geodesic structure that influences both the accretion disk images and their associated shadows. By investigating how variations in scalar hair - quantified by a normalized charge - and the underlying curvature affect the observable features of the system, we identify distinct regimes in the visual appearance of both the disks and their shadows. For high values of the normalized charge, approaching the boson star limit, the shadow regions display chaotic patterns with numerous small, disconnected components across all curvatures. At moderately high levels of scalar hair, the chaotic nature of the shadows persists, yet a dominant central dark region begins to emerge, whose size and shape are strongly dependent on the Gaussian curvature. The accretion disk images reflect this transition: in low curvature target space, the disk appears highly distorted and fragmented, while increasing curvature leads to more coherent, symmetric, and stable configurations. As the normalized charge decreases further, both the disk and shadow images gradually converge toward those typical of the Kerr black hole, with the influence of the curvature becoming progressively less significant.


More about Gr@v at: gravitation.web.ua.pt


The Gr@v Seminars are supported in part by the FCT – Portuguese Foundation for Science and Technology, through projects 2022.04560.PTDC and 2024.05617.CERN and through CIDMA – Center for Research and Development in Mathematics and Applications, under the FCT Multi-Annual Financing Program for R&D Units .

fct Fundação para a Ciência e a Tecnologia

MARIE CURIE ACTIONS