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

Fri., December 12, 2025, at 11h00.

Room: 11.2.21 and **Teams ID:** 350 380 787 671 1

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New Aspects of spontaneous scalarization of black holes beyond General relativity

Spontaneous scalarization is a mechanism that allows black holes to develop a non-trivial profile of a scalar field "scalar hair" because of tachyonic instabilities, enabling tests of gravity beyond General Relativity. Motivated by stability and threshold issues in Gauss-Bonnet scalarization, we propose a new model characterized by two nonminimal couplings of the scalar field to both Gauss-Bonnet curvature and a U(1) gauge field (e.g. electromagnetic field). The presence of two distinct sources of tachyonic instability broadens the conditions for spontaneous scalarization. We track how the electric charge and the coupling constants govern the onset of the scalar field and derive new solution branches with nontrivial scalar profiles. Numerical integration shows multiple coexisting scalarized black hole solutions with adjustable thresholds, influenced by the relative strengths of curvature and matter couplings. We examine their scalar charge, horizon properties, and thermodynamic characteristics, demonstrating how the model can selectively activate or suppress scalarization phenomena. The matter source term modifies the scalarization onset and promotes stable solutions, as indicated by the evolution of the scalar charge and horizon quantities. These findings suggest an alternative approach to scalarization, may avoid the instabilities of curvature-only or matter-only models, and offer new ways to test strong-gravity effects in upcoming observations.

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

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