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Spontaneous scalarization in the presence of magnetic fields

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The phenomenon known as "Spontaneous Scalarization", a deviation of Einstein's field equations that arise once a certain threshold in curvature is exceeded, and hence circumventing the no-hair theorems, has attracted lots of attention recently due to the possibility of allowing scalarized solutions to exist while the weak field regime is still unchanged. It was first described for neutron stars, in which a massless scalar field is coupled to a traceless energy-momentum tensor. This approach was generalized to massive scalar fields, and recently generalized to vacuum solutions of Einstein's field equations. In the latter, the process can be triggered by a coupling between the scalar field and a matter content, such as the electromagnetic tensor, as well as high-order curvature terms, like the Gauss-Bonnet invariant. Furthermore, it has been shown that the phenomenon appears even in the absence of a compact object. Melvin Universe, which describes a self-gravitating magnetic field, can undergo spontaneous scalarization for magnetic as well as high curvature couplings (see 1 and references therein). (1) The above suggests that these two couplings are qualitatively different in nature. In this project, we aim to contribute to this discussion by considering a solution describing an uncharged black hole immersed in a magnetic field.

Palavras-chave: Generalized theories of gravity. Blach hles. Spontaneous scalarization.

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Referências:

1 BRIHAYE, Y.; CAPOBIANCO, R.; HARTMANN, B. Spontaneous scalarization of self-gravitating magnetic fields. **Physical Review D** v. 103, n. 12, p. 124020, 2021.