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Einstein-Charged Scalar Field Theory: Black Hole Solutions and Their Stability.

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A charged scalar field can be used to extract energy from a charged black hole via superradiant scattering. A mirror-like or AdS boundary could lead the system to an instability. This is because the scalar fields are trapped outside the black hole and repeatedly amplified, therefore ultimately the back-reaction on the black hole background will become non-negligible.

A charged scalar field on the Reissner-Nordström background with a mirror has been shown to possess a superradiant instability [1]. However the possible end-point of this superradiant instability remains unknown. In this talk, I will consider a fully coupled system consisting of gravity, an electric field and a charged scalar field with a mirror. By solving the field equations, numerical solutions representing charged hairy black holes are obtained. Then I will comment on the stability of these solutions. More details of this work are to appear in

Ref. [2].

References

[1] Juan Carlos Degollado, Carlos A. R. Herdeiro, and Helgi Freyr Rúnarsson. Rapid growth of superradiant instabilities for charged black holes in a cavity. *Phys.Rev.*, D88:063003, 2013.

[2] Sam Dolan, Supakchai Ponglertsakul, and Elizabeth Winstanley. Article in preparation.

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