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M. de Cesare: Evolving black hole with scalar field accretion

Tuesday 20 December 2022 16:45 (15 minutes)

I will present a new method to study evolving black holes in general relativity. Approximate analytical solutions are obtained by expanding the Einstein field equations close to the trapping horizon for a dynamical spherically symmetric black hole in the presence of a minimally coupled self-interacting scalar field. This is made possible by a new parametrization of the metric, in which the displacement from the horizon as well as its expansion rate feature explicitly. Our results are valid in a neighbourhood of the horizon and hold for any scalar field potential and spacetime asymptotics. An exact equation for the accretion rate is also obtained, which generalizes the standard Bondi formula. We also develop a dynamical system approach to study near-equilibrium black holes; using this formalism, we focus on a simple model to show that the near-equilibrium dynamics is characterized by simple scaling relations among dynamical variables. Moreover, we show that solutions with purely ingoing energy-momentum flux never reach equilibrium.

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