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Constraining modified gravity theories with physical black holes

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The existence of black holes is one of the key predictions of general relativity (GR) and therefore a basic consistency test for modified theories of gravity. In spherical symmetry, only two classes of GR solutions are compatible with the formation of a regular apparent horizon in finite time of a distant observer. In this talk, I will demonstrate how to derive constraints that any self-consistent modified gravity theory must satisfy to be compatible with their existence. In addition, I will discuss their properties, highlight characteristic features, and illustrate the construction on some popular modified theories of gravity, e.g. the Starobinsky model. Both of the GR solutions can be regarded as zeroth-order terms in perturbative solutions of this model. On the other hand, it is also possible to construct non-perturbative solutions without a well-defined GR limit.

Note: some of the results presented in this talk are summarized in arXiv:2012.11209.

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