General Relativity and Quantum Cosmology

Black holes in modified gravity theories

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In the context of $f(R)$ gravity theories, the issue of finding static and spherically symmetric black hole solutions is addressed. Two approaches to study the existence of such solutions are considered: first, constant curvature solutions, and second, the general case (without imposing constant curvature) is also studied. Performing a perturbative expansion around the Einstein-Hilbert action, it is found that only solutions of the Schwarzschild-(Anti-) de Sitter type are present (up to second order in perturbations) and the explicit expressions for these solutions are provided in terms of the $f(R)$ function. Finally we consider the thermodynamics of black holes in Anti-de Sitter space-time and study their local and global stability.

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