

A loop quantum gravity inspired effective action in spherically symmetric background and its applications

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Developing covariant effective descriptions of quantum-corrected black holes is an important challenge in loop quantum gravity (LQG). In this talk, I will present an LQG-inspired effective action in spherical symmetry that admits the quantum Oppenheimer–Snyder (q-OS) black hole as a vacuum solution. Starting from a two-dimensional dilaton gravity framework obtained by integrating out the angular degrees of freedom, the construction introduces an auxiliary constraint sector that promotes the mass parameter to a spacetime scalar and enforces its constancy on shell, without introducing local propagating degrees of freedom. Using the covariant phase space formalism, I will discuss the associated Hamiltonian charges and black hole thermodynamics. The Wald entropy contains the classical area term together with a logarithmic correction, while the auxiliary sector contributes a boundary term essential for a consistent first law. I will then present a generalized Birkhoff theorem showing that the vacuum sector admits a two-parameter family of locally static solutions. The additional integration constant is not fixed by asymptotic flatness, and setting it to zero selects the q-OS branch. Its variation raises an integrability issue for the thermodynamic phase space. These results provide a covariant framework for investigating quantum-corrected black hole dynamics, entropy, and the physical conditions required to select particular vacuum solutions.

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