Contribution ID: **229** Type: **Talk**

Thermodynamic properties of regular black holes from pure gravity

Tuesday, 24 June 2025 14:40 (15 minutes)

Candidate theories of quantum gravity are widely expected to resolve the singularities predicted by general relativity. In the absence of a complete theory, singularity-free models —often referred to as regular black holes —have emerged as a compelling alternative, sidestepping the problematic causal structure of their classical counterparts. A rather ubiquitous prediction across various quantum gravity frameworks is the presence of higher-order curvature corrections to the gravitational action. We show that, within quasitopological gravity, an infinite series of such terms can generically lead to singularity resolution in D $geqslant5$ dimensions. We also perform a detailed analysis of the resulting black hole thermodynamics, which lies at the intersection of quantum gravity, information theory, and geometry. Notably, the equation of state displays features reminiscent of fluids with finite molecular volume. In addition, we investigate singularity resolution in $D = 4$ through nonlinear electrodynamics with magnetic charge, comparing the relevant phase structure of and discussing implications for relativistic quantum information and the internal geometric structure of regular black holes. [1] R. A. Hennigar, D. Kubizňák, S. Murk, and I. Soranidis, Thermodynamics of regular black holes in anti-de Sitter space (in preparation) [2] F. Simovic and I. Soranidis, Euclidean and Hamiltonian thermodynamics for regular black holes, https://doi.org/10.1103/PhysRevD.109.044029

Primary authors: KUBIZŇÁK, David (Charles University); SIMOVIC, Fil (Macquarie University); SORANIDIS, Ioannis (Macquarie University); HENNIGAR, Robie A. (Durham University); MURK, Sebastian (Okinawa Institute of Science and Technology)

Presenter: SORANIDIS, Ioannis (Macquarie University)

Session Classification: Tuesday Parallel Session C