NEW YORK CITY COLLEGE OF TECHNOLOGY
Physics Department
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Enthalpy and Isoperimetric Inequalities for Black Holes in Gravity and Supergravity

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Abstract

Various aspects of the geometry and the thermodynamics of black holes in gravity with a cosmological constant, and in gauged supergravities, are explored. In such theories, where the gauge coupling or the cosmological constant can be thought of as an integration constant arising from a higher-dimensional origin, it becomes appropriate to think of it as an additional thermodynamic variable associated with a pressure. The conjugate variable defines a "volume" for the black hole, although its geometric interpretation becomes quite subtle if the black hole is rotating. We discuss the generalised Smarr-Gibbs-Duhem relation that is obeyed when the volume is included, and its derivation through a generalisation of Komar integral methods. We discuss also how the volume, and the area of the black hole event horizon, satisfy an intriguing inequality that is closely related to the usual isoperimetric inequality in Euclidean space.

Light refreshments will be served.