Department of Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

The classical interior of charged black holes with AdS asymptotics

(Zoom Seminar)

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Zoom link shall be shared separately

The gravitational dual to the grand canonical ensemble of a large N holographic theory is a charged black hole. These spacetimes can have Cauchy horizons that render the classical gravitational dynamics of the black hole interior incomplete. We show that a (spatially uniform) deformation of the CFT by a neutral scalar operator generically leads to a black hole with no inner horizon. There is instead a spacelike Kasner singularity in the interior. For relevant deformations, Cauchy horizons never form. We then consider charged scalars, which are known to condense at low temperatures, thus providing a holographic realization of superconductivity. We look inside the horizon of these holographic superconductors and find intricate dynamical behavior. The spacetime ends at a spacelike Kasner singularity, and there is no Cauchy horizon. Before reaching the singularity, there are several intermediate regimes which we study both analytically and numerically. These include strong Josephson oscillations in the condensate and possible `Kasner inversions' in which after many e-folds of expansion, the Einstein-Rosen bridge contracts towards the singularity. Due to the Josephson oscillations, the number of Kasner inversions depends very sensitively on temperature, and diverges at a discrete set of temperatures that accumulate at the critical temperature. Near these discrete set of temperatures, the final Kasner exponent exhibits fractal-like behavior.

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