

Physics Seminar: Matthew Heydeman

Wednesday, October 4 · 2:00 – 3:00pm

Location: 313

Title: Probing Supersymmetric Black Holes with Surface Defects

Abstract: Supersymmetric black holes in Anti de-Sitter space have recently been shown to have a large number of exactly degenerate microstates, and it is an open problem to probe and ultimately distinguish these microstates in terms of the bulk degrees of freedom. In the first part of the talk, we will review how AdS5 black hole microstates may be reliably counted in the dual N=4 SYM theory using the 1/16 BPS superconformal index and how this result is reproduced by the bulk gravitational path integral in the near BPS / N=2 super JT gravity limit. This perspective also suggests a "mass gap" between BPS and near-BPS quantum black holes. With the goal of understanding more detailed properties involving the BPS black holes using the bulk description, we will turn to the question of whether there are supersymmetric probes of the black hole which have an exact field theory dual. We find one such candidate is the superconformal index with the insertion of a Gukov-Witten surface operator of N=4 SYM, dual to a D3 brane which wraps the AdS5 black hole horizon. We find a saddle with a large N growth which can be exactly matched to the probe brane action, and further conjecture a generalized Cardy formula for surface defects in holographic 4d SCFT's. In addition to detecting the familiar deconfinement transition associated to the dominance of the bulk black hole saddle, this provides an example of a system in which a black hole interacts with other degrees of freedom which has a microscopic description.