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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. 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 superconformal index, a partition function preserving 1/16-supersymmetry. We discuss some of the surprising implications for the bulk gravitational path integral as well as the relationship to super JT gravity, which demonstrates that the BPS and near-BPS black holes are separated by a mass gap at strong coupling.

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. 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.