"The Quantum Structure of Black Holes"

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Type: These.

String theory is a quantum theory of gravity, and has had several astounding successes in describing properties of black holes. Recent progress in string theory points to the possibility that black holes should not be thought of as fundamental objects, but rather as statistical descriptions of a huge number of smooth horizonless microstate geometries, or fuzzballs. If correct, this "fuzzball proposal" will revolutionize our understanding of black holes and quantum gravity in general: the classical black hole solution would be like the analogue of the thermodynamic description of a gas, while the horizonless microstates would be the analogue of the statistical description of this gas.

Establishing this requires the construction and counting of very large classes of solutions that have the same charges, mass and angular momentum as a black hole, but have no horizon. We plan to attack this problem in the context of supergravity theories that emerge as low-energy limits of string theory, and to construct large classes of such solutions, both for supersymmetric and for non-supersymmetric black holes. We also plan to study these solutions using the AdS-CFT correspondence.

A background in general relativity and quantum field theory is necessary.