

Séminaire de matrices, cordes et géométries aléatoires

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Orme des Merisiers Salle Claude Itzykson, Bât. 774

**Emergent classical spacetime from microstates of an
incipient black hole**

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Black holes have an enormous underlying space of microstates, but universal macroscopic physics characterized by mass, charge and angular momentum as well as a causally disconnected interior. This leads two related puzzles: (1) How does the effective factorization of interior and exterior degrees of freedom emerge in gravity?, and (2) How does the underlying degeneracy of states wind up having a geometric realization in the horizon area and in properties of the singularity? We explore these puzzles in the context of an incipient black hole in the AdS/CFT correspondence, the microstates of which are dual to half-BPS states of the N=4 super-Yang-Mills theory. First, we construct a code subspace for this black hole and show how to organize it as a tensor product of a universal macroscopic piece (describing the exterior), and a factor corresponding to the microscopic degrees of freedom (describing the interior). We then study the classical phase space and symplectic form for low-energy excitations around the black hole. On the AdS side, we find that the symplectic form has a new physical degree of freedom at the stretched horizon of the black hole, reminiscent of soft hair, which is absent in the microstates. We explicitly show how such a soft mode emerges from the microscopic phase space in the dual CFT via a canonical transformation and how it encodes partial information about the microscopic degrees of freedom of the black hole.
