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The instability of Anti-de Sitter spacetime for the Einstein-scalar field system

The AdS instability conjecture provides an example of weak turbulence appearing in the dynamics of the Einstein equations in the presence of a negative cosmological constant. The conjecture claims the existence of arbitrarily small perturbations to the initial data of Anti-de Sitter spacetime which, under evolution by the vacuum Einstein equations with reflecting boundary conditions at conformal infinity, lead to the formation of black holes after sufficiently long time.

In this talk, I will present a rigorous proof of the AdS instability conjecture in the setting of the spherically symmetric Einstein-scalar field system. The construction of the unstable initial data will require carefully designing a family of initial configurations of localized matter beams and estimating the exchange of energy taking place between interacting beams over long periods of time, as well as estimating the decoherence rate of those beams. I will also discuss possible paths for extending these ideas to the vacuum case.