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Why does black hole describe the deconfinement phase?

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In the gauge/gravity duality, the deconfinement transition in the gauge theory is identified with a formation of black hole in the dual gravity theory. By assuming this correspondence, many predictions on QGP have been made. In this talk, we justify this approach quantitatively, and also provide intuitive understanding. Firstly we give quantitative evidence for this identification from the thermodynamic study of the supersymmetric theory. We show that black hole and Yang-Mills theory give the same answer, even at finite temperature, including the 1/N correction. Then we consider generic gauge theories, including QCD, and show that the deconfinement transition is the condensation of very long and self-intersecting QCD strings, which is analogous to the formation of a black hole in string theory. We provide a concrete picture by using lattice gauge theory and matrix models in the Hamiltonian formulation,
and give numerical evidence supporting this interpretation. We also argue how the fast thermalization of the QGP can be understood from this viewpoint.

This talk is based on the following work:

Hanada, Hyakutake, Ishiki and Nishimura, Science (2014)[arxiv:1311.5607].
Hanada, Maltz and Susskind, arxiv:1405.1732[hep-th].

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