NSYSU physics 書報討論

Weekly Seminar

Black Hole from Entropy Maximization

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URL QR

14:10-15:00 Thu-26/Sep/2024, at PH2006

Abstract

The identity of a black hole is still mysterious theoretically and observationally. It has the thermodynamic entropy (proportional to its surface area: the Bekenstein-Hawking formula). According to thermodynamics and statistical mechanics, the origin of thermodynamic entropy is quantum. Therefore, a black hole should be essentially a quantum object. So, what is the quantum definition/characterization of black holes? One candidate, motivated by holography and thermodynamics, is that a black hole maximizes thermodynamic entropy for a given surface area. As a step towards exploring this possibility, we study typical spherical static configurations as self-gravitating quantum many-body systems in a mean-field approximation of quantum gravity (semi-classical Einstein equation), and find a picture of black holes: A radially-uniform dense configuration without horizon or singularity. The interior metric is a self-consistent and non-perturbative solution for Planck's constant. The maximum entropy, given by the volume integral of the entropy density, agrees with the Bekenstein-Hawking formula through self-gravity, leading to the holographic entropy bound for thermodynamic entropy. Finally, we see a speculative view that the configuration represents semi-classically a quantum-gravitational condensate. [arXiv:2309.00602]

Location 地址:
PH2006