# 879th ASRC Seminar

Date: Wednesday, October 2nd, 13:30~15:00

Location: At the second-floor lobby of ASRC or Online.

Speaker: Yuki Yokokura, D.Sci.
(RIKEN Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS))

Title: **Black Hole from Entropy Maximization**

要旨:

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] (For a broad audience to enjoy this talk, I will first explain the motivation and background, and try to keep the expression as simple and physical as possible.)

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