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How to make a quantum black hole with ultra-cold gases

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We argue that a small, quantum black hole can be made from atoms and lasers.

The holographic principle claims that the quantum gravitational systems, e.g. superstring theory, is equivalent to non-gravitational quantum systems, e.g. super Yang-Mills theory. Here the 'equivalence' means two theories cannot be distinguished even in principle. Therefore, if the holographic principle is true, then by engineering the non-gravitational systems by using an optical lattice, one can create actual quantum black holes.

In this presentation, we consider the simplest example: the Sachdev-Ye-Kitaev (SYK) model.

We design an experimental scheme for creating the SYK model with use of ultra-cold fermionic atoms.

This presentation is based on a paper "Creating and probing the Sachdev-Ye-Kitaev model with ultracold gases: Towards experimental studies of quantum gravity," arXiv:1606.02454 with Ippei Danshita (Yukawa Institute for Theoretical Physics, Kyoto University) and Masaki Tezuka (Department of Physics, Kyoto University).

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