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16th RQC Colloquium

Nanofiber Cavity Quantum Electrodynamics Systems for Distributed Quantum Computing

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Sep. 13, 2023(Wed) **16:00–17:00**(JST)

This colloquium will be held in HYBRID format.

On-site Venue: Wako C61 Wako Welfare and Conf. 2F Large Meeting Room Online

Online Venue: Zoom. To receive the link, register in advance at https://krs2.riken.jp/m/rqc_registration_form

Distributed quantum computing, where many quantum processing units containing small to moderate number of qubits are connected to form a large-scale quantum network, is a promising approach to realize a quantum system with a large number of qubits required for fault-tolerant universal quantum computing.

Cavity quantum electrodynamics (QED) systems, where atoms and photons are confined and interacts within optical cavities, can be utilized to construct a distributed quantum computer, if one could place many atoms in a cavity while maintaining strong coupling between individual atoms and the cavity, individually address the atoms, operate quantum gates on selected atoms, and connect multiple cavity QED systems with low losses. These tasks have been difficult to achieve with conventional cavity QED systems based on free-space cavities. In order to overcome these difficulties with the conventional cavity QED systems, we have been developing novel cavity QED systems based on optical nanofibers and neutral atoms.

In this talk, I will present our experimental research on a nanofiber cavity QED system with a trapped single atom in the strong coupling regime, the setting of coupled-cavities QED, where two nanofiber cavity QED systems are coherently connected by a meter-long low-loss channel in an all-fiber fashion, development of high-finesse nanofiber cavities for achieving high cooperativity, and the recent progress toward distributed quantum computing with nanofiber cavity QED systems.