Fully-quantum learning: Higher-order quantum algorithms for comparison and inversion of unknown unitary operations

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This colloquium will be held in **HYBRID** format.
On-site Venue: Wako C61 Welfare and Conference Building, 2F Large Meeting Room
Online Venue: Zoom. To receive the link, register in advance at
https://krs2.riken.jp/m/rqc_registration_form

Quantum learning is learning properties of unknown quantum objects (states and operations) by connecting the objects to a quantum computer. Fully-quantum learning is directly calculating a specific property of a quantum object by a quantum computer without extracting unnecessary classical information about the quantum objects and formalized by a higher-order quantum transformation (a map of a map). We first present a higher-order quantum algorithm that optimally compares two unknown unitary operations with multiple calls of each unitary operation [1]. Then, we present another higher-order quantum algorithm to learn and apply the inverse of an unknown unitary operation with finite calls of the unitary operation [2].

[1] Y. Hashimoto, A. Soeda and M. Murao, arXiv:2208.12519
[2] S. Yoshida, A. Soeda and M. Murao, Phys. Rev. Lett. **131**, 120602 (2023)