Development of analog optical quantum computer at RIKEN

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We have developed an optical quantum computer based on continuous-variable measurement-based principles. This optical quantum computer offers several distinct advantages over other quantum computing platforms, including fast clock frequencies, high scalability, room-temperature operation, and compatibility with telecom technology. For example, its clock frequency has the potential to achieve remarkable speeds thanks to the THz bandwidth of optical resource devices. In addition, time-multiplexing techniques with a compact setup enable a significant increase in both the number of inputs and operations achievable.

Our optical quantum computer employs four optical parametric oscillators, along with a tailored interferometer to generate a large-scale entanglement in the time domain. Quantum operations are executed through measurements on this entanglement. This optical quantum computer focuses on analog quantum computation, enabling linear transformations on 101 continuous-variable input modes with a 100 MHz clock frequency. The system is connected to the cloud, and a software development kit has been developed to improve usability. In this presentation I will explain the principles and current status of the optical quantum computer at RIKEN.

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