プログラム名：量子人工脳を量子ネットワークでつなぐ高度知識社会基盤の実現
PM名：山本　喜久
プロジェクト名：量子人工脳

委 託 研 究 開 発

実 施 状 況 報 告 書（成果）

平成27年度

研究開発課題名：

Pursuit of the novel working principle of quantum artificial brain

研究開発機関名：

スタンフォード大学

研究開発責任者

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1. Activities, Accomplishment and Findings

   We have succeeded in implementing a measurement-feedback-based OPO Ising machine with N=100 pulses (spins). To achieve this, we have developed a synchronously-pumped 160-pulse fiber-ring-cavity OPO, which is actively stabilized. We have built a custom FPGA system for performing the real-time measurement-feedback action, and have integrated the FPGA system with the optical system via a balanced homodyne detector and ADC setup (on the input) and a pair of fiber-based electro-optic modulators and DAC (on the output).

   We have tested our system by programming in a variety of Ising models, and have found that the system can produce absolute ground states with non-zero success probability, in many cases exceeding 1%. This includes the canonical N=16 ring-and-spoke graph first investigated at RIKEN/NII by Takata, Marandi, *et al.*, and all extensions of the ring-and-spoke graph up to N=100.

   We exhaustively studied all possible cubic graphs with 16 vertices, and found that our system can find the ground state for every single instance. We also studied random cubic graphs with up to 100 vertices, and found that the system can also obtain the ground state for such graphs.

2. Outreach, Events and Other Activities

   None.