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２８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

Martin M. Fejer

1. Activities, Accomplishment and Findings

   In Year 1, we have succeeded in implementing a measurement-feedback-based OPO Ising machine with N=100 pulses (spins). In Year 2 we have focused on three areas: A.) testing the performance of this prototype system; B.) developing models to explain the results of the prototype system and to suggest ways to improve the system; C.) development of free-space experiments to directly explore the quantum features of OPO networks.

   For A.), we have benchmarked the system with a wide variety of Ising problems with Jij in {0,1}. In addition to our previous findings about cubic graphs, we found that the machine can solve random graphs with fixed numbers of edges. We varied the edge density from 0 to 1, and found that we could solve random graphs with any edge density to tried. This was done with the full number of spins (graph nodes), i.e., N=100.

   For B.), we have developed several models and have implemented them numerically on classical computers. We have been using these models to explore alternative parameter regimes for our experimental machines to operate in.

   For C.), we have built and tested the nonlinear optics components of the apparatus to lock the carrier-envelope-offset frequency of a Ti:Saph mode-locked laser. We also evaluated the performance of a Laser Quantum laser, and made progress on experiment design.

2. Outreach, Events and Other Activities

   None.