Abstract Submitted
for the DAMOP19 Meeting of
The American Physical Society

Polarization-Independent Photon Storage System with Variable Time Delay[1] MICHELLE VICTORA, SPENCER JOHNSON, University of Illinois at Urbana-Champaign, FEDOR BERGMANN, Bergmann Messgeraete Entwicklung KG, MICHAEL GOGGIN, Truman State University, PAUL KWIAT, University of Illinois at Urbana-Champaign — Quantum optical memories are a key component for a variety of quantum information applications, from extending quantum communication channels to building high-efficiency single-photon sources. However, current broad bandwidth photon storage systems we've seen operate at somewhat low efficiency and short storage times (on the order of 10 ns). Here we develop a system with multiplexed free-space storage cavities, able to store single photons with high efficiency over variable delays [N x 12.5 ns, $1 \leq N \leq 999$], and over several nanometers bandwidth. The system can store multiple photons simultaneously and can potentially store qubits encoded in various degree of freedoms (e.g., polarization, timing, and spatial modes). We have demonstrated a process fidelity >98% for storage times up to 125 ns and >90% for up to 500 ns. A future goal for this experiment is to achieve storage of hyperentanglement. While previous hyperentangled photon storage systems only achieved 5% efficiency, we have currently demonstrated fiber-coupled transmission above 65% for delay times up to 125 ns, and free-space transmission above 50% for delay times up to 5 μs.

[1]This work is supported by NSF Grant No. 1521110.

Michelle Victora
University of Illinois at Urbana-Champaign

Date submitted: 01 Feb 2019 Electronic form version 1.4