All-optical cluster-state generation using Rydberg dipole blockade T. BRAGDON, E. KUZNETSOVA, University of Connecticut, S.F. YELIN, University of Connecticut, ITAMP Harvard-Smithsonian Center for Astrophysics — We analyze the generation of cluster-states, which are useful in one-way quantum computing architectures, in a 2D array of Rydberg atoms. Dipole blockade is used as a mechanism for controlled-Z operation between nearest neighbors. Applying an electric field gradient allows individual atomic addressing due to spatially dependent Stark-shifts. The latter combined with a train of optical pulses tailored to resonantly excite spatially selected pairs of atoms is proposed to entangle nearest neighbors. In order to efficiently generate a 2D cluster-state, we apply this protocol in parallel to non-interacting 1D chains of atoms.

Timothy Bragdon
University of Connecticut