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Remote Atom Entanglement DAVID MOEHRING, FOCUS Center and University of Michigan Department of Physics, MARTIN MADSEN, BORIS BLINOV, RUDOLPH KOHN, CHRISTOPHER MONROE — We report on progress toward the quantum entanglement between two remotely located atoms via the joint detection of emitted photons from each atom. In the experiment, single $^{111}Cd^{+}$ ions are trapped in two different ion traps spaced by 1 meter. Each atom is excited to a state with multiple decay channels and the atomic spin becomes probabilistically entangled with the spontaneously emitted photon's polarization [1]. When the two photons are detected in coincidence, the two atoms are expected to be left in a known Bell state. Even though this is established at random times, the atom-atom entanglement is "heralded" by the joint detection of the two photons, and becomes a resource for further quantum information processing. This work is supported by the U.S. National Security Agency and the Advanced Research and Development Activity under Army Research Office contract, and the National Science Foundation ITR program. 1. *"Observation of Entanglement between a Single Trapped Atom and a Single Photon"*, B.B. Blinov, D.L. Moehring, L.-M. Duan, C. Monroe, Nature (London) **428**, 153 (2004).

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