Abstract Submitted
for the DAMOP06 Meeting of
The American Physical Society

Heralded entanglement between remote atomic ensembles HUGUES DE RIEDMATTEN, CHIN-WEN CHOU, DANIEL FELINTO, SERGEY POLYAKOV, JEFF KIMBLE, California Institute of Technology, STEVEN VAN ENK, Bell labs, Lucent Technologies — A critical requirement for diverse applications in Quantum Information Science is the capability to disseminate quantum resources over complex quantum networks. This requires deterministic or heralded storage of entanglement between remote locations. Atomic ensembles appear to be a promising candidate for this task . In this contribution we report observations of entanglement between two atomic ensembles located on different tables in distinct apparatuses separated by 2.8 meters [1]. Quantum interference in the detection of a photon emitted by one of the samples projects the otherwise independent ensembles into an entangled state with one joint excitation stored remotely in $\sim 10^5$ atoms at each site. After a delay of 1 μs to demonstrate quantum memory, we confirm entanglement by mapping the state of the atoms to optical fields and by measuring mutual coherences and photon statistics for these fields. We thereby determine a quantitative lower bound for the entanglement of the joint state of the ensembles. Although the entanglement creation is probabilistic, the initial detection heralds unambiguously the creation of an entangled state between the two ensembles, which can be stored and is physically available for subsequent utilization. [1] C.W. Chou et al, Nature **438,** 828-832(2005)

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Date submitted: 27 Jan 2006 Electronic form version 1.4