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Entanglement generated by dissipation and steady state entanglement of two atomic ensembles

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Room temperature atomic ensembles in spin protecting cells have become a versatile resource for quantum memory and quantum sensing [1,2,3]. Dissipation has always been the main factor limiting the life time of entanglement. We have demonstrated [4] that using both vector and tensor parts of the atomic polarizability we can engineer forward scattering from two ensembles which works as a dissipation process into a reservoir joint for both ensembles. This collective dissipation leads to generation of entanglement between the two ensembles of atoms which can be sustained for up to 40 msec, much longer than the decoherence - limited entanglement life time of 2 msec. Combining the dissipation mechanism with the continuous measurement, we demonstrate steady state atomic entanglement observed for up to an hour. At any unspecified moment the dissipation mechanism can be switched off and such ready-to-use entanglement of two atomic systems can be used for teleportation or other operations.

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[2] K. Jensen et al Nature Physics 7, 13 (2011)
[3] W. Wasilewski et al. Phys. Rev. Lett., 104, 133601 (2010).
[4] H. Krauter, C. Muschik, K. Jensen, W. Wasilewski, J. M. Petersen, J. I. Cirac, and E. S. Polzik. arXiv:1006.4344; and 22nd ICAP Proceeding. J. Phys.: Conf. Ser. 264, 012022 (2011). 5. C. A. Muschik, E. S. Polzik, J. I. Cirac arXiv:1007.2209.