DAMOP08-2008-020001

Abstract for an Invited Paper
for the DAMOP08 Meeting of
the American Physical Society

Quantum state transfer from light to an atomic ensemble at room temperature

HANNA KRAUTER, Quantop, Niels Bohr Institute

The dispersive interaction of a light beam with an atomic ensemble of 10^{12} Cesium atoms at room temperature constitutes an atom light interface that opens up possibilities for a large variety of experiments interesting for quantum information processing. Here, we describe different options for the transfer of the quantum mechanical state of a light pulse to the atoms, overcoming the classical limitations. The first experimental demonstration of interspecies teleportation - between an atomic and a photonic object - was realized in this setup [1]. The achieved fidelity of 0.56 can be improved by the usage of squeezed light and a more adapted feedback scheme. In addition, a direct-mapping-protocol has previously been demonstrated for coherent light states [2]. The obtained fidelity can be increased by preparing the atomic ensemble in a spin squeezed state before starting the protocol. Spin squeezing has been shown in our setting by individual atom spin squeezing, where we utilize the multilevel structure of Cesium, as well as by a QND measurement of one of the atomic spin components via light. For the latter, a squeezed light source - which we are currently integrating into the experiment - can be useful, enabling the production of stronger atomic squeezing. Furthermore, squeezed or entangled light can be mapped to the atomic ensemble, thus extending the faithful quantum mapping to a class of non classical states. The reported work was conducted together with T. Fernholz, K. Jensen and J. F. Sherson in the group of Eugene Polzik. [1] Sherson, et al., Nature 443, 557 [2] Julsgaard, et al., Nature 432, 482