Quantum Properties of Coated Cell Beamsplitters

MICHAEL HOHENSEE, MASON KLEIN, YANHONG XIAO, DAVID F. PHILLIPS, RONALD L. WALSWORTH, Harvard-Smithsonian CfA — The demonstration of phase coherent transport of slow light between two separated modes in a paraffin-coated vapor cell suggests that quantum states may be exchanged between two modes via a randomly time-dependent coupling to an intermediate spin ensemble. We show that the efficiency of inter-mode exchange can be enhanced by application of a phase shift to the spin ensemble. Provided that the mode-ensemble coupling is sufficiently slow, the inter-mode coupling can be quite strong, while inhomogeneous losses are a function of the distribution of the ensembles' interaction times. These results suggest that even very classically disordered systems can serve to coherently manipulate quantum states.