

Abstract Submitted
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Observation of a large, resonant, cross-Kerr nonlinearity in a cold Rydberg gas and progress towards quantum non-demolition measurement of photon number JOSIAH SINCLAIR, DANIELA ANGULO, NOAH LUPU-GLADSTEIN, Univ of Toronto, KENT BONSMAN-FISHER, National Research Council of Canada, AEPHRAIM STEINBERG, Univ of Toronto — We report an experimental observation of a dispersive cross-Kerr nonlinearity based on resonant Rydberg EIT. We observe that the phase shift acquired by a resonant optical pulse propagating through a cold cloud of atoms under EIT conditions depends linearly on the intensity of a second optical pulse. Our observations are consistent with a simple theoretical treatment based on van der Waals interactions, which provides an intuitive explanation for the origin and scaling of the cross-Kerr nonlinearity. Finally, we discuss various ways to increase the per-photon phase shifts and decrease measurement uncertainty, both of which will be required in order to realize a quantum non-demolition measurement of photon number.

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