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Towards efficient photon-photon interaction at room temperature REIHANEH SHAHROKHSHAHI, MEHDI NAMAZI, STEVEN SAGONA-STOPHEL, BERTUS JORDAAN, EDEN FIGUEROA, Physics department, Stony Brook University — Strong atom mediated photon-photon interactions are the backbone of future deterministic quantum gates. Here we present our current results regarding the interaction of few photon level fields mediated by ^{87}Rb atoms in a room temperature atomic vapor. We have implemented a double-lambda atomic scheme [1]. The first EIT system uses a weak probe coupling to the D_1, $5S_{1/2}, F = 1 \leftrightarrow 5P_{1/2}, F = 1$ transition and strong control field coupling to the $5S_{1/2}, F = 2 \leftrightarrow 5P_{1/2}, F = 1$ transition, while the second EIT system addresses the same atomic levels albeit with an extra 80 MHz one photon detuning. The presence of few photon level signal field is used to steer the phase of the probe photon wave packet . We have achieved meaningful crossed phase modulation for 400ns long probe and signal pulses containing only a few photons. The magnitude of the probe field phase shift per photon in the signal field is quantified using a homodyne detector and is several orders of magnitude larger as compared to what we have observed in our previous characterization of a Kerr nonlinearity [2]. [1] Z.-Y. Liu, et al. Phys. Rev. Lett., 117, 203601 (2016). [2] C. Kupchak, et al, Sci. Rep, 5, 16581 (2015).

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