Abstract Submitted
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Demonstration of a Mesoscopic Quantum Gate[1] JONATHAN PRITCHARD[2], LINDSEY KEARY, KATIE MCDONNELL, Department of Physics, University of Strathclyde, Glasgow, U.K., G4 0NG — Rydberg atoms are an exciting platform for large scale quantum computing with demonstrations of high fidelity entanglement and coherent control. The strong, long-range dipole-dipole interaction between Rydberg atoms creates a dipole blockade which prevents the excitation of more than one atom within a radius $R < 10\ \mu$m to the Rydberg state. Using this effect we have previously demonstrated ground-state entanglement between a pair of atoms with a fidelity of 81%. However, scaling from single atoms to atomic ensembles for optical interfacing introduces challenges due to the collective $\sqrt{N}$-enhancement from blockade giving number sensitivity to the excitation pulses. We present recent results demonstrating an alternative mesoscopic gate scheme based on electromagnetically induced transparency (EIT), originally proposed by Müller *et al.*. This protocol provides a scalable approach to performing entanglement of large ensembles using a single control atom whilst circumventing challenges of the collective Rabi frequency. The resulting CNOT^N gate protocol is therefore robust against number fluctuations and provides a route to creating useful entangled states for high-precision measurements beyond the standard quantum limit.

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[2]

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