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A Hybrid Atom-Superconductor Interface for Quantum Networking[1] REMY LEGAIE, CRAIG PICKEN, JONATHAN PRITCHARD, University of Strathclyde — Quantum mechanics offers a revolutionary approach to how information is processed, with unprecedented levels of security through quantum encryption and exponential speed up with quantum computing. A key challenge to exploiting these benefits is the development of the next-generation hardware required for creating networks exploiting light at the single photon level. Hybrid quantum computation overcomes this challenge by combining the unique strengths of disparate quantum technologies, enabling realization of a scalable quantum devices.
We present a new project using cold atoms trapped above superconducting microwave resonators to enable generation, storage and entanglement of optical photons on-chip. Strong Rydberg atom dipole-dipole interactions provide a mechanism for efficient single photon coupling to atomic ensembles, whilst entanglement is mediated via an off-resonant interaction with the superconducting microwave cavity to provide long distance (∼mm scale) interaction lengths. This represents the first steps to the creation of a quantum analog of a router, an essential building block for quantum networking. Long term this can be integrated with superconducting qubits technologies to exploit fast on-chip processing power.

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