

Abstract Submitted  
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**Photonic Quantum Logic with Narrowband Light from Single Atoms** ALLISON RUBENOK, University of Bristol, ANNEMARIE HOLLECZEK, OLIVER BARTER, JEROME DILLEY, PETER B. R. NISBET-JONES<sup>1</sup>, GUNNAR LANGFAHL-KLABES, AXEL KUHN, University of Oxford, CHRIS SPARROW, University of Bristol, Imperial College London, GRAHAM D. MARSHALL, JEREMY L. O'BRIEN, KONSTANTINOS POULIOS<sup>2</sup>, JONATHAN C. F. MATTHEWS, University of Bristol — Atom-cavity sources of narrowband photons are a promising candidate for the future development of quantum technologies. Likewise, integrated photonic circuits have established themselves as a fore-running contender in quantum computing, security, and communication. Here we report on recent achievements to interface these two technologies: Atom-cavity sources coupled to integrated photonic circuits. Using narrow linewidth photons emitted from a single  $^{87}\text{Rb}$  atom strongly coupled to a high-finesse cavity we demonstrate the successful operation of an integrated control-not gate. Furthermore, we are able to verify the generation of post-selected entanglement upon successful operation of the gate. We are able to see non-classical correlations in detection events that are up to three orders of magnitude farther apart than the time needed for light to travel across the chip. Our hybrid approach will facilitate the future development of technologies that benefit from the advantages of both integrated quantum circuits and atom-cavity photon sources.

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