Deterministic Storage and Retrieval of Telecom Quantum Dot Photons Interfaced with an Atomic Quantum Memory

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A hybrid interface of solid-state single-photon sources and atomic quantum memories is a long sought-after goal in photonic quantum technologies [1]. The storage and retrieval of single photons on demand is a key requirement for merging disparate quantum systems into large-scale hybrid quantum networks capable of supporting the future quantum internet [2]. Here we demonstrate deterministic storage and retrieval of photons from a semiconductor quantum dot in an atomic ensemble quantum memory at telecommunications wavelengths. We store single photons from a InAs quantum dot [3] in a high-bandwidth rubidium vapour based quantum memory [4], with a total internal memory efficiency of (12.9 ± 0.4)%. The signal-to-noise ratio of the retrieved photons is 18.2 ± 0.6, limited only by detector dark counts. This represents a significant step towards the goal of an efficient hybrid quantum light-matter interface, pivotal for developing future quantum technologies.

References

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Figures

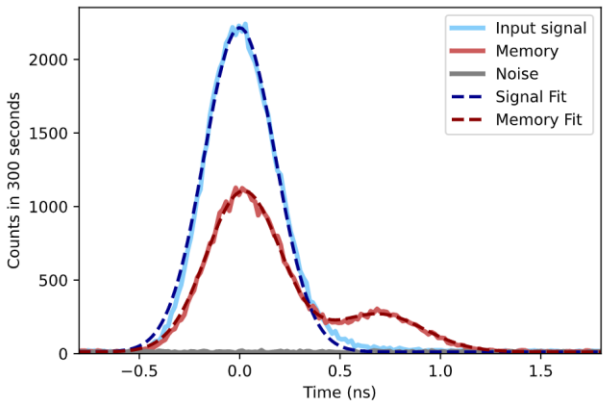

Figure 1: Histogram showing the arrival time of quantum dot photons through the quantum memory when the memory is turned off (blue) and with the memory on (red), indicating storage and retrieval 800ps later.