Quantum Memory for Telecom Light with Hot Atoms

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Photonics presents a promising platform for future quantum-enhanced technologies owing to its light speed, high information capacity, resilience to room-temperature environments, and robustness over metropolitan distances [1]. However, the efficient generation and manipulation of indistinguishable photons remains probabilistic, while the distribution of photons over continental scales suffers inherent channel-propagation losses. Therefore, the success probability of any composite photonic system falls exponentially with the number of quantum elements and channels comprising the system, presenting a barrier to scalable photonic quantum technology.

A quantum optical memory is a potential solution to this scaling issue. Quantum memories utilise light-matter interactions to store and recall quantum states of light on-demand, allowing to multiplex over non-deterministic processes for the synchronisation of quantum networking operations [2]. Atomic-ensembled-based systems are well suited for such devices where light can be efficiently mapped into and stored as long-lived excitations within the atomic medium [3].

Hot alkali vapours combine strong light-matter interactions, high-bandwidth (GHz) implementation and moderate-temperature operation for technical simplicity [4, 5]. In this talk, I will present our latest results using hot rubidium atoms to store telecom wavelength pulses at the single photon level, and present a strategy for overcoming the Doppler dephasing limitation.

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