Atom-light interaction in thermal Rubidium vapours confined to a volume less than λ^3

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Atom-Light interactions in the quantum regime show promise for applications in quantum information processing e.g. computing. Here, we study the fundamentals of the interaction itself using thermal vapours of Rubidium confined to sub-wavelength scale cavities. We achieve this with bespoke 'Nanocells' made in-house via ion-etching and optical contact bonding. Using a variety of detection methods we achieve high signal-to-noise spectroscopic and photon statistic measurements that indicate the rich effects of the extreme geometry on the atom-light interaction. Ultimately, through use of high numercal aperture lensing, we hope to resolve a single atom in a volume less than λ^3.

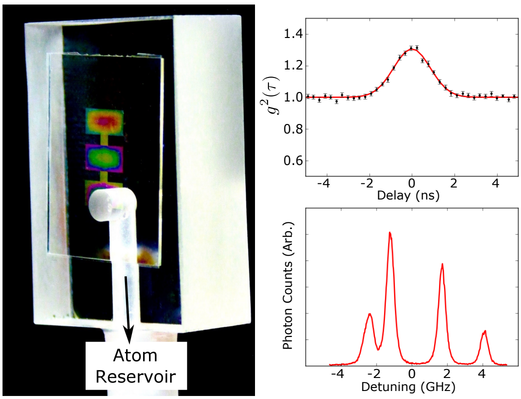

FIG. 1. A photograph of a nano-layer vapour cell (left), photon bunching observed via Hanbury Brown and Twiss [1] method (upper-right), and Total Internal Reflection Fluoresence (TIRF) spectroscopy (lower-right) of the D2 ($5^2S_{1/2} \rightarrow 5^2P_{3/2}$) manifold in Rubidium.

[1] R. Hanbury Brown and R. Q. Twiss, Nature **178** 1046-1048 (1956).

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