Investigation of fine-structure changing collisional transfer in ^{87}Rb vapour in the hyperfine Paschen-Back regime

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In thermal vapour quantum optics experiments, collisions between the subject atom and buffer gases can be a significant source of noise. I will present an investigation into the Rb – buffer gas collisional process in thermal ^{87}Rb vapour in a high magnetic field (0.6T), which transfers population between the $5P_{1/2}$ and $5P_{3/2}$ states. We use an etalon cavity filter to spectrally resolve the collision-induced fluorescence and find that these collisions preserve the m_I quantum number, with a range of different buffer gases. We also use the filter to measure the fluorescence width and lineshape.

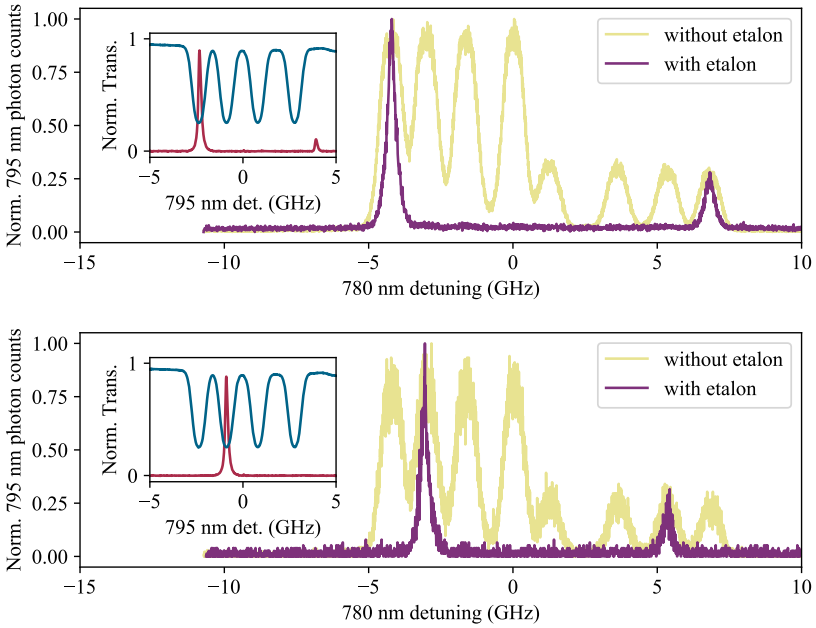

Figure 1. 780 nm laser light is input, scanning over the D2 peaks, exciting atoms to $5P_{3/2}$. A collisional process then transfers atoms to $5P_{1/2}$, from where they emit a 795 nm (D1) photon. Yellow traces show this 795 nm emission as a function of 780 nm input detuning. The insets show the etalon transmission window (red trace) relative to the D1 795 nm absorption lines (blue trace). The purple trace in the main figure is the fluorescence photon counts after passing through the etalon. We find that we only observe fluorescence when the etalon window transition, and the 780 excitation transition, have the same m_I value.

[1] D. J. Whiting et al., Single-Photon Interference due to Motion in an Atomic Collective Excitation, PRL, **118**, 253601 (2017).

[2] C. R. Higgins et al., Atomic line versus lens cavity filters: a comparison of their merits, OSA Continuum **3**, 961 (2020).