Absolute absorption and dispersion in dense alkali-metal thermal vapours

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Many of the work-horse techniques of contemporary atomic physics experiments were first demonstrated in hot vapours. These media are ideally suited for quantum-optics experiments as they combine (I) a large resonant optical depth; (II) long coherence times; (III) well-understood atom-atom interactions. These features aid with the simplicity of both the experimental set up and the theoretical framework.

We have studied experimentally and theoretically the absorption and dispersion of alkali-metal atomic vapours [1-3]. Our model includes the effects of dipole-dipole interactions [4] and calculates the absolute susceptibility that enables quantitative predictions in the vicinity of the D lines. The model was a crucial component in our experimental measurement of the cooperative Lamb shift [5], the first measurement of this phenomenon, 40 years after its prediction. In a related experiment we measured the refractive index of high-density Rb vapour in a gaseous atomic nanolayer, thereby answering the question of what is the theoretical maximum refractive index of an atomic vapour [6]. We will present ideas and preliminary data of how to generate heralded single photons with a dense thermal ensemble.

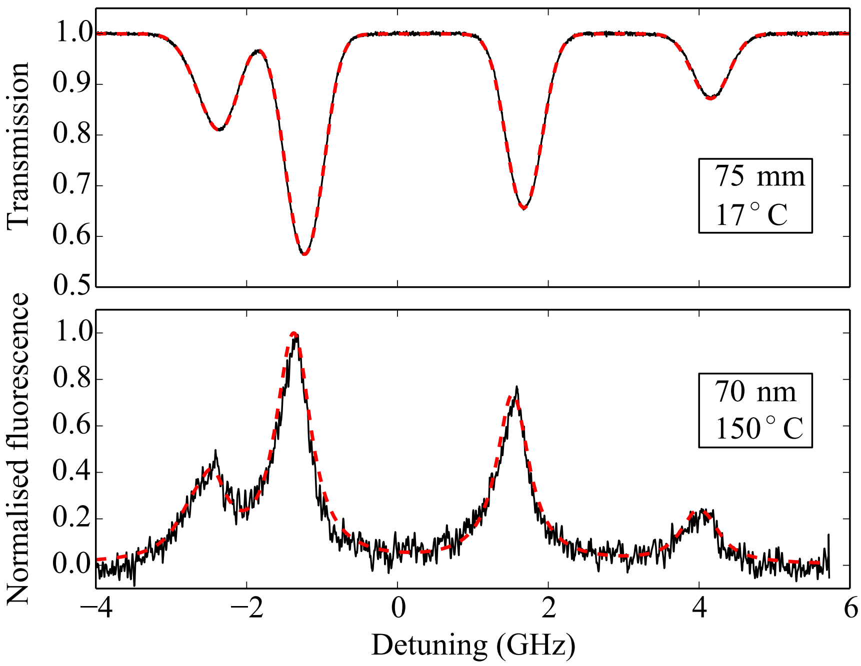

Figure 1: *Experimental absorption (upper) and fluorescence (lower) spectra with theoretical models (red) taken on the Rb D2 line in cells differing in length by a factor of* 10^6.

References

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