Excitation transfer from Second to First resonance line of Potassium observed in hot atomic vapor

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We present experimental investigation on the fluorescence profiles observed by excitation of the hyperfine transitions of the second resonance line of potassium with a wavelength of 404.4 nm in dependence on the atomic density. Such excitation leads to both direct decay of the excited level population to the ground state (violet fluorescence), and to cascade decay via the first resonance lines (infrared fluorescence). It has been shown that the behavior of these two fluorescence profiles is different: increasing the atomic density, the violet fluorescence profile exhibits a well-pronounced self-absorption dip, while the infrared line does not show any narrow-width reduced absorption structure (Fig.1). Moreover, the profiles of the infrared line have a higher signal-to-noise ratio than that of the violet line. Our investigations show that beside atomic population, atomic polarization is also transferred by the cascade transitions. This is evidenced by registration of coherent magneto-optical resonances at the two fluorescence lines. The signal-to-noise ratio of these resonances registered at the first resonance line is significantly higher than at those obtained at the second resonance line. A numerical modelling of the process of fluorescence self-absorption is also presented. The proposed study makes it possible to examine cascade transitions in alkali atoms, particularly the preservation of atomic polarization, i.e. the coherence transfer by cascade transitions.

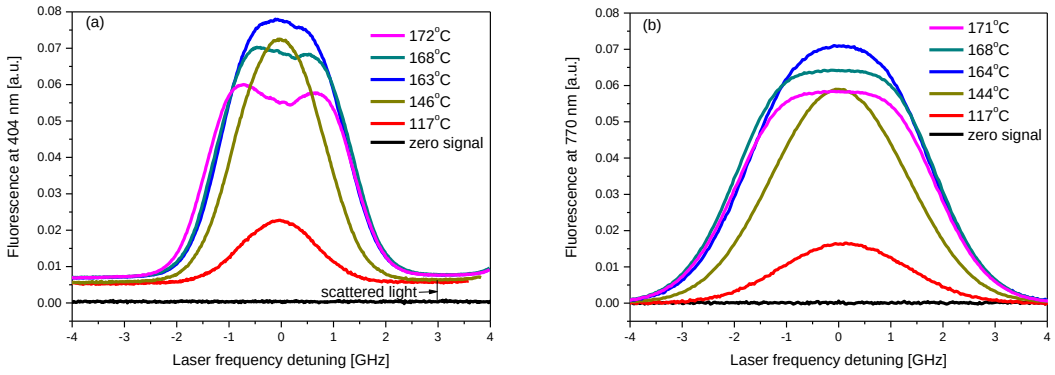

Figure 1. Fluorescence profiles of (a) the violet spectral line and (b) the infrared spectral line, at different optical cell temperatures.

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