

# High resolution spectroscopy of Cs atomic layers of nanometric and micrometric thickness

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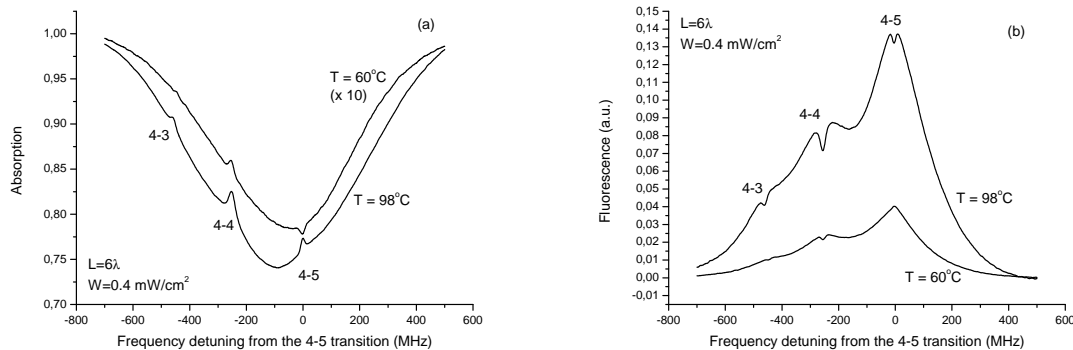
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The miniaturization of practical devices based on alkali atomic vapor confined in optical cells is of rising interest for development of photonic sensors. In this communication we present high resolution laser spectroscopy of Cs vapor confined in a unique optical cell with nanometric thickness (NTC) [1], where a strong spatial anisotropy is present for the time of interaction between the atoms and the laser radiation.

Extremely narrow velocity selective optical pumping (VSOP) resonances ( $\sim 12$  MHz) in the absorption and fluorescence profiles of the open optical transitions are demonstrated. The improved experimental system as compared to the used in [2] made possible the registration of a resonance in the fluorescence also of the closed transition.

A theoretical simulation is performed to analyze the physical processes behind the sub-doppler width (SDW) resonance sign reversal for the closed atomic transitions. The model involves elastic interactions between Cs atoms as well as elastic interaction of atom-cell windows, both resulting in depolarization of the excited state, which can lead to the new experimental observations.

We show that a small increase in the NTC thickness (from  $L = \lambda$  to  $L = 6\lambda$ ) allows reduction of light intensity and atomic source temperature needed for the narrow resonance formation, as can be seen in Fig.1.



**Figure 1:** Transmission (a) and fluorescence (b) spectra at the  $F_g = 4$  set of transitions, observed in the NTC with  $L = 6\lambda$ . For higher atomic concentration a narrow dip in the fluorescence occurs at the closed  $F_g = 4 \rightarrow F_e = 5$  transition.

This makes it advantageous to use the narrow dips in the fluorescence profiles as frequency references for precise and significantly simplified stabilization of laser frequency, as well as for magnetometers with nanometric local spatial resolution and tunable atomic frequency references [3,4].

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## References

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