Study of Atomic Transitions of Rb D_2 line in Strong Transverse Magnetic Fields by an Optical Half-Wavelength Cell

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It is demonstrated that the use of the $\lambda/2$ method allows one to effectively investigate individual atomic transitions of the D_2 line of Rb in strong transverse magnetic fields (with laser radiation of π-polarization) up to 7 kG. The method is based on strong narrowing of the absorption spectrum (which provides sub-Doppler resolution) of a rubidium filled thin cell with the thickness L equal to the half-wavelength ($L = \lambda/2$) of the laser radiation ($\lambda = 780$ nm) resonant with the D_2 line. In particular, the $\lambda/2$ method has allowed us to resolve completely 12 and 8 atomic transitions of the ^{85}Rb and ^{87}Rb, correspondingly. These 20 atomic transitions are contained within two groups of ten atomic transitions each (see Fig.1). We have determined their frequency positions, fixed (within each group) frequency slopes, the probability characteristics of the transitions, and other important characteristics of the hyperfine structure of Rb in the hyperfine Paschen–Back regime (HPB), which means that when a strong magnetic field is applied there is a decoupling of the total electronic angular momentum $\boldsymbol{J}$ and nuclear momentum $\boldsymbol{I}$ [1]. The theoretical model very well describes the experiment.

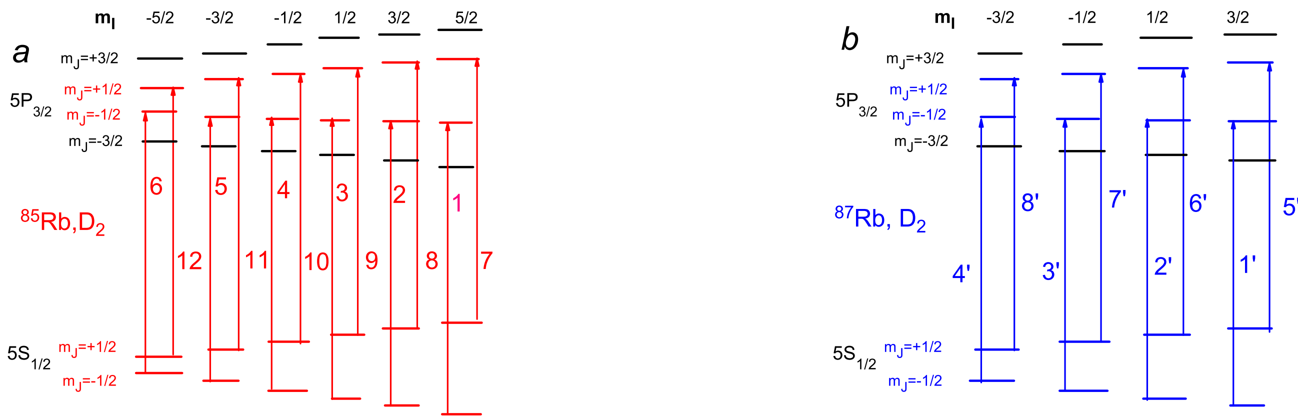

Figure 1: *Diagram of the hyperfine structure of the D_2 line of the ^{85}Rb (a) and ^{87}Rb (b) in the HPB regime. The selection rules are $\Delta m_J = 0$, $\Delta m_I = 0$. There are 12 and 8 transitions of the ^{85}Rb and the ^{87}Rb, correspondingly.*

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References

[1] A. Sargsyan *et al.* Optics Lett. **37** 1379 (2012)