Use of EIT- and N-resonances to study decoupling of electronic J and nuclear I momentums of ^{85}Rb

R. Mirzoyan[1,2], C. Leroy[2], Y. Pashayan-Leroy[2], A. Sargsyan[1], D. Sarkisyan[1]

[1]Institute for Physical Research, NAS of Armenia, Ashtarak, 0203, Armenia
[2]Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR CNRS 6303 - Université de Bourgogne, F-21078 Dijon Cedex, France
Corresponding Author: rafayelm@gmail.com

Electromagnetically induced transparency (EIT) resonance in strong magnetic fields up to 2000 G has been investigated with the use of a 30-μm-thin cell filled with atomic Rb vapor and neon gas. The EIT resonance in the Λ- system of the D_1 line of ^{85}Rb atoms has been formed with the use of two narrowband 795 nm diode lasers (Fig.1a). The EIT- resonance in a longitudinal magnetic field is split into five components. It has been demonstrated that the frequencies of the five EIT components are either blue (Fig.1c) or red (Fig.1d) shifted with an increase in the magnetic field, depending on the frequency ν_p of the probe laser. It is shown that in both cases the ^{85}Rb atoms enter in the hyperfine Paschen–Back (HPB) regime in magnetic fields of > 1500 G. HPB is manifested by the frequency slopes of all five EIT components asymptotically approaching the same fixed value s = 2.86 MHz/G. This means that a decoupling of the total electronic angular momentum **J** and the nuclear magnetic momentum **I** starts. Similar results have been obtained by the use of N-type resonance which is formed in the same Λ- system of the D_1 line (Fig.1b). In some cases it is more convenient to use N-type resonance to study HPB regime. N-resonance is formed in 40-μm-thin cell filled with an atomic Rb vapor and neon gas. Note, that the sign of the frequency shift is opposite to each other in the case of EIT-and N-resonance. The experiment agrees well with the theory.

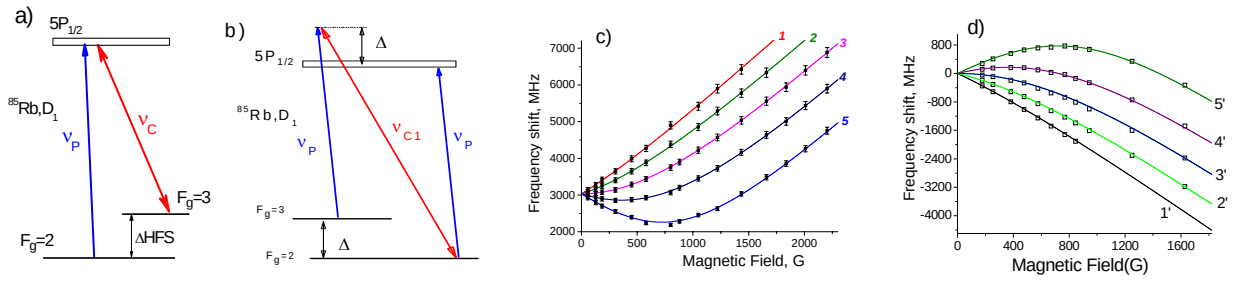

Fig.1 a), b) ^{85}Rb, D_1 line, the coupling ν_c or ν_{C1} and probe ν_p frequencies forms EIT- or N-resonances c) when the probe ν_P starts from F_g=2 for the EIT-resonance (or from F_g=3 for the N-resonance) there is a blue frequency shifts of the EIT-and N-resonance components in a B-field, solid curves, theory; symbols, experiment, for B > 1500 G HPB regime becomes predominant , d) when the probe ν_p starts from F_g=3 for the EIT-resonance (or from F_g=2 for the N-resonance) there is a red frequency shifts of the EIT-and N-resonance components in a B-field.

The research leading to these results has received funding from the European Union FP7/2007-2013 under *grant agreement* n◦ 205025 - IPERA. Research conducted in the scope of the International Associated Laboratory (France-CNRS & SCS-Armenia) IRMAS.
R.M. and A.S. thanks ANSEF Opt- 3047. R.M. also thanks PhD students research program No 13A-1c09.

References

[1] A. Sargsyan, R. Mirzoyan, D. Sarkisyan , JETP Lett., V. 96, 303(2012).
[2] A. Sargsyan, R.Mirzoyan, A.Papoyan, D. Sarkisyan, Opt. Lett.,V. 37, 4871 (2012).