Two types of circular dichroism of magnetically induced atomic transitions in alkali atoms

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Atomic transitions of alkali atoms, particularly, of Cs atom for which the condition F_e-F_g = ΔF = ±2 are satisfied have null probability in a zero magnetic, while a giant increase in their probability can occur in an external magnetic field. Such transitions are called magnetically- induced (MI) [1]. Interest in the MI transitions of alkali metal atoms, is caused by high probabilities in wide ranges of external magnetic fields which could be even higher of that of the usual atomic transitions. The following rule has been established for the intensities of the MI transitions: the intensities of MI transitions with ΔF=+2 are maximum when using σ^+ radiation, while the intensities of MI transitions with ΔF=-2 are maximum when using σ^- radiation, the difference in intensity when using radiation σ^+ and σ^- can be significant, that is, type-1 magnetically induced circular dichroism (MICD1). Here we present the experimental and theoretical results concerning MICD2 of the type-2 which is as follows. Comparisons of the intensity in magnetic fields (0.1-6 kG) of the Cs strongest MI transition with ΔF = + 2 using σ^+ radiation (it means F_g = 3→F_e = 5 transition) with the most intense transition with ΔF = -2 using σ^- radiation (it means, F_g=4→F_e=2 transitions) shows that the probability of MI transition with ΔF = + 2 is always greater [2]. Figure 1 shows the experimental and theoretical curves of the Cs, D_2, L =λ / 2 = 426 nm, using σ^+ radiation, magnetic field B= 1500 G containing 7 MI transitions.

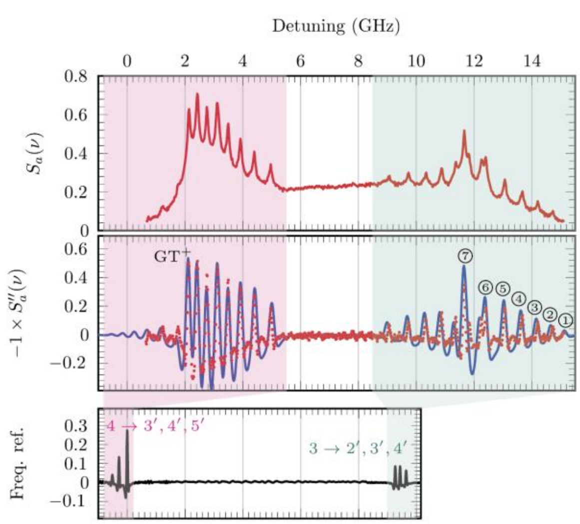

Figure 1. Cs, D_2, L =λ / 2 = 426 nm, using σ^+ radiation, magnetic field B= 1500 G, the upper curve is the absorption spectrum for F_g=3,4→ F_e=3,4,5 transitions, contains MI transitions F_g=3→ F_e=5 with numbers 1–7 in circles. Middle panel: second derivative (SD) of the absorption spectrum (red dots: experiment, blue solid line: theory); bottom panel: frequency reference at B=0.

[1] A. Tonoyan, A. Sargsyan, E. Klinger, et al., EPL, **121**, 53001 (2018).

[2] A. Sargsyan, A.Amiryan, A.Tonoyan, E. Klinger, D. Sarkisyan, Physics Letters A 390,127114 (2021)