P-ODD EFFECTS IN GROUND STATE HYPERFINE TRANSITIONS OF HYDROGEN, POTASSIUM AND CAESIUM

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Most of the proposals concerning atomic experiments to study the parity non-conservation (PNC) are based on the search of atomic systems, where these effects are extremely enhanced. Alternative approach supposes choosing of atomic systems, where the most precise measurements are available. The advantages of this approach were proved in recent experiments where the upper bounds on the electric dipole moments of xenon and mercury were established /1/.

Here /2/, we want to attract attention to the possibility to study the PNC effects with the help of the hydrogen maser and magnetic cells on potassium and caesium, where very narrow and stable spectral lines are achieved. In all these cases transitions between the hyperfine components of the ground state take place. Only the nuclear spin-dependent part of the PNC hamiltonian is important in such transitions. Just this part is of main interest now.

The idea of the proposed experiment is as follows. The polarized atom is subjected to three radio pulses: the first and the third are the pulses of a weak oscillating magnetic field (they induce usual hyperfine M1-transitions) while the second one is a pulse of a strong electric field (it can cause E1-transitions only by means of the PNC interaction). The duration of this pulse can be made of the order. of the spin relaxation time. The one-second value is achieved for the latter in the devices under consideration. Just this fact offers the opportunity to get a small P-odd amplitude. The total transition probability after pulses is a function of the relative phases of the corresponding fields, that gives a good chance to extract and measure the P-odd part of the amplitude. Calculations show that it reaches the value of 10^{-2} for caesium, while for potassium and for hydrogen it is approximately 25 and $2 \cdot 10^4$ times smaller. It is important that accurate calculations have been made for all these atoms /2/.

Optimal experimental conditions need additional study. Here we can only mention that: i) the application of a constant magnetic field can give some advantages, ii) spurious effects are proportional to the transition frequency. The latter has the smallest value for ^{41}K. This question was in particular discussed by A. Ya. Kraftmaher and V. V. Flambaum.

REFERENCES

1. *Vold T. G., Raab E. J., Heckel B., Fortson E. N.* Phys. Rev. Let., 52. 2229. 1984.
Lamoreaux S. K., Jacobs J. P., Heckel B. R., Raab E. J., Fortson N. Phys. Rev. Lett., 59. 2275. 1987.
2. *Gorshkov V. G., Ezhov V. F., Kozlov M. G., Mikhailov A. I.* Yad. Fiz., 48. 1363. 1988.