

The Cs Parity Violation experiment in Paris:
 E_1^{pv} determination within 2×10^{-13} atomic units
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A precise atomic Parity Violation (APV) experiment provides an original test of the electron-nuclear weak interaction mediated by the neutral vector boson Z_0 , a test complementary to high energy experiments. It consists in measuring a left-right asymmetry of $\simeq 10^{-6}$ in the atomic interaction with a radiation field resonant for the forbidden 6S-7S cesium transition. It involves the transition dipole amplitude E_1^{pv} of only 10^{-11} ea₀. Our pulsed pump-probe experiment, carried out in a vapor cell submitted to a longitudinal \vec{E} -field, provides a novel method of APV measurement by exploiting the amplification of the asymmetry by stimulated emission. After pulsed excitation of the forbidden transition in presence of a parallel electric field \vec{E} , the probe beam resonant for the 7S-6P_{3/2} transition is transiently amplified. Polarization analysis of the probe allows us to detect selectively a *chiral* contribution arising from E_1^{pv} . The plane defined by the excitation laser polarization and \vec{E} is a plane of symmetry of the experiment. If the probe linear polarization is at the input of the vapor *inside* the plane of symmetry, at the cell output *it deviates from this plane* by a small angle $\theta^{pv} = -ImE_1^{pv}/\beta E$ (β : 6S - 7S transition polarizability) which changes sign when the direction of \vec{E} is reversed. This is a manifestation of the PV linear dichroism, whose eigenaxes are offset by 45° from the symmetry axes.

We have increased by a factor of 3.5 both the sensitivity and the accuracy of our initial 9% result [1], thanks essentially to a polarization-tilt magnifier, upgraded cesium cells (non-reflective windows with a ring-shape metal-coating for better application of \vec{E}), together with a 1% in-situ determination of \vec{E} . Latest results [2] yielding a 2.6% accurate determination of E_1^{pv} will be presented (Fig.1). Besides, a new project for APV measurements to the 0.1% precision level on the 6S-7S Cs transition is proposed [3].

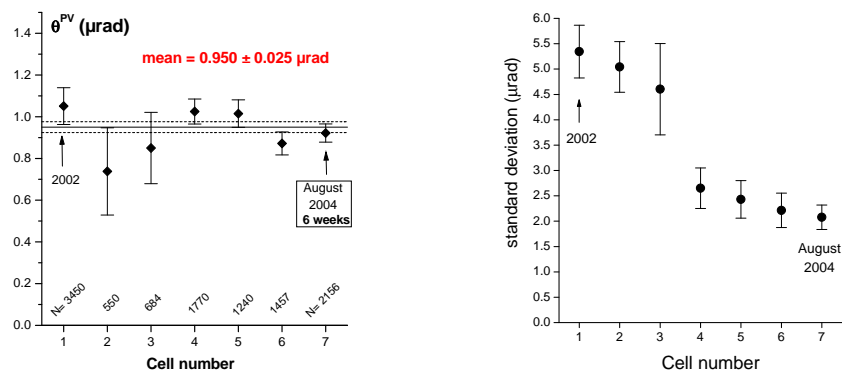


Figure 1: Values of θ^{pv} at $E=1.62\text{kV/cm}$ from seven different Cs cells and Improvement in signal-to-noise.

References

- [1] J. Guéna *et al.*, *Phys. Rev. Lett.* **90**, 143001 (2003).
- [2] J. Guéna *et al.*, arXiv:physics/0412017, to appear in *Phys. Rev. A* (2005).
- [3] J. Guéna, M. Lintz and M.A. Bouchiat, *J. Opt. Soc. Am.* **B22**, 21 (2005).