Contribution ID: **319**

Type: **Oral**

# Magnetoelectric Effect in Lorentz-violating Extensions of the Standard Model

We demonstrate that an atom placed in a constant background interacting with the electronic axial-vector current exhibits a new type of parity-breaking transverse magnetoelectric polarizability. Within beyond-Standard-Model (BSM) frameworks, such as the Lorentz-violating Standard Model Extension, such constant backgrounds are considered to be condensates of Planck-scale fields, thus, precision measurements of the magnetoelectric polarizability is able to constrain non-trivial BSM physics. Indeed, we demonstrate that the contribution to this effect within the Standard Model due to weak interaction is strongly suppressed, the effect thus being purely exotic. We calculate magnetoelectic polarizabilities for simple atoms and present new constraints on the value of the Lorentz-violating axial-vector condensate.

## Summary

Within the Standard Model Extension representing an effective framework for Lorentz and/or CPT violation searches, we study an atomic system in an axial-vector condensate background. Using the technique developed in our previous papers [see, e.g., O.G. Kharlanov and V.Ch. Zhukovsky, CPT and Lorentz violation effects in hydrogenlike atoms, J. Math. Phys. 48, 092503 (2007)], we find the electron eigenstates modified by the background and then apply the perturbation theory to find the electric/magnetic dipole moments generated as a response to a weak magnetic/electric field applied to the atom. These contributions to the atomic dipole moments are parity-odd and exotic (i.e., beyond-Standard-Model); on the other hand, a direct calculation reveals that a non-exotic P-odd contribution coming from weak interactions is strongly suppressed. As a result, the P-odd magnetoelectric effect in atoms represents a clear signature of beyond-Standard-Model physics. Using existing experimental data and the polarizabilities found, we derive new constraints on the axial-vector condensate. We also analyze semi-qualitatively the importance of the effect in a ferromagnet and other magnetic materials, where it can be strongly amplified due to strong spin polarization that is crucial for the effect to show up.

**Primary author:** Dr KHARLANOV, Oleg (Lomonosov Moscow State University)

**Co-author:** DEGTEV, Ivan (Lebedev Physical Institute of Russian Academy of Science)

**Presenter:** Dr KHARLANOV, Oleg (Lomonosov Moscow State University)

**Track Classification:** Theoretical Physics