Contribution ID: **291** Type: **Oral**

Theory of electric dipole moments of hadrons and nuclei

Thursday 11 September 2014 15:18 (25 minutes)

Electric dipole moments (EDMs) break parity and time-reversal (T) symmetry and, by the CPT-theorem, CP-symmetry. If measured they are unambigious signs of new physics, since CP-violation in the quark mixing matrix predict EDMs orders of magnitude away from current experimental limits. The SM also contains the QCD vacuum angle (the theta term) whose value is unknown but strongly limited by neutron EDM experiments. This smallness leaves room for T-violation from physics beyond-the-SM which is expected to exist in order to explain the universal matter/antimatter asymmetry.
An open question remains: If an EDM is measured, is it caused by the theta-term or from physics beyond the SM?
Triggered by experimental plans to measure the EDMs of light nuclei with unprecedented accuracy in storage rings, this talk will be focused on these systems. After giving an overview of the field of EDMs and the relevant concepts, I will present a framework, based on effective field theories (in particular chiral perturbation theory), in which we calculate light-nuclear EDMs in a consistent framework. I will argue that measurements of a few of these EDMs could point towards the fundamental mechanism of time-reversal violation.

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Session Classification: Parallel V: E3 QCD and New Physics

Track Classification: Section E: QCD and New Physics