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T-violating moments of light nuclei

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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, at the Standard Model scale, can be captured by effective dimension-six operators such as quark EDMs, and quark and gluon color-EDMs. Triggered by various experimental proposals to measure with high accuracy the EDMs of the nucleon and light nuclei directly, I focus here on some important open questions: Is it possible to pinpoint the dominantant source of T-violation from these hadronic and nuclear EDM measurement? Can we separate the theta term from physics beyond-the-SM? If so, can we also separate the various beyond-the-SM sources?
I answer these questions by applying chiral effective theory. Different fundamental sources of T-violation transform differently under chiral symmetry and, at energies below the QCD phase-transition, induce different T-violating interactions among pions, nucleons, and photons. These differences in hadronic interactions give rise to a different pattern of hadronic observables. I give results on the T-odd moments of the nucleon, deuteron, helion, and triton, calculated within this framework, and discuss how their measurements could point towards the fundamental mechanism of T-violation.

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