Contribution ID: **27** Type: **not specified**

The equivalent Electric Dipole Moment in SMEFT

Monday 2 June 2025 17:10 (15 minutes)

The Electric Dipole Moment of the electron (eEDM) is typically investigated in experiments using paramagnetic molecules. However, the physical observable in these searches consists in a linear combination of CP-violating interactions, rather than the eEDM alone, which is commonly referred to as the equivalent EDM of the system. Assuming the presence of new CP-odd physics from heavy degrees of freedom, we parameterize its effects within the Standard Model Effective Field Theory (SMEFT) framework. We systematically compute the contributions to the full low-energy direction probed by EDM searches, focusing on leading-order effects at dimension six and one-loop level, while also discussing selected two-loop and dimension-eight contributions. We find that eEDM experiments are sensitive to a broader class of SMEFT operators than previously recognized.

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Session Classification: Global EFT Analyses II