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Contribution of sources of P,T-violation to permanent electric dipole moments of molecules

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"New physics"beyond the standard model, such as supersymmetric models, can imply violations of discrete symmetries, i.e. space parity (P), time-reversal (T) and charge conjugation (C). Many different hypothetical sources of simultaneous violation of P- and T-symmetry can be discussed on the elementary particle level, such as P,T-odd currents between quarks and electrons or permanent electric dipole moments (EDMs) of elementary particles. All these fundamental P,T-odd interactions could induce net P,T-odd moments in bound systems such as atoms and molecules[1]. Thus, a measurement of e.g. a permanent EDM of an atom or a molecule is difficult to interpret and predict due to possible interference of the various fundamental sources of P,T-violation. Nonetheless, due to enormous electronic structure enhancements of such P,T-odd effects in polar molecules, low-energy high-precision experiments on these molecules can give access to the TeV energy-regime[2, 3].

In this poster possible sources of discrete symmetry violation are summarised and their effects on molecular spectra are discussed. Requirements of molecules for high-precision spectroscopy that aims to measure a permanent molecular EDM are elucidated. Trends of P,T-violation within the periodic table of elements determined with quasi-relativistic calculations[4, 5] as well as measurement models for disentanglement of sources of P,T-violation in molecules are discussed[6, 7]. Simple analytical models, which are gauged by ab initio calculations, help to identify suitable molecules for experiments.

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