MEASUREMENT OF THE ELECTRON'S ELECTRIC DIPOLE MOMENT IN THORIUM MONOXIDE

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Some polar diatomic molecules have large effective internal electric fields ($\mathcal{E}_{eff} \sim 10^{11}\ V/cm$[b]) that can be used to make measurements of the electron's electric dipole moment (eEDM) with unprecedented sensitivity. By performing precision spectroscopy on the metastable $H^3\Delta_1$ state of ThO in a cryogenic buffer gas beam, we have demonstrated a statistical sensitivity to the eEDM of $\delta d_e \approx 1 \times 10^{-28}\ e \cdot cm/\sqrt{T/\text{days}}$, which is competitive with the current experimental limit, $|d_e| < 1.05 \times 10^{-27} e \cdot cm$[c]. The existence of a non-zero eEDM on this level would be evidence for the existence of interactions that violate parity and time-reversal symmetries that are not included in the Standard Model. Many extensions to the Standard Model (in particular supersymmetric theories) predict the eEDM to be very close to the current experimental limit. We present an overview and discuss the characterization of systematic errors in this experiment.[d]

[a] ACME COLLABORATION

[b] E. R. Meyer and J. L. Bohn, Phys. Rev. A 78, 010502 (2008)

[c] J. Hudson, D. Kara, J. Smallman, B. Sauer, M. Tarbutt, E. Hinds, Nature 473 493 (2011)

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