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Lorentz and CPT violating corrections to hydrogen energy levels at order α^2 GREGORY ADKINS, THEODORE YODER, Franklin and Marshall College — The standard model extension (SME) is an effective field theory for physics beyond the SM that contains non-SM effects such as Lorentz and CPT violation. The SME effective Lagrangian contains a number of coefficients that describe new interactions. These as-yet-unobserved coefficients must be small. One approach for the detection of the SME coefficients is to calculate their effect on observable physical quantities, particularly those measureable to high precision. We have calculated the effect of the SME interactions on the energy levels of hydrogen. Starting from the field theory effective Lagrangian we have obtained the Hamiltonian of an SME-extended Dirac equation and have applied a Foldy-Wouthuysen expansion to obtain a non-relativistic effective Hamiltonian correct through terms quadratic in the momentum 3-vector. This Hamiltonian, at the order of interest, has the form $H' = (A_{ij} + B_{ijk}\sigma_k)p^i p^j$ where A_{ij} and B_{ijk} are linear combinations of the SME parameters. We have evaluated the energy level corrections due to H', which are of order α^2 times the SME coefficients. Constraints on the combinations of SME coefficients found in A_{ij} and B_{ijk} can be obtained by comparison with experimental results.

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