Searching for Exotic Interactions between Antimatter

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We show that atomic antimatter spectroscopy can be used to search for new bosons that carry spin-dependent exotic forces between antifermions [1]. A comparison of a recent precise measurement of the hyperfine splitting of the 1S and 2S electronic levels of antihydrogen and bound-state quantum electrodynamics theory yields the first tests of exotic positron-antiproton interactions, constraining the dimensionless coupling strengths g_pg_p , g_Vg_V and g_Ag_A , corresponding to the exchange of a pseudoscalar (axion-like), vector, or axial-vector boson, respectively. We also discuss new tests of CPT invariance with exotic spin-dependent and spin-independent interactions involving antimatter.

References

[1] L. Cong, F. Ficek, P. Fadeev, Y. V. Stadnik, D. Budker. Searching for Exotic Interactions between Antimatter, arXiv:2503.07161 (2025).