

Abstract Submitted
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Electron-interacting WIMPs: Can dark matter scattering on electrons explain the DAMA modulation signal? BENJAMIN ROBERTS, Univ of Nevada - Reno, VLADIMIR DZUBA, VICTOR FLAMBAUM, UNSW Australia, GLEB GRIBAKIN, Queens University, Belfast, MAXIM POSPELOV, University of Victoria, BC, YEVGENY STANDIK, UNSW Australia — Atoms can become ionised during the scattering of a slow, heavy particle off a bound electron. Such an interaction involving leptophilic WIMP dark matter is a potential explanation for the anomalous 9σ annual modulation in the DAMA direct detection experiment. We show that due to non-analytic, cusp-like behavior of Coulomb functions close to the nucleus leads to an effective atomic structure enhancement. Crucially, we also show that electron relativistic effects are important. With this in mind, we perform high-accuracy relativistic calculations of atomic ionisation. We scan the parameter space: the DM mass, the mediator mass, and the effective coupling strength, to determine if there is any region that could potentially explain the DAMA signal. While we find that the modulation fraction of all events with energy deposition above 2 keV in NaI can be quite significant, reaching 50%, the relevant parts of the parameter space are excluded by the XENON10 and XENON100 experiments.

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