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New Atomic Methods for Dark Matter Detection BENJAMIN ROBERTS, YEVGENY STADNIK, VLADIMIR DZUBA, VICTOR FLAMBAUM, Univ of New South Wales, NATHAN LEEFER, Helmholtz Institute Mainz, Johannes Gutenberg University, DMITRY BUDKER, Helmholtz Institute Mainz, Johannes Gutenberg University; University of California at Berkeley — We propose to exploit P and T violating effects in atoms, nuclei, and molecules to search for dark matter (eg axions) and various other cosmic fields. We perform calculations of electric dipole moments (EDMs) that a dark matter field would induce in atoms. Crucially, the effects we consider here are linear in the small parameter that quantifies the dark matter interaction strength; most current searches rely on effects that are at least quadratic in this parameter. The induced oscillating EDMs have the potential to be measured with very high accuracy, and experimental techniques in this field are evolving fast. Pairs of closely spaced opposite parity levels that are found in diatomic molecules will also lead to a significant enhancement in these effects. We are also interested in a possible explanation for the anomalous DAMA dark matter detection results based on DM-electron scattering. Our calculations may provide a possible mechanism for dark matter induced ionisation modulations that are not ruled out by other experiments. Alternatively, they could further reduce the available parameter space for certain dark matter models. Phys. Rev. Lett. 113, 081601 (2014); Phys. Rev. D 90, 096005 (2014) [Editors' Suggestion].

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