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Dark matter and violation of symmetries

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Low-mass boson dark matter particles produced after Big Bang form classical field and/or topological defects. In contrast to traditional dark matter searches, effects produced by interaction of an ordinary matter with this field and defects may be first power in the underlying interaction strength rather than the second power or higher (which appears in a traditional search for the dark matter).This may give an enormous advantage since the dark matter interaction constant is extremely small.
Effects of dark matter and dark energy include apparent violation of the fundamental symmetries: oscillating or transient atomic electric dipole moments, precession of electron and nuclear spins about the direction of Earth's motion through the axion dark matter (the axion wind effect), and axion-mediated spin-gravity couplings [1-3], violation of Lorentz symmetry and Einstein equivalence principle [4]. Recent measurements by nEDM collaboration [5] improved the limits on interaction of the low-mass axion with gluons and nucleons up to 3 orders of magnitude. Improved limits on the axions and low mass Z'- bosons have been derived from the measurements of atomic and molecular electric dipole moments [6] and parity violating effects [7].
Interaction between the density of the dark matter particles and ordinary matter produces both 'slow' cosmological evolution and oscillating variations of the fundamental constants including the fine structure constant alpha and particle masses. Atomic Dy, Rb and Cs spectroscopy measurements and the primordial helium abundance data allowed us to improve on existing constraints on the quadratic interactions of the scalar dark matter with the photon, electron, quarks and Higgs boson by up to 15 orders of magnitude. Limits on the linear and quadratic interactions of the dark matter with W and Z bosons have been obtained for the first time [8,9].
We also discuss parity violating effects produced in atoms and molecules by the nuclear weak quadrupole moment [4], enhanced EDM in atoms and molecules produced by the collective nuclear magnetic quadrupole moments [10], and 7 orders of magnitude improvement of the limits on the anisotropy of the speed of light [11] (firstly measured in the famous Michelson-Morley experiment). This anisotropy leads to the anisotropy of the Coulomb interaction affecting nuclear and atomic spectra.
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