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Effects of dark matter from Big Bang Nucleosynthesis to atomic clocks

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I will present a review of experiment and theory in these areas based on our 30 Phys. Rev. Lett., Phys. Rev. D, A and Nature-Physics papers published in 2018-2019.
A. Zhitnitsy et al developed Axion Quark Nuggets (AQN) model which can explain both bariogenesis and dark matter within the Standard Model plus axion. We have suggested methods to detect axions produced by AQN passing through Earth and demonstrated that AQN model may also solve primordial Lithium deficit puzzle.
Axion and dilaton dark matter produces apparent variation of fundamental constants and violation of the fundamental symmetries including oscillating electric dipole moments (EDM). In our work with nEDM collaboration first measurements of this effect improved limits on the interaction of low mass axion with gluons and nucleons up to 3 orders of magnitude.
According to the Schiff theorem, nuclear EDM is completely screened by electrons in atoms and molecules, i.e. non-observable. We derived the dynamical screening theorem including cases of the oscillating electric field and oscillating EDM and demonstrated that the screening is incomplete in these cases. Moreover, nuclear EDM may be enhanced by many orders of magnitude in the case of the resonance. This gives us an efficient method to search for the axion dark matter (which produces the oscillating nuclear EDM).
Interference with atomic photon transition makes effect of axions and dark photon to appear in the first order in the extremely small interaction constants (instead of the first order in the traditional detection scheme). Coherent axion production in atomic transitions is possible. Information about CP-violating axion interaction has been extracted from the measurements of atomic and molecular. [1]V.V.Flambaum,A.R.Zhitnitsky,Phys. Rev. D 99, 023517 (2019). arxiv:1909.09475[2]G. Abel et al. Phys. Rev. X, 7, 041034 (2017).[3]V.V. Flambaum, H.B. Tran Tan, Phys. Rev. A98, 043408 (2018),arXiv:1904.07609[4]V.V. Flambaum, I.B. Samsonov, H.B. Tran Tan, Phys. Rev. D 99, 115019 (2019).[5]V.V.Flambaum, I.B.Samsonov,H.B.Tran Tan, D.Budker,Phys.Rev.D 98, 095028, (2018).[6]Y.V. Stadnik, V. A. Dzuba, V. V. Flambaum, Phys. Rev. Lett. 120, 0132024 (2018).

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