

Quantum vacuum and virtual gravitational dipoles: a common explanation of dark matter, dark energy and matter-antimatter asymmetry in the Universe?

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We present the consequences of the working hypothesis that quantum vacuum fluctuations are virtual gravitational dipoles, what might be, if for instance, particles and antiparticles have the gravitational charge of the opposite sign. The hypothesis of virtual gravitational dipoles permits to consider the Standard Model matter (i.e. matter composed from quarks and leptons interacting through the exchange of gauge bosons) as the only matter-energy content of the Universe. The phenomena usually attributed to hypothetical dark matter, may be considered as a consequence of the local gravitational polarization of the quantum vacuum by the immersed baryonic matter; apparently, the galactic halo of dark matter can be replaced by the halo of the polarized quantum vacuum. Globally quantum vacuum may be considered as a cosmological fluid which during expansion of the Universe converts from a fluid with negative pressure, allowing an accelerated expansion of the Universe, to a fluid with zero pressure (physically it means the end of the accelerated expansion). In addition, as a consequence of hypothesis of virtual gravitational dipoles together with the gravitational version of the Schwinger mechanism, we may live in a cyclic universe with cycles alternatively dominated by matter and antimatter. At least mathematically there is no the initial singularity, there is no need for the cosmic inflation and there is an amusing explanation of the matter-antimatter asymmetry in the universe: our universe is dominated by matter because the previous cycle was dominated by antimatter (and the next cycle would be dominated by antimatter again).

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