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The Model of Dark Energy Based on the Quantum-Mechanical Uncertainty Relation

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Existence of the Dark Energy became now a commonly-accepted paradigm of cosmology, but the physical essence of this quantity remains absolutely unknown and its numerical values are drastically different in the early and modern Universe. In fact, the Dark Energy is usually introduced in literature either by postulating some additional terms in the Lagrangians or by employing the empirical equations of state. In the present report, we try to look at this problem from a more specific point of view, namely, employing the quantum-mechanical uncertainty relation between the time and energy in the Mandelstam-Tamm form, which is appropriate for the long-term evolution of quantum systems [Yu.V. Dumin. Grav. & Cosmol., v.25, p.169 (2019); v.26, p.259 (2020); v.27, in press (2021)]. This leads us to the time-dependent effective Lambda-term, decaying as 1/t. The corresponding cosmological model possesses a number of quite appealing features: (1) While in the standard cosmology there are a few very different expansion stages (governed by the Lambda-term, radiation, dust-like matter, and Lambda-term again), our model provides a universal description of the entire evolution of the Universe by the same "quasi-exponential" function. (2) As follows from the analysis of causal structure, the present-day cosmological horizon comprises a single domain developing from the Big Bang. Therefore, the problems of homogeneity and isotropy of the matter, the absence of topological defects, etc. should be naturally resolved. (3) Besides, our model naturally explains the observed approximately flat 3D space, i.e., solution with zero curvature is formed "dynamically", starting from the arbitrary initial conditions.

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