The Cosmological Model Based on the Uncertainty-Mediated Dark Energy

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Abstract: Existence of the effective Lambda-term is a commonly-accepted paradigm of the modern cosmology, but physical essence of this quantity remains absolutely unknown, and its numerical values are drastically different in the early and modern Universe. In fact, the Lambda-term is usually introduced in literature either by postulating the arbitrary additional terms in the Lagrangians or by employing the empirical equations of state. In the series of our recent papers [Yu.V. Dumin. Grav. & Cosmol., v.25, p.169 (2019); v.26, p.259 (2020); v.27, in press (2021)], we tried to provide a more rigorous physical basis for the effective Lambda-term, starting from the time-energy uncertainty relation in the Mandelstam-Tamm form, which is appropriate for the long-term evolution of quantum systems. This results in the time-dependent Lambda-term, decaying as 1/t. The uncertainty-mediated cosmological model possesses a number of specific features, some of which look rather appealing: (1) While the standard cosmology involves a few very different stages (governed by the Lambda-term, radiation, dust-like matter, and again Lambda-term), 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 Bing 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. (4) The age of the Universe turns out to be much greater than in the standard cosmology; but this should not be a crucial drawback, because the most of problems are associated with insufficient rather than excessive age of the Universe.

Keywords: cosmology; Dark Energy; quantum uncertainty relation

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