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On the solution of the problem of the cosmological constant

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Calculation of the vacuum energy density in quantum field theory gives a value 10^{122} times higher than the observed one, and many proposed approaches have not solved this problem and have not calculated its real value. However, the application of the microscopic theory of superconductivity to the description of the physical vacuum on the Planck scale made it possible to solve the problem of the cosmological constant and obtain a formula for the observed vacuum density or dark energy. Its numerical value is $6.09 \cdot 10^{-30} g/cm^3$, and it is in complete agreement with observations, since the experimental value is $(6.03 \pm 0.13) \cdot 10^{-30} g/cm^3$ (J. Prat, C. Hogan, C. Chang, J. Frieman, 2022).
The cosmological model with superconductivity (CMS), proposed by the author, also implies a description of the earliest stage of the Universe evolution preceding the inflation stage. It describes the formation of the inflaton field as a special condensate of primordial fermions with the Planck mass, followed by the inflationary expansion of the early Universe. The current expansion of the Universe and its evolution are described as an ongoing second-order phase transition, and the flow of physical cosmological time is a consequence of processes occurring on Planck scales. The value of the Hubble parameter $H_0 = 69.76\ km \cdot s^{-1} Mpc^{-1}$ calculated in CMS corresponds to the average value for most values of this parameter obtained by different methods. CMS also describes black holes as a quantum condensate of primary fermions with Planck mass.

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