Resolving cosmological singularity problem in a logarithmic superfluid theory of physical vacuum

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Recently proposed statistical mechanics arguments [1] and previously known Madelung hydrodynamical presentation of condensate functions [2] have revealed that the quantum liquids with logarithmic nonlinearity, often referred as "logarithmic fluids", are very instrumental in describing generic condensate-like matter, including strongly-interacting quantum fluids, one example being a superfluid component of He-4 [3-6]. A large number of applications of the logarithmic fluids can be also found in a theory of physical vacuum which becomes a useful tool for explaining a phenomenon of gravity. Using the logarithmic superfluid model, one can formulate an essentially quantum post-relativistic theory of superfluid vacuum, which successfully recovers special and general relativity in the "phononic" (low-momenta) limit, but otherwise has rather different tenets and foundations. The paradigm of superfluid being a fundamental background opens up an entirely new prospective on the emergence of the Lorentz symmetry and spacetime, black holes, cosmological singularities, and so on [7-12].

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