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Logarithmic superfluid vacuum and its manifestations through gravitational and cosmological phenomena

Recently proposed statistical mechanics arguments [1] and hydrodynamical presentation of quantum wave equations [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 liquids, one example being He II, 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 is a useful tool for understanding and describing the 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 as a fundamental background opens up an entirely new prospective on the emergence of Lorentz symmetry and induced four-dimensional spacetime, induced gravitational potential, deformed dispersion relations, black holes, cosmological evolution and singularities, and so on [7-13].

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