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Microscopic vortices in classical liquids

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In the present article we introduce the notions about the microscopic vortices (MV) in classical liquids. The infinite exact chain of engaging kinetic equations of non-Markov type were obtained for the time correlation function (TCF) MV. For its closing and solving the so-called orthogonal dynamic variables of the first, second, third and higher levels are introduced. The consequent usage of this variables let the "quasi-hydrodynamic" approximation for the memory function of the third level $M_3(t)$ be used. In the case $M_3(t)$ is presented as the linear combination of memory functions of the lowest levels. The coefficients in this expansion may be described by means of the relaxation frequency and even moments TCF MV. The present theory can be compared with the molecular-dynamic (MD)-data of different authors for the transverse currents in liquid argon. It is in accordance with the experimental MD-data frequency spectrum MV the liquid argon; it gives an opportunity to determine a spectrum of vortex excitation and relaxation parameters (the lifetime and the excitation relaxation time), a spectrum of non-Markov's MV parameter and its spatial dispersion. We obtained data to prove the existence of considerably fluctuating MV in liquids. Their relaxation is characterized by considerably expressed non-Markov's kinetic properties.

1. Introduction

The vortex movement belongs to the most general form of the fluid movement in nature and technological arrangements. The vortices determine the properties and the behavior of luminary as well as turbulent currents in liquid, gas and plasma. The explanation of the features, and peculiarities of the stationary and chaotic vortices is usually based on the usage of the hydro-dynamic models and equations [1–4]. The usage of hydrodynamics lets to realize and explain a wide range of macroscopic vortex movements in the large interval on hydrodynamics spatial scales: from a few millimeters (in the low-viscosity liquids) till 25,000 km (the Red Spot in the atmosphere on Jupiter).

Not much attention is paid to the studies of the microscopic properties of vortex at this time. The microscopic vortices that spontaneously appear and disappear in the

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