International Conference on
Quantum Mechanics and Applications
July 20-21, 2018 | Atlanta, USA

Hydrodynamics of superfluid quantum space: De Broglie interpretation of the quantum mechanics

Valeriy I Sbitnev
National Research Center Kurchatov Institute, Russia

Presently, we imagine the physical vacuum as a superfluid quantum medium containing enormous amount of particle-antiparticle pairs arising and annihilating continuously. It is the Bose-Einstein condensate existing at super low temperatures of the cosmic space. Then a motion of this cold superfluid quantum medium can be described in the non-relativistic limit by pair of equations-the Navier-Stokes equation and the continuity equation. However, the first equation describes motion of a classical viscous fluid. We need to modify this equation. The modifications concern to the pressure gradient ∇P and to the term incorporating the viscosity of the fluid. The modification of the pressure gradient ($\nabla P \rightarrow \nabla P - P \cdot \ln(\rho_M)$) leads to appearance of the quantum potential, Q, equal to the pressure divided by the density distribution ρ, namely, $Q = P/\rho$. As a result, the above-mentioned pair of equations leads to emerging the Schrodinger equation when defining the wave function in the polar form bearing information about the velocity field of the fluid and the mass density distribution, ρ_M. From the above it follows, that the wave function is a real object evolving on the superfluid quantum space. Because of reflecting from any obstacles, like slits in a grating, the wave function creates an interference pattern near a moving particle. As a result, the interference fringes provides an optimal path for subsequent movement of the particle. It proves that the interpretation of quantum mechanics given by de Broglie and further developed by Bohm is the correct interpretation. With regard to the modification of the viscosity, it would seem that, in the first approximation, we could discard it. This is not a good idea. Instead, we suppose:

$$\langle \mu(t) \rangle = 0, \qquad \langle \mu(t)\mu(0) \rangle > 0. \qquad (1)$$

That is, the viscosity coefficient is a parameter fluctuating about zero. It means that there is an energy exchange within this superfluid medium. It is the zero-point energy fluctuations.

By multiplying the modified Navier-Stokes equation by the operator curl, we come to the vorticity equation

$$\frac{\partial \omega}{\partial t} + (\omega \cdot \nabla) v = \nu(t) \nabla^2 v \qquad (2)$$

This equation in the cylindrical coordinate system permits to consider the vortex in its cross-section geometry. Topological transformation of a toroidal vortex to the vortex ball discloses a path of spin-1/2 rotation arising from the transformation of a two-folded string given in the toroidal vortex.

Biography

Valeriy I Sbitnev has PhD in 1987 from Moscow State University. He is senior researcher in Saint-Petersburg Nuclear Physics Institute, Kurchatov NRC. He has published more than 50 papers in reputed journals.

valery.sbitnev@gmail.com

Notes: