Microscopic Dynamical Theory of Vortices: Insights from superfluids and further implications

Professor Ping Ao (敖平, 长江特聘教授, 973 首席)

Shanghai Center for Systems Biomedicine and Department of Physics, Shanghai Jiao Tong University

ABSTRACT
Vortex dynamics in superfluids and superconductors has been one of intriguing physics phenomena fascinating generations of physicists ever since Lev Landau’s work in 1940’s. It is one of truly emerging macroscopic quantum effects. Surprisingly, its fundamental equation of motion had not been established until middle 1990’s, which was done by David Thouless, Qian Niu, myself, and many others. I will briefly review the basic physical considerations in the establishment of its equation of motion, such as Berry phase, quantum dissipative dynamics. I will discuss how one of most subtle and important effect, the Magnus force was directly checked experimentally. This Magnus force is essentially an alternative expression of Josephson effect. I will also discuss how the famous Hall anomaly in type II superconductors can be quantitatively explained based on a vortex many-body effect model. Most importantly, there are still a few important open issues. I will speculate on how some further experiments can be done, in both classical and quantum fluids.

欢迎老师和同学参加！