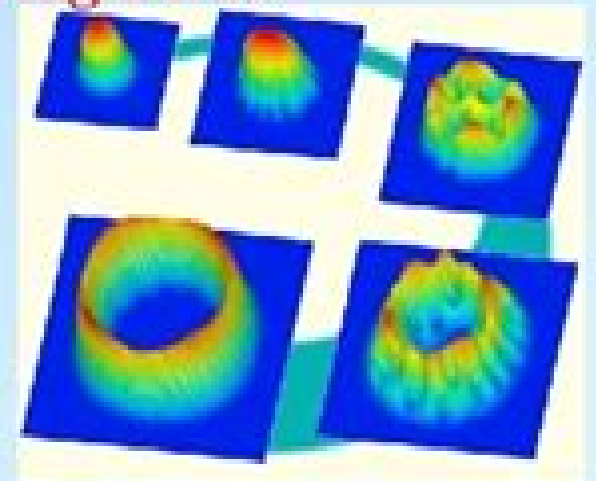
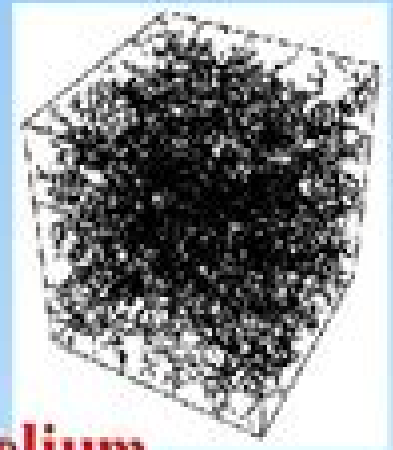


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Quantized Vortex Dynamics And Superfluid Turbulence

Edouard B. Sonin



Quantized Vortex Dynamics And Superfluid Turbulence:

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Quantized Vortices in Helium II Russell J. Donnelly, 1991-03-07. This book discusses the properties of quantized vortex lines in superfluid helium 4 in the light of research on vortices in modern fluid mechanics and gives the first comprehensive treatment of the problem. The author's comprehensive approach will make this book invaluable for students taking advanced undergraduate or graduate courses and for all those involved in research on classical and quantum vortices.

Non-equilibrium Thermodynamics of Superfluid Helium and Quantum Turbulence Maria Stella Mongiovì, David Jou, Michele Sciacca, 2025-07-23. This book puts together non equilibrium thermodynamics, heat transport properties of superfluid He II and thermodynamic and dynamic aspects of quantum turbulence. A one fluid extended model of superfluid helium with heat flux as an additional independent variable is presented and compared with the two fluid model to explore how both models complement each other. Important features arise in rotating situations and in superfluid turbulence characterized by quantized vortices leading to strong nonlinearities between heat flux and temperature gradient. The dynamics of vortex lines and their interaction with heat dynamics, a central topic in superfluid turbulence, is dealt with by introducing the vortex line density as an independent variable and writing its dynamical equations considering the transitions from laminar to turbulent flows and from diffusive to ballistic regimes. Classical and quantum turbulence are compared from a mesoscopic view and from their energy spectra. The work also explores some parallelisms of quantum vortex thermodynamics with cosmic string thermodynamics and black hole thermodynamics, exhibiting duality connections amongst them. It emphasizes didactical views over specialistic details and may be used as an introduction to nonequilibrium thermodynamics of superfluid helium and its heat transport properties, second sound, nonlocal transport, nonlinear connections with quantum turbulence. The book is useful to researchers in superfluid helium, in heat transport and in

thermodynamics of cosmic strings and black holes The diversity and complexity of its several physical equations will be inspiring for researchers in mathematical physics

Emergent Nonlinear Phenomena in Bose-Einstein Condensates Panayotis G. Kevrekidis, Dimitri J. Frantzeskakis, Ricardo Carretero-González, 2007-12-29 This book written by experts in the fields of atomic physics and nonlinear science covers the important developments in a special aspect of Bose Einstein condensation namely nonlinear phenomena in condensates Topics covered include bright dark gap and multidimensional solitons vortices vortex lattices optical lattices multicomponent condensates mathematical methods rigorous results and the beyond the mean field approach

Dynamics of Quantised Vortices in Superfluids Edouard B. Sonin, 2016-02-04 A comprehensive overview of the basic principles of vortex dynamics in superfluids this book addresses the problems of vortex dynamics in all three superfluids available in laboratories 4He 3He and BEC of cold atoms alongside discussions of the elasticity of vortices forces on vortices and vortex mass Beginning with a summary of classical hydrodynamics the book guides the reader through examinations of vortex dynamics from large scales to the microscopic scale Topics such as vortex arrays in rotating superfluids bound states in vortex cores and interaction of vortices with quasiparticles are discussed The final chapter of the book considers implications of vortex dynamics to superfluid turbulence using simple scaling and symmetry arguments Written from a unified point of view that avoids complicated mathematical approaches this text is ideal for students and researchers working with vortex dynamics in superfluids superconductors magnetically ordered materials neutron stars and cosmological models

Transport and Turbulence in Quasi-Uniform and Versatile Bose-Einstein Condensates Gauthier Guillaume, 2020-09-26 Advancing the experimental study of superfluids relies on increasingly sophisticated techniques We develop and demonstrate the loading of Bose Einstein condensates BECs into nearly arbitrary trapping potentials with a resolution improved by a factor of seven when compared to reported systems These advanced control techniques have since been adopted by several cold atoms labs around the world How this BEC system was used to study 2D superfluid dynamics is described In particular negative temperature vortex states in a two dimensional quantum fluid were observed These states were first predicted by Lars Onsager 70 years ago and have significance to 2D turbulence in quantum and classical fluids long range interacting systems and defect dynamics in high energy physics These experiments have established dilute gas BECs as the prototypical system for the experimental study of point vortices and their nonequilibrium dynamics We also developed a new approach to superfluid circuitry based on classical acoustic circuits demonstrating its conceptual and quantitative superiority over previous lumped element models This has established foundational principles of superfluid circuitry that will impact the design of future transport experiments and new generation quantum devices such as atomtronics circuits and superfluid sensors

Novel Superfluids K. H. Bennemann, John B. Ketterson, 2013-02-28 This book reports on the latest developments in the field of Superfluidity one of the most fundamental interesting and important problems in physics with applications ranging from metals helium liquids photons in cavities

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