1. Record Nr. UNINA9911011654303321

Autore	Mongiovì Maria Stella
Titolo	Non-equilibrium Thermodynamics of Superfluid Helium and Quantum Turbulence : The Richness of Non-Fourier Heat Transport / / by Maria Stella Mongiovì, David Jou, Michele Sciacca
Pubbl/distr/stampa	Cham : , : Springer Nature Switzerland : , : Imprint : Springer, , 2025
ISBN	3-031-85148-X
Edizione	[1st ed. 2025.]
Descrizione fisica	1 online resource (480 pages)
Collana	UNIPA Springer Series, , 2366-7524
Altri autori (Persone)	JouDavid SciaccaMichele
Disciplina	621.4021
Soggetti	Thermodynamics Heat engineering Heat - Transmission Mass transfer Quantum theory Condensed matter Engineering Thermodynamics, Heat and Mass Transfer Quantum Physics Condensed Matter Physics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di contenuto	-- Introduction -- The two-fluid model of superfluid hydrodynamics -- The one-fluid extended model -- Superfluid hydrodynamics in rotating systems -- Turbulence in superfluids -- Coupled heat and vortex flows -- Coupling between mass flow, heat flux and vortices -- Microscopic approach to Helium II -- Quantized vortices -- Classical vs quantum turbulence -- Thermodynamics of vortex tangles and of cosmic strings -- Perspectives and suggestions.
Sommario/riassunto	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.