The Ginzburg–Landau Framework in the Study of Mesoscopic Superconductivity and Vortex Dynamics

Rafael Zadorosny[1]*

[1] Universidade Estadual Paulista, São Paulo, Brazil

*email: rafael.zadorosny@unesp.br

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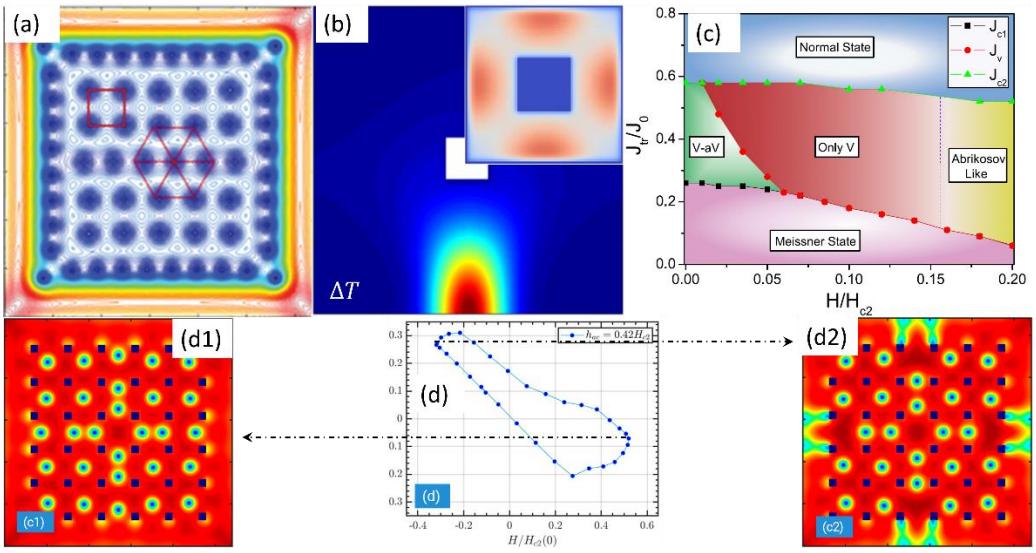
In this lecture, an overview of the Ginzburg–Landau theory will be presented, along with a discretization methodology for the time-dependent Ginzburg–Landau equations applied to the study of equilibrium and non-equilibrium states of vortex matter in mesoscopic superconductors. As application examples, some of the main results obtained by our research group in recent years will be discussed. Firstly, a characteristic size scale that defines the threshold between macroscopic and mesoscopic behaviors will be presented [1]. Additionally, dissipation mechanisms governing mesoscopic superconductors [2,3], vortex dynamics and phase-slip lines in superconducting tapes [4], as well as vortex dynamics under AC magnetic fields [5], will also be addressed.



Pic. (a) Crossover of the vortex lattice near the macro–meso threshold; (b) temperature variations in vortex motion (darkest red indicates maximum variation, dark blue indicates zero); (c) diagram of vortex dynamics illustrating kinematic vortex behavior and an Abrikosov-like vortex; (d) AC magnetic field excitation, where (d1) shows the vortex configuration after entry and (d2) the onset of vortex exit.

Bibliography

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