



DQ-mat block lecture on "Quantum Gases in ring and bubble geometries", Day 1

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(Guest of Dr. N. Gaaloul)

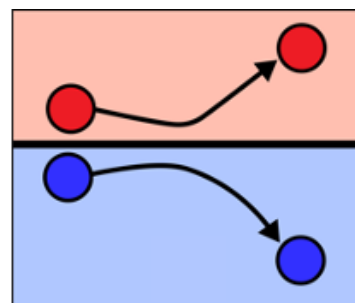
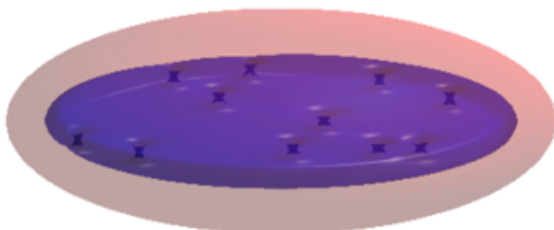
Leibniz Universität Hannover
Room D326
Building 1101, Welfengarten 1
Tuesday, 04 July 2023, 2.00 pm

"Warm Atomic Superfluids Far From Equilibrium: Microscopic Treatment of Superflow Decay and Quantum Vortex Dissipation"

Ultracold atomic gases are ideal playgrounds for studying non-equilibrium physics of many-body quantum systems. While the zero-temperature and high-temperature regimes of these systems are largely well-understood, this is not the case for the intermediate regime due to the complex interplay between coherent dynamics and incoherent quantum and thermal fluctuations. In this talk, I address two phenomena that have been explored experimentally but remain poorly understood from a theoretical perspective: decay of superfluid flow in a toroidal Bose-Einstein condensate (BEC), and the finite-temperature dynamics of quantum vortices in quasi-2D BECs. In the first study, I will present detailed numerical simulations to explore the unexplained temperature dependence of persistent current decay in a toroidal superfluid, uncovering the importance of both quantum and thermal fluctuations across the partially-degenerate regime [1]. In the second, I will present an analytic investigation of mutual-friction damping and diffusion of vortices in oblate atomic superfluids that accounts for previously neglected number-conserving interactions between superfluid and thermal atoms [2], closing a gap between theory and experiment previously bridged by phenomenology.

[1] Z. Mehdi, A. S. Bradley, J. J. Hope, and S. S. Szigeti, *SciPost Phys.* 11, 080 (2021)

[2] Z. Mehdi, S. S. Szigeti, J. J. Hope, and A. S. Bradley, *Phys. Rev. Res.* 5, 013184 (2023)



All DQ-mat members and all interested are cordially invited to attend.