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Emergent Universal Drag Law in a Model of Superflow

Monday 2 September 2024 17:00 (2 hours)

Despite the fundamentally different dissipation mechanisms, many laws and phenomena of classical turbulence equivalently manifest in quantum turbulence. The Reynolds law of dynamical similarity states that two objects of same geometry across different length scales are hydrodynamically equivalent under the same Reynolds number, leading to a universal drag coefficient law. We confirm the existence of a universal drag law in a superfluid wake, facilitated by the nucleation of quantized vortices. We study superfluid flow across a range of Reynolds numbers for the paradigmatic classical hard-wall and the Gaussian obstacle, popular in experimental quantum hydrodynamics. In addition, we provide a feasible method for measuring superfluid drag forces in an experimental environment using control volumes.

References

Short bio (50 words) or link to website

Maarten is a PhD student in the Bose-Einstein Condensation Laboratory at the University of Queensland. He joined the group during his Masters, where he set up a two-dimensional optical trap for Bose-Einstein condensates to study quantum turbulence. Currently, Maarten is working on drag phenomena in superfluids.

Relevant publications (optional)

Career stage

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