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Dynamics of Quantum Vortices LARA THOMPSON, UBC, PHILIP STAMP, UBC, PITP — Quantized vortices exist in systems ranging from low-T magnets, to superfluids and superconductors; however, their dynamics remain controversial. Even the existence of a force acting transverse to the motion (like a Lorentz force) relative to thermal quasiparticles has been widely debated. Quite remarkably, it remains unresolved just what forces act on a quantum vortex. From an influence functional calculation, we show that the expected log divergent mass generalizes to a frequency dependent mass and damping, which, in time, manifest as memory dependent damping forces, acting both longitudinal and transverse to current motion. Because topological properties are involved, our results apply equally to quantum vortices in many different systems. For instance for vortices in insulating magnets, we are able to find the various forces, including those resulting from vortex-magnon interactions, and derive their dynamics. In contrast to superfluids and superconductors, an experimental test in insulating magnets should be possible using existing methods.

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