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Quantum Dynamics of a Bose Superfluid Vortex[1] LARA THOMPSON, Massachusetts Institute of Technology, PHILIP STAMP, University of British Columbia, Pacific Institute of Theoretical Physics — Quantum vortex dynamics remain poorly understood despite decades of theoretical investigation. The vortex is a topological soliton, arising from the same medium as the quasiparticles with which it interacts. Hence the coupling between the vortex "zero mode" and the quasiparticles has no term linear in the quasiparticle variables – the lowest order coupling is quadratic. We present a fully quantum-mechanical derivation of the vortex equation of motion valid at low temperatures where the normal fluid density is small. The resulting equation of motion is naturally expressed as a function of the dimensionless frequency $\tilde{\Omega} = \hbar\Omega/k_B T$. The usual Hall-Vinen/Iordanskii equations are valid when $\tilde{\Omega} \ll 1$ (the "classical regime"), but elsewhere, the equations are strongly memory dependent. We will discuss the experimental implications of this frequency dependence in Bose superfluids and cold atomic gases.

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