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Dissipation in Nanoscale Superfluids ADRIAN DEL MAESTRO, University of Vermont, BERND ROSENOW, University of Leipzig — Pressure driven flow of a superfluid inside a narrow channel can be maintained by the nucleation of vortices and their resulting motion across the flow lines. The maximum velocity of the superfluid is set by a nucleation rate which crucially depends on the microscopic details of the vortices and flow profile. Within the kinetic vortex theory, we have determined the critical superfluid velocity inside a nanoscale constriction and obtain agreement with experimental results for superfluid helium-4 in nanopores. In the small pore limit, when the ratio of pore radius to correlation length is of order unity, we find a drastic suppression of the superfluid velocity that can be understood within the Langer-Ambegaokar-McCumber-Halperin theory of resistive fluctuations in thin superconducting wires.

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