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Transition to turbulence and its dependence on vortex damping in superfluids M. KRUSIUS, V.B. ELTSOV, R. DE GRAAF, R.E. SOLNTSEV, Low Temperature Laboratory, Helsinki University of Technology, FIN-02015 TKK, Finland, LOW TEMPERATURE LABORATORY TEAM — In superfluids the motion of quantized vortex lines with respect to normal excitations is damped by mutual friction dissipation. In the B phase of superfluid helium-3 at millikelvin temperatures mutual friction has steep exponential temperature dependence: At higher temperatures vortex motion is overdamped, as is typical in superconductors, and the vortex number remains constant in dynamic processes. In contrast, at lower temperatures and low damping turbulence becomes possible, similar to superfluid helium-4, where the tangled turbulent motion of quantized vortices is present at essentially all temperatures. In our rotating measurements the characteristics of such a temperature dependent onset of turbulence is explored for the first time. Within the critical temperature regime of vortex damping we find power-law dependence between the perturbation required to achieve turbulence and a mutual friction controled dynamical parameter, which here in superfluid dynamics corresponds to Reynolds number. This result is similar to recent measurements on the onset of turbulence in viscous pipe flow, where the amplitude of the critical flow perturbation has been measured to have power-law dependence on Reynolds number.

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