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Flow of He II in a channel with ends blocked by superfleaks[1]
LADISLAV SKRBEK, Faculty of Mathematics and Physics, Charles University, Prague, TIMOFYI CHAGOVETS, Institute of Physics, Prague — We report experiments of He II flow thermally induced by a fountain pump in channels of square cross-section with ends blocked by sintered silver superleaks and its decay (PRL 100 (2008) 215302). We confirm a critical velocity $v_{\rm cr}^{\rm I}$ of order 1 cm/s, which does not scale with the channel size and is therefore an intrinsic property of the self-sustained vortex tangle of vortex line density L, measured by the second sound attenuation. In addition to the previously reported turbulent A-state characterized by $L^{1/2} = \gamma(T)(v - v_{\rm cr}^{\rm I})$ we have discovered a new B-state characterized by $L = \beta(v - v_{\rm cr}^{\rm II})$. We offer a phenomenological model assuming that in the B-state the superflow matches the classical parabolic profile, with a slip velocity $v_{\rm cr}^{\rm II}$ of order few cm/s and that a confined viscous normal fluid flow of toroidal form is induced inside the channel due to the mutual friction force. When the fountain pump is switched off, after an initial decay, a confined quasi-viscous flow of a single-component fluid with effective kinematic viscosity $\nu_{eff}(T)$ establishes, giving rise to the observed exponential decay. The calculated values of $\nu_{eff}(T)$ are in agreement with those deduced from other experiments on decaying He II turbulence.

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