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Superfluid-Turbulence Cascade by Its Low-Temperature Cutoff EVGENY KOZIK, Institute for Theoretical Physics, ETH Zurich, and Department of Physics, University of Massachusetts Amherst, BORIS SVISTUNOV, Department of Physics, University of Massachusetts Amherst — Recent advances in experimental techniques have made it possible to explore highly non-trivial short-wavelength physics of low-temperature superfluid turbulence. We analyze the transformation of the (quasi-)classical Kolmogorov cascade into the Kelvin-wave cascades on individual vortex lines at high enough wavenumbers, revealing a chain of three qualitatively distinct intermediate regimes, supported by local-induction motion of the vortex lines, and distinguished by specific reconnection mechanisms. On the basis of this scenario, we develop a theory of low-temperature cascade cutoff, which predicts a peculiar behavior of the quantized vortex line density, L, controlled by the frictional coefficient, $\alpha(T) \ll 1$, responsible for the cutoff. Excellent agreement with a recent experiment by Walmsley *et al.* [arXiv:0710.1033]—in which $L(T)$ has been measured down to $T \sim 0.08\,\mathrm{K}$—validates our scenario and allows to quantify the Kelvin-wave cascade spectrum.

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