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The Importance of Nonlocal Terms in Superfluid Turbulence RENA ZIEVE, OWEN DIX, University of California, Davis — Simulations of vortex motion in superfluid helium based on the Biot-Savart law plus vortex reconnections can model homogeneous superfluid turbulence. However, the quantitative properties of the turbulent tangle are disturbingly sensitive to details of how the computations are carried out, and in some cases the tangle degenerates unphysically into an arrangement of parallel straight vortices. These problems have been attributed to the reconnection procedure, to the periodic boundary conditions used for most calculations, and to the localized induction approximation (LIA) which often replaces the (non-local) Biot-Savart integral. Previous work using numerical calculation of the complete Biot-Savart integral does not show the same issues as the LIA calculations, but these are time-consuming calculations. We show here that numerical integration over a relatively small region can suffice, as long as the size of the region exceeds the typical intervortex spacing. This result explains why the non-local contribution has a strong effect. It contributes an attraction between nearby vortices that ultimately leads to reconnections, which prevent the vortices from settling into an array of parallel lines.

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