Counterflow channel: statistical studies on the normal component

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A still open issue in superfluid helium II flows concerns the nature and the structure of the flows of the superfluid and normal fluid components in the presence of quantum vortices. The latter are responsible for the mutual friction interaction between the two phases which strongly modifies the vortex–free laminar flows of the two components. Experiments in counterflow channels employing metastable helium molecules[1] have concluded flat velocity profiles and theorized a turbulent structure for the normal fluid flow.
In the present work, we focus our attention on: (i) the mesoscopic profile of the normal fluid velocity in different vorticity regimes (T I and T II), by the means of self-consistent two–dimensional numerical simulations of helium II channel counterflows; (ii) the statistical analysis of the structures of the superfluid and normal fluid velocity fields employing energy spectra, structure functions and PDFs. The ultimate aim is to give an important contribution for establishing whether the features of the T I and T II regimes determined in counterflow experiments are related to the conjectured turbulent transition of the normal fluid flow[2,3].

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