Numerical experiments on a two dimensional counterflow channel in helium II by means of a one-fluid model

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Superfluid helium is usually described by the two-fluid model proposed by Tisza and Landau with normal and superfluid components, with densities ρ_n and ρ_s and velocities $\mathbf{v}_n$, $\mathbf{v}_s$. An alternative model is a one-fluid model based on ρ, $\mathbf{v}$, T and bfq (total density, average velocity, temperature, and heat flux)) which was proposed by means of the Extended Thermodynamics [1]. Both descriptions are related; because $\rho = \rho_s + \rho_n$, $\rho\mathbf{v} = \rho_s\mathbf{v}_s + \rho_n\mathbf{v}_n$, $\mathbf{q} = \rho_s TS(\mathbf{v}_n - \mathbf{v}_s)$. The former is closely related to microscopic view and the second one to macroscopic experiments.
Here we present our recent numerical simulation in a 2D counterflow channel filled with turbulent superfluid helium in the TI status. The aim is to compare the obtained results to the ones achieved by means of the two-fluid model in the same conditions. This analysis would give more light to differences and analogies between these two models taking into account the recent experimental results obtained by Guo et al.[2] on the normal fluid profile.

1. Mongiovì, M.S. (1993). "Extended irreversible thermodynamics of liquid helium II", Phys. Rev. B **48**, 6276.
2. Guo, W.; Cahn, S.B.; Nikkel, J.A.; Vinen, W.F.; McKinsey, D.N. (2010). "Visualization Study of Counterflow in Superfluid 4He using Metastable Helium Molecules", Phys. Rev. Lett. **105**, 045301.

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