Evolution of the anisotropy of the quantum vortex tangle

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Abstract The evolution of a quantised vortex tangle in superfluid ^{4}He depends on its line-length density, but it is also related to various geometrical measures of the vortex lines forming the tangle. In this paper microscopic dynamics of the vortex tangle is studied analytically to derive an evolution equation for an average binormal to the vortex lines, which is an important measure controlling the growth of the vortex tangle. This equation supplements the Vinen equation for the line-length density. The resulting system (in the contrary to the both Vinen equation alone and alternative Vinen equation) is applicable to an analysis of transients in which the counter-flow changes its direction as well as to the processes with counter-flow changing periodically with various frequencies.

Research on fields anisotropic
Is surely an interesting topic;
The unit binormal
Shows features abnormal,
As seen if you're not too myopic!

1. Introduction

The variety of the dynamic phenomena exhibited by the superfluid ^{4}He (He II) involves the appearance and motion of quantised vortices. We recall that at low velocities He II flows in a frictionless, presumably laminar manner and can be described within the ideal fluid model. When the characteristic velocities becomes sufficiently large, the superfluid laminar flow develops into a superfluid turbulent flow in which quantum vortices form a chaotic tangle. The quantum tangle is a complex system which behaviour can be analysed via various geometrical and topological measures. The topological complexity measures like linking number, writhing number etc. are on the current investigation, see Barenghi, Samuels & Ricca in this volume. Here we focus on geo-