

Quantum turbulence: From superfluid helium to atomic Bose-Einstein condensates

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Abstract

We discuss recent developments in quantum fluid dynamics and quantum turbulence (QT) for superfluid helium and atomic Bose-Einstein condensates. Quantum turbulence was discovered in superfluid ^4He in the 1950s, but the field moved in a new direction starting around the mid 1990s. Quantum turbulence (Fig.1) is comprised of

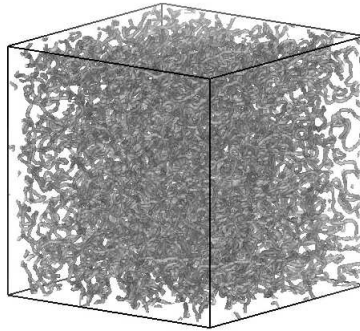


Figure 1: Quantum turbulence

quantized vortices that are definite topological defects arising from the order parameter appearing in Bose-Einstein condensation. Hence QT is expected to yield a simpler model of turbulence than does conventional turbulence. A general introduction to this issue and a brief review of the basic concepts are followed by a description of vortex lattice formation in a rotating atomic Bose-Einstein condensate, typical of quantum fluid dynamics (Fig.2). Then we discuss recent developments in QT of superfluid helium such as the energy spectra, QT

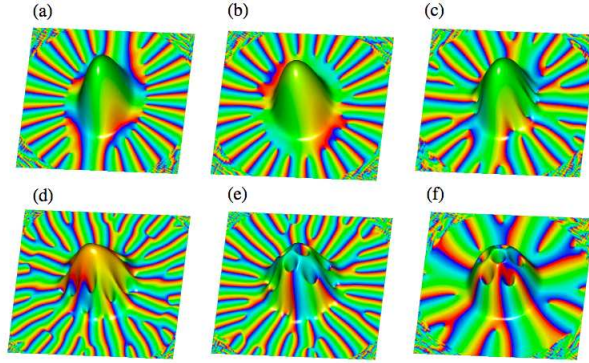


Figure 2: Vortex lattice formation

created by vibrating structures etc.. As an application of these ideas, we end with a discussion of QT in atomic Bose-Einstein condensates.

References

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