

COOL STUFF AT COLD TEMPERATURES

Katepalli R Sreenivasan

New York University, NY 10012, USA

E-mail: krs3@nyu.edu

Liquid helium has superfluid properties at low temperatures. For ^4He the transition temperature is 2.17 K; for ^3He , it is about 0.0025 K. Superfluids flow without friction and possess other extraordinary properties. One of them is the formation of line vortices whose diameters are atomic in scale. Quantum mechanics constrains their circulation to be discrete. These quantum vortices interact with each other, reconnect and form complex topological structures—among them a random tangle. Certain properties of this random tangle are similar to those of classical turbulence. For this reason, the random tangle is called quantum turbulence. We shall explore several fascinating properties of superfluid helium, present recent experimental, theoretical and computational results on quantum turbulence, and discuss their implications on our understanding of classical turbulence.

Keywords: superfluidity; quantum turbulence; vortex reconnection; particle tracking;