SFB/TRR 21 - Colloquium

1. Juli 2011, Tübingen

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Superfluid Turbulence: Nonthermal Fixed Point in an Ultracold Bose Gas

Nonthermal fixed points of the dynamics of a dilute degenerate Bose gas are analysed in two and three spatial dimensions. For such systems, universal power-law distributions, previously found within a nonperturbative quantum-field theoretic approach, are shown to be related to vortical dynamics and superfluid turbulence. The results imply an interpretation of the momentum scaling at the nonthermal fixed points in terms of independent vortex excitations of the superfluid. Long-wavelength acoustic excitations on the top of these are found to follow a non-thermal power law. The results shed light on fundamental aspects of superfluid turbulence and have strong potential implications for related phenomena, e.g., in early-universe inflation or quark-gluon plasma dynamics.

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