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Colloquium of the Physics Department of ENS

Mercredi 7 Fevrier 2024, 13 :30
DPT-PHYS-ENS, ConfIV (E244) - Dépt de Physique de l'ENS - 24 rue Lhomond 75005 PARIS
Domaines : physics

Titre : *Universal scalings in evolving and stationary wave turbulence*

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Résumé : *Using the Nonlinear-Schrodinger (NLS) equation as a master model, I will present analytical and numerical results concerning several types of universal scaling regimes in wave turbulence. In stationary turbulence, these will be concerned with a revised theory of the famous Kolmogorov-Zakharov (KZ) spectra, both the direct and the inverse cascades. In evolving wave turbulence, the universal scalings manifest themselves in self-similar asymptotics (referred to as "non-thermal fixed points" in some recent papers). The latter behaviour comes in three flavours : self-similarity of the first, second and third kinds respectively. The self-similarity of the first kind appears as a large time asymptotic of the spectrum propagating toward high frequencies. Its scaling is fully determined by energy conservation. The self-similarity of the second kind appears as a finite time blow-up of the wave-kinetic equation (WKE) at the zero frequency : it is related to a physical phenomenon of the Bose-Einstein condensation. The scaling of this self-similarity is non-trivial : it cannot be found from conservation laws, and it is determined by solving a "nonlinear eigenvalue problem". The self-similarity of the third kind appears in the forced-dissipated settings as a final stage of transition to the KZ spectrum and it takes the form of a frequency-space wave reflected from the low-frequency dissipative range. Its scaling is inherited from the previous (blowup) self-similar stage. I will present numerical results testing the analytical predictions arising from simulations of both the WKE and the 3D NLS equation.*