Direct and inverse cascades in turbulent Bose-Einstein condensate

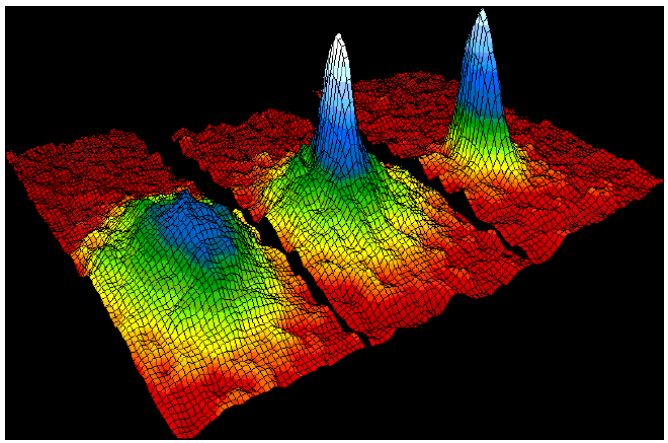
Ying Zhu[1], Boris Semisalov[2,3,4], Giorgio Krstulovic[2] and Sergey Nazarenko[1]

[1]Université Côte d'Azur, CNRS, Institut de Physique de Nice (INPHYNI)

[2] Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, Laboratoire Lagrange

[3] Novosibirsk State University, Russia

[4] Sobolev Institute of Mathematics SB RAS, Russia



Snap shots illustrate the condensation of rubidium atoms.

(Image credit : NIST/JILA/CU-Boulders)

- Bose-Einstein Condensate (BEC) and Wave Turbulence (WT)

- Gross-Pitaevskii equation (GPE) and Wave Turbulence theory (WTT)
- Kolmogorov-Zakharov (KZ) spectra wave-kinetic equation (WKE) in four-wave system :
  - For direct cascade of energy $n_{\boldsymbol{k}} = C_d P^{1/3} k^{-3} \log^{-\frac{1}{3}} (k/k_f)$
  - For inverse cascade of particles $n_{\boldsymbol{k}} = C_i Q^{1/3} k^{-7/3}$
- Goals : Validate the KZ solutions and find out the prefactor constants.
- Main achievements :

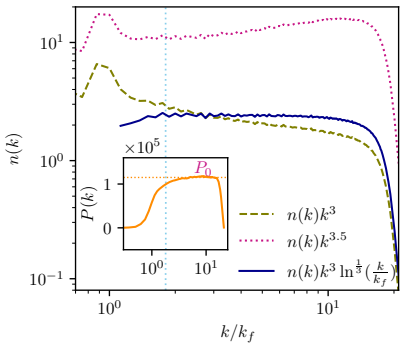
- Direct cascade

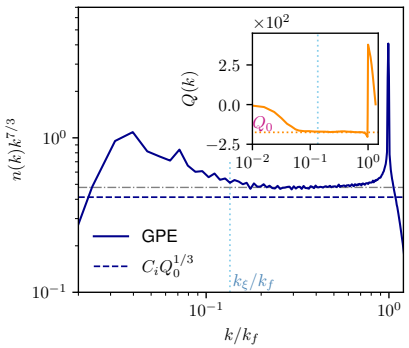
  C_d numerically fitted

- Inverse cascade

  C_i theoretical derivation

GPE





WKE