莫大–北理工–深北莫
应用数学联合研究中心
Совместный научно-исследовательский центр прикладной математики МГУ–ППИ–МГУ-ППИ
MSU–BIT–SMBU Joint Research Center of Applied Mathematics

计算数学与控制系
Факультет вычислительной математики и кибернетики
Faculty of Computational Mathematics and Cybernetics

应用数学讲座

Научный Семинар по Прикладной Математике
Research Seminar on Applied Mathematics

报告人 / Докладчик / Speaker: 谢尔盖·纳扎连科教授，法国蔚蓝海岸大学尼斯物理研究所主任 Назаренко Сергей Витальевич

题目 / Название / Title: Universal scalings in evolving and stationary wave turbulence

时间 / Время / Time：2026/3/19 15:45-17:15

地点 / Место / Venue: 主楼336

摘要 / Аннотация / Abstract:

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 KolmogorovZakharov (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.

Introduction to Professor Sergey Nazarenko：

CURRENT POSITION

2024 – present Directeur de Recherche de Classe Exceptionnelle (DRCE-2) au CNRS, L'Institut de Physique de Nice UMR 7010, CNRS, Université de la Côte d'Azur.

FELLOWSHIPS AND AWARDS

2018 – 2020 Chaire D'Excellence IDEX (Initiative of Excellence) awarded by Université de la Côte d'Azur, France.

2013 – 2014 Chaire Externe Senior du PALM LabEx ("Physics: Atoms, Light and Matter", the Lab. of Excellence), awarded by the Fondation for Scientific Cooperation of the Paris-Saclay campus, France.

2012 – 2013 Invited Distinguished Scientist at the Institute for Computational Technology of Siberian Branch of the Academy of Sciences, Educati of the Russian Federation.

2008 – 2014 Professeur Invité, Observatoire de la côte d'Azur, July 2008, June 2009, July 2010, Nov 2010, March 2011, Sept 2012, Sept 2014; Université Pierre et Marie Curie (Paris VI), March-April 2009

1996 – 2002 Warwick Research Fellowship received from the University of Warwick, UK.