复旦大学物理系 Colloquium

Time: 14:00, Tuesday, 2021.11.9

Location: Room C108, Jiangwan Physics Building

Fluctuation-response relation in and out of equilibrium

汤雷翰 教授

北京计算科学研究中心/香港浸会大学

Abstract: The response of a physical system, large or small, to external perturbations is of interest in a variety of contexts, not the least climate change whose study was awarded Nobel Prize in Physics this year. Einstein in 1905, while examining Brownian motion, proposed a relation relating mobility of a particle to its diffusion coefficient in a fluid. Systematic theories of response and fluctuations in equilibrium systems were developed by Onsager, Callen and Welton, and Kubo. Since the 1990s, there has been a renewed interest in the topic for small systems and generalizations of the fluctuation-response relation (FRR) to nonequilibrium systems. In this talk, I will give an elementary introduction to the subject and then discuss aspects of violation of the FRR in nonequilibrium systems[1] that underlie interesting behavior such as adaptation of individuals and spontaneous oscillations in communicating cell populations[2].

[1] Shou-Wen Wang, Kyogo Kawaguchi, Shin-ichi Sasa, and Lei-Han Tang, "Entropy production of nanosystems with time scale separation", Phys Rev Lett 117, 070601 (2016).

[2] Shou-Wen Wang and Lei-Han Tang, "Emergence of collective oscillations in adaptive cells", Nature Communications 10, 5613 (2019).

Biography: Dr. Lei-Han Tang completed his PhD in statistical physics at the Carnegie Mellon University in 1987. He did postdoctoral work on nonequilibrium and disordered systems at various US and German institutions. He served as Lecturer at the Imperial College London from 1996-1997 before joining the Hong Kong Baptist University in 1997 as an associate professor and then full professor. In 2010 he joined the Beijing Computational Science Research Center through the 1000 Talent Program. His research combines analytical and computational approaches to explore the effects of equilibrium and nonequilibrium fluctuations in various physical and biophysical contexts. In recent years, he has collaborated with experimentalists on the development of quantitative tools and models to analyze and integrate biological data and behavior at the cellular level, in particular those related to metabolism, cell motility, and development. He was elected Fellow of the American Physical Society in 2010.