概率论系列报告

报告题目（Title）: Fluctuating-rate model and stochastic phenotype transition of a single cell

报告人（Speaker）: 葛颢 研究员 北京国际数学研究中心

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时间（Time）: 4 月 20 日(周一) 下午 3:00-4:00

地点（Venue）: 北京大学理科一号楼 1418

摘要（Abstract）: We proposed a fluctuating-rate model for the stochastic biochemical dynamics in a single cell, which is indeed stochastic coupled Ordinary Differential Equations. We also found that the fluctuating-rate model yields a nonequilibrium landscape function, which, similar to the energy function for equilibrium fluctuation, provides the leading orders of fluctuations around each phenotypic state, as well as the transition rates between the two phenotypic states. The rigorous proof needs to integrate the well-known Donsker-Varadhan theory and Feidlin-Wentzell theory in the field of large deviation principles. We further apply this model to Lac operon, and show that the stochastic gene-state switching can significantly broaden the environmental parameter ranges for the existence of bistability induced by positive feedback, which can be beneficial dealing with unpredictable environmental changes. We also demonstrate that the transition rates between different phenotypic states achieve the maximal value at the intermediate region of gene-state switching, and the barrier term in the rate formula can help to distinguish two categories of bistability.

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