


复旦大学数学科学学院
数学综合报告会

报告题目：Noise can facilitate the stability of ecological networks

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报告摘要：

Noise is ubiquitous in natural and man-made systems. In noisy environment, the interactions among species may fluctuate randomly, leading to more complicated interactions among species. Because of the intrinsic nature of noise, it is always regarded as mischievous, i.e., noise will destroy order or add disorder in natural and artificial systems. In this talk, we focus on the effects of noise and network structure on the stability of complex ecological networks with prey-predator interactions. As the interaction strength increases, the system can exhibit a transition from stable state to Turing instability, while as the interaction strength decreases, the system transitions from Turing instability to stable state. There are two crucial critical points in Turing instability, forward and backward. We found that both forward and backward critical points increase as the increase of noise intensity. This means that noise is conductive to maintaining the stability of ecological networks, and restoring the stability of ecosystem. Due to different forward and backward critical points of Turing instability, the hysteresis loop and multi-stability phenomena can be observed. Furthermore, the influence of network structure on two tipping l points is also investigated. We report that increasing the connectivity of both the Erdös-Re´nyi and small-world networks can induce the occurrence of Turing instability, and suppress the transition from Turing instability to stable state. Based on the stability theory of stochastic differential equations, sufficient conditions for Turing instability are derived. And the analytical results are consistent with the numerical results.

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