

## Theoriekolloquium

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Am **16. November 2023** um **14.15 Uhr** im Raum **W2 1-143** hält

**Frau Dr. Yu Meng (MIPPKS, Dresden)**

einen Vortrag mit dem Titel

**Impossible ecologies: Interaction networks and stability  
of coexistence in ecological communities**

Does an ecological community allow stable coexistence?

Identifying the general principles that determine the answer to this question is a central problem of theoretical ecology. Random matrix theory approaches have uncovered the general trends of the effect of competitive, mutualistic, and predator-prey interactions between species on stability of coexistence. However, an ecological community is determined not only by the counts of these different interaction types, but also by their network arrangement. This cannot be accounted for in a direct statistical description that would enable random matrix theory approaches. Here, we therefore develop a different approach, of exhaustive analysis of small ecological communities, to show that this arrangement of interactions can influence stability of coexistence more than these general trends. We analyse all interaction networks of ecology less than five species species with Lotka–Volterra dynamics by combining exact results for ecology less than three species and numerical exploration. Surprisingly, we find that a very small subset of these networks are "impossible ecologies", in which stable coexistence is non-trivially impossible. We prove that the possibility of stable coexistence in general ecologies is determined by similarly rare "irreducible ecologies". By random sampling of interaction strengths, we then show that the probability of stable coexistence varies over many orders of magnitude even in ecologies that differ only in the network arrangement of identical ecological interactions. Finally, we demonstrate that our approach can reveal the effect of evolutionary or environmental perturbations of the interaction network. Overall, this work reveals the importance of the full structure of the network of interactions for stability of coexistence in ecological communities.

Interessierte sind herzlich eingeladen.

gez. Prof. Dr. Ulrike Feudel