

# Einladung zum Würzburger Mathematischen Kolloquium

Julius-Maximilians-Universität Würzburg • Fakultät für Mathematik und Informatik

Prof. Dr. Ansgar Jüngel

Universität Wien

## Modeling and analysis of multi-species systems in biology

Mittwoch, 7. Jan. 2015 • 16:15 Uhr

Raum SE 40, Mathematik Ost, Emil-Fischer-Str. 40, Campus Hubland-Nord

### Inhaltsangabe

Nature is dominated by systems composed of many individuals with a collective behavior. Examples include wildlife populations, biological cell dynamics, and tumor growth. There is a fast growing interest in multi-species systems both in theoretical biology and applied mathematics, but because of their enormous complexity, the scientific understanding is still very poor. Instead of calculating the trajectories of all individuals, it is computationally much simpler to describe the dynamics of the individuals on a macroscopic level by averaged quantities such as population densities. This leads to systems of highly nonlinear partial differential equations with cross diffusion, which may reveal surprising effects such as uphill diffusion and diffusion-induced instabilities, seemingly contradicting our intuition on diffusion.

Major difficulties of the mathematical analysis of the cross-diffusion equations are their highly nonlinear structure and the lack of positive definiteness of the diffusion matrix. In this talk, a method inspired from nonequilibrium thermodynamics is proposed, which allows for a mathematical theory of some classes of such systems. It is based on a transformation of entropy variables which make the diffusion matrix positive definite. This property is a purely algebraic condition and may be shown by computer algebra systems. We explain the technique for some systems modeling populations and tumor growth. Numerical results illustrate the cross-diffusion effects.



[www.mathematik.uni-wuerzburg.de/kolloquium.html](http://www.mathematik.uni-wuerzburg.de/kolloquium.html)

Zu diesem Vortrag laden wir Sie herzlich ein.  
Im Anschluss an die Vorträge Kaffee und Tee im Foyer vor dem SE 40.

Die Dozentinnen und Dozenten der Mathematik

