TECHNISCHE
UNIVERSITÄT
DRESDEN

Zentrum für Informationsdienste und Hochleistungsrechnen

EINLADUNG
zum
ZIH - KOLLOQUIUM

Title: **Regularization of collapse in cellular dynamics: connecting microscopic and macroscopic modelling**

Referent: **Dr. Pavel Lushnikov**
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Abstract:

Biological cells interact through chemotaxis by secreting a diffusing chemical (chemoattractant) and moving towards the gradient of the chemoattractant thereby creating an effective nonlocal attraction between cells. The macroscopic description of the cellular density dynamics through the Keller-Segel model has striking qualitative similarities with the nonlinear Schrödinger equation including critical collapse in two dimensions and supercritical collapse in three dimensions. The critical collapse has logarithmic corrections to a $(t_0-t)^{1/2}$ scaling law of a self-similar solution. Regularization of collapse requires taking into account the finite size of cells at the microsopic level of the cellular dynamics description. Microscopic motion of eukaryotic cells is accompanied by random fluctuations of their shapes which creates serious challenges in microscopic level simulations. We derive a nonlinear diffusion equation coupled with a chemoattractant from microscopic cellular dynamics in dimensions one and two using an excluded volume approach.
The nonlinear diffusion coefficient depends on the cellular volume fraction and provides a regularization (prevention) of a cellular density collapse. A very good agreement is shown between Monte Carlo simulations of the microscopic Cellular Potts Model and numerical solutions of the derived macroscopic equations for relatively large cellular volume fractions about 0.3. We also discuss connections of microscopic and macroscopic cellular dynamics for myxobacteria.

Ort: **Informatik-Neubau, Nöthnitzer Str. 46, INF E042**
Zeit: **Donnerstag, den 27. Mai 2010, 11:00 Uhr**

gez. Prof. Dr. Wolfgang E. Nagel