Berlin Leipzig Seminar
Analysis/probability theory
Second Meeting Winter Term 2005/06

Jointly organized by the University of Leipzig, the Max Planck Institute Leipzig, and the Technical University Berlin

Date:

Friday, 25 November 2005

Venue:

Max Planck Institute for Mathematics in the Sciences, Inselstr. 22, 04103 Leipzig,
Room A01

Program:

10:30–11:30: **Matthias Röger (Technical University Eindhoven)**
Cell membranes, lipid bilayers and the Willmore functional

11:40–12:25: **Stephan Luckhaus (University of Leipzig)**
To be announced

14:00–15:00: **Dimitris Tsagkarogiannis (MPI Leipzig)**
Higher order methods for the coarse-graining of stochastic lattice systems

Everybody is welcome to attend.

Wolfgang König, Leipzig University

Abstracts:

Röger: *Cell membranes, lipid bilayers and the Willmore functional*

Cells membranes, typically formed by lipid bilayers, show a remarkable stability, namely resistance to stretching, bending and fractures. On a micro-scale lipid molecules are considered to consist of head and tails. Starting from a simple two bead model an energy on the meso-scale was derived. The bilayer appears here as 'thickened surfaces'. We give an asymptotic development of the meso-scale energy in terms of the thickness of the objects. In two space dimensions, we rediscover the Willmore functional which classically describes the bending energy of curves. This connection is made precise by proving the Gamma-convergence of suitable scaled versions of the energy. A Wasserstein distance term in the functional suggests to use the geometry induced by the associated optimal mass transport problem.

Tsagkarogiannis: *Higher order methods for the coarse-graining of stochastic lattice systems*

In this talk we present a strategy how to approximate a microscopic system by another coarser one which lives in an intermediate scale between the microscopic and the mesoscopic. Such a coarse-grained system is easier computable since it has fewer degrees of freedom than the microscopic, but it still retains its stochastic character, which is essential to the applications. We view the coarse-graining as a renormalization group map and using cluster expansion techniques we derive expilicit estimates between the two (fine and coarse) descriptions. The talk is based on joint work with Markos Katsoulakis (Massachusetts), Petr Plechac (Warwick) and Luc Rey-Bellet (Massachusetts).