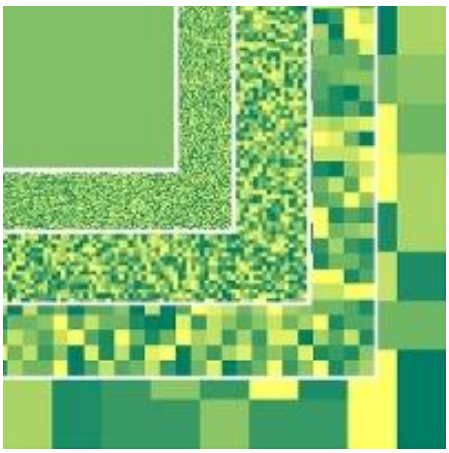
DFG Research Center MATHEON
Mathematics for key technologies

TU Berlin, MA 415
June 27th 2013, 9am

MATHEON MULTISCALE SEMINAR*

organised by R. Klein (FU), D. Petersheim (HU), K. Schmidt (TU), and B. Wagner (TU)
Technical University Berlin, Department of Mathematics, Room MA 415, *June 27th 2013, 9am-12.30pm*

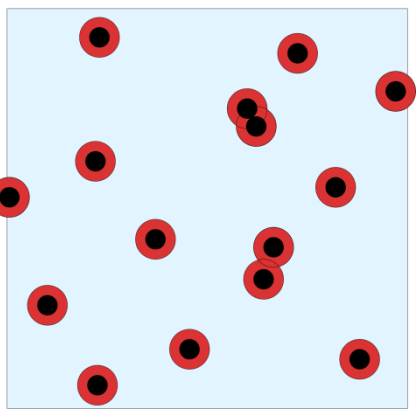
Stefan Neukamm (WIAS Berlin, 9am)
Quantitative results in stochastic homogenization



I will present recent quantitative results for the stochastic homogenization of linear elliptic equations with random coefficients in a discrete setting. Classical qualitative homogenization theory states that on large length scales the random coefficients can be replaced by homogenized coefficients that are deterministic and constant in space. The homogenized coefficients are characterized by a formula that involves the solution to the so called "corrector problem". In contrast to periodic homogenization, in the stochastic setting the corrector problem is a highly degenerate elliptic equation on a probability space. In this talk I will explain how to obtain various optimal estimates on the corrector, on approximations of the homogenized coefficients and on the homogenization error based on a quantification of ergodicity that in particular covers the case of independent and identically distributed coefficients. The approach is mainly based on elliptic and parabolic regularity theory combined with some elements of statistical mechanics and probability theory. The talk is based on joint work with A. Gloria (Université Libre de Bruxelles) and F. Otto (MPI Leipzig).

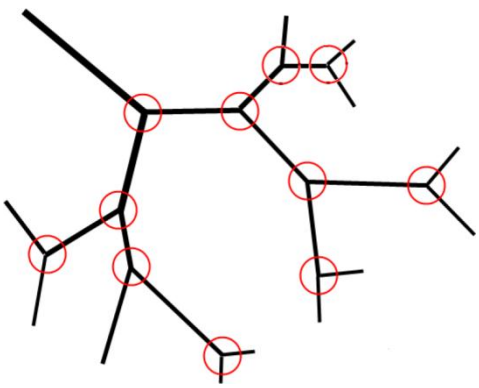
- Coffee Break -

Maria Bruna (University of Oxford, 10.30am)
Diffusion of finite-size particles: multiple species and confined geometries



We discuss nonlinear Fokker-Planck models describing diffusion processes with particle interactions. These models are motivated by the study of systems in biology and ecology composed of many interacting individuals, and arise as the population-level description of a stochastic particle-based model. In particular, we consider a system finite-sized hard-core interacting Brownian particles and use the method of matched asymptotic expansions to obtain a systematic model reduction. The result is a nonlinear Fokker-Planck equation, with the nonlinear term accounting for the size-exclusion interactions. We will present two applications: the diffusion of heterogeneous species (e.g. two types of cell populations), and the diffusion in confined domains (e.g. ion transport in channels).

Adrien Semin (Technical University Berlin, 11.30am)
Construction and analysis of improved Kirchhoff conditions for acoustic wave propagation in a junction of thin slots



We study the acoustic wave propagation in a network of thin slots. As "thin slots" we consider structures whose transverse direction is much smaller than the wavelength, and we focus on what happens in a junction of thin slots. We study here a family of problems where the transverse cross sections of each slot scales with the factor ε of a given reference cross section, and describe the corresponding solutions when ε tends to 0 via the solution of some approximated model defined on the 1D limit geometry. We recall the limit conditions we obtain at the junction (the so-called Kirchhoff conditions) and we show how to improve these conditions. More explicitly we discuss the conditions for a junction of two slots with an angle.

* The MATHEON Multiscale Seminar takes place approximately three times per term with talks about recent work on partial differential equations with multiple scales. Please contact one of the organisers if you want to be invited by e-mail or if you would like to contribute a talk. Webpage: **http::://www.tu-berlin.de/?multiscale-seminar**