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Quantitative methods in stochastic homogenization

We consider the (steady-state) diffusion equation on the integer lattice with random coefficients. Classical results in homogenization show that for stationary and ergodic coefficients homogenization occurs: in the macroscopic limit the random coefficient field can be replaced by homogenized coefficients that are deterministic and constant in space. The homogenized coefficients are defined via 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 posed on an infinite-dimensional function space; and thus its analysis becomes tricky. In this talk we present quantitative estimates on the corrector equation. They rely on the observation that ergodicity can be quantified by combining a certain spectral gap estimate from statistical mechanics with estimates on the parabolic Greens function.

This is joint work with Antoine Gloria, INRIA Lille, and Felix Otto, MPI Leipzig