

Course abstracts

Course 1: Coarse-graining and renormalization for elliptic operators

Lecturer: Scott Armstrong (Sorbonne and Courant)

Abstract: The plan for this course is to give an overview of coarse-graining for elliptic operators in divergence form. We will start with some motivation, reviewing the connection between diffusion processes and elliptic operators (their infinitesimal generators). Next we will introduce the coarse-grained diffusion matrices and explore their basic properties. Then we will prove some quantitative homogenization results by an iteration of coarse-graining estimates to larger scales. Time permitting, we will explore how the coarse-graining theory applies to equations with multifractal coefficient fields and allows us to prove anomalous diffusion for certain stochastic processes with drift.

Course 2: Spin glasses and the Parisi formula

Lecturer: Jean-Christophe Mourrat (ENS Lyon)

Abstract: Spin glasses are models of statistical mechanics in which a large number of elementary units, called spins, interact in a disordered manner. One of the main results of the theory is the Parisi formula, which describes the limit of the free energy of these systems. The goal of the lectures will be to present this formula and some open problems that relate to it, as well as partial progress.