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Lecture 1: Singular stochastic PDEs and paracontrolled distributions

Non-linear evolution problems perturbed by singular noise sources arise naturally as scaling limits of certain microscopic evolutions or homogenisation problems. The parabolic anderson model, the Kardar-Parisi-Zhang equation and the stochastic quantization equation are examples of such systems. Solving (or even giving a meaning to) these equations require a detailed understanding of the propagation of the stochastic perturbations via the non-linear evolution. I will explain how ideas and tools from harmonic analysis can be useful in this analysis and in the related problem of studying the convergence of the microscopic models to their scaling limits.

Lecture 2: Regularisation by noise in PDEs

It can happen that randomly perturbing a PDE can lead to better properties for the solutions. Random perturbation have usually sample paths which are very irregular and it seems that is this irregularity to play a key role in the regularisation effect. I will introduce a deterministic and quantitative notion of irregularity for functions of one variable and show how it can be used to analyse the behaviour of linear and non-linear PDEs modulated by such irregular perturbations. The following situations will be considered: linear transport equations, non-linear Schrödinger equations and the KdV equation.