Regularisation and analysis of Dean-Kawasaki-type equations

Prof. Dr. Johannes Zimmer (University of Bath, UK)

The Dean-Kawasaki model consists of a nonlinear stochastic partial differential equation describing the evolution of the density function for a system of finitely many particles governed by Langevin dynamics. This equation is formally obtained, in a Schwartz distribution setting, on the hydrodynamic scale. As motivation for the study of this class of equations, we will show that the fluctuations they describe can, in the purely diffusive case, be linked to macroscopic diffusion operators of Wasserstein type. We then derive and analyse a suitably regularised Dean-Kawasaki model for noninteracting particles obeying a second order Langevin equation, in one space dimension. We prove a high-probability result for the existence and uniqueness of mild solutions to this regularised Dean-Kawasaki model. Extensions to the case of weakly interacting particles will also be described. This is joint work with Federico Cornalba and Tony Shardlow.