Oliver Tearne: Collapse of attractors under small random perturbations

Crauel and Flandoli show that the random attractor corresponding to a one-dimensional random dynamical system (RDS) is a one point set, provided there exists a compact absorbing set and a unique invariant Markov measure. For example, adding arbitrarily small additive white noise to the one-dimensional ODE $\dot{x} = x - x^3$ causes the deterministic attractor to collapse from an interval to a single point. I will present an algorithm used to investigate this phenomenon in two dimensions, and analytical results showing the random

attractor is a one point set for n-dimensional RDS generated by a class of gradient stochastic differential equations. Central to the algorithm is the result

$\partial\Omega_B \subseteq \Omega_{\partial B}$ for omega-limit sets of compact sets B. This is used to prove that boundaries of deterministic and random attractors are covered by omega-limit

sets of boundaries of compact absorbing sets. To apply the algorithm I will show that any neighbourhood of an absorbing set for the deterministic system is also absorbing for the corresponding stochastic system with positive probability.