

IRTG 2544 “Stochastic Analysis in Interaction”, Berlin

Metastability in interacting particles systems and stochastic PDEs

Nils Berglund

Institut Denis Poisson – Université d’Orléans, Université de Tours, CNRS,
France

25 October – 3 November, 2022

Based on joint works with Giacomo Di Gesù,
Bastien Fernandez, Barbara Gentz and Hendrik Weber



What is metastability?

Supercooled water

(Source: https://youtu.be/fSPzMva9_CE)

Metastable systems

Ising model with Glauber dynamics at low temperature
(Online: https://youtu.be/_vrtfDcjfxU)

Metastable systems

Interacting dipoles on a torus
(Online: <https://youtu.be/tIIl7AGlOC0>)

Metastable systems

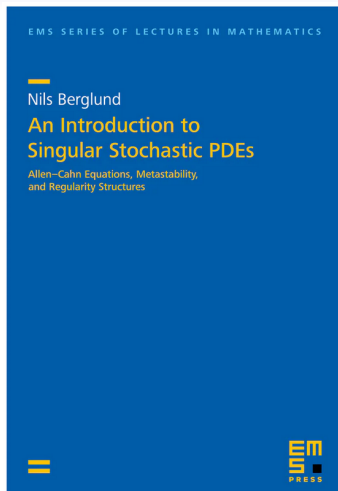
Particles interacting with a Lennard–Jones potential
(Online: <https://youtu.be/zz60EZ0TBxk>)

Metastable systems

1d Allen–Cahn equation (lattice approximation)
(Online: <https://youtu.be/d1eT0qHX80Q>)

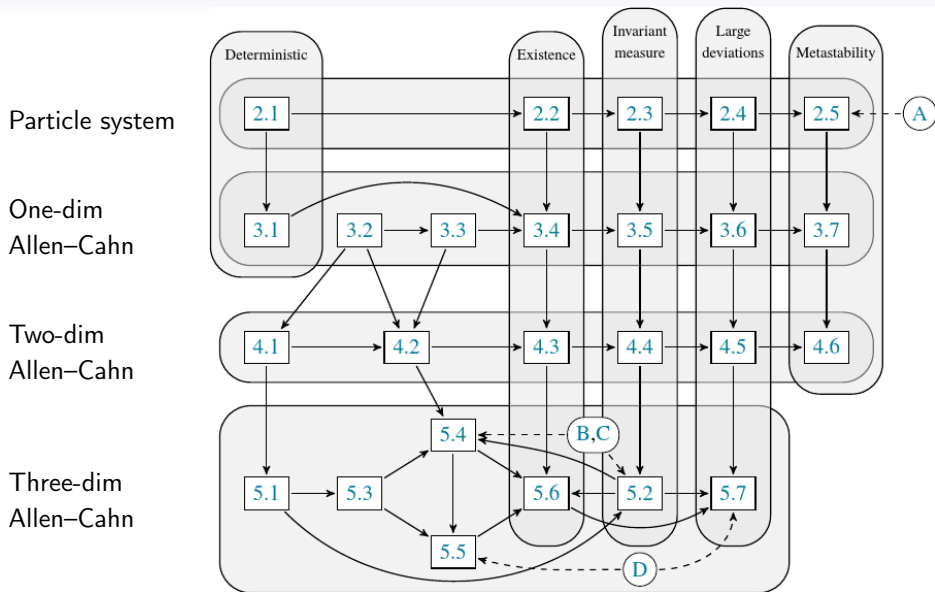
Metastable systems

2d Allen–Cahn equation (viscosity is increasing over time)
(Online: <https://youtu.be/yXOEaxZHNCQ>)



Preprint version: <https://arxiv.org/abs/1901.07420>

Structure of the book



Contents of the minicourse

1. Introduction

2. Lattice approximation (SDE)

- ◇ Existence of solutions, invariant measures, large deviations
- ◇ Metastability

3. Allen–Cahn SPDE on the $1d$ torus

- ◇ Space-time white noise
- ◇ Stochastic heat equation
- ◇ Existence/uniqueness of solutions
- ◇ Invariant measure
- ◇ Large deviations and metastability

4. Allen–Cahn SPDE on the $2d$ torus

- ◇ Wick renormalisation
- ◇ Existence/uniqueness of solutions
- ◇ Invariant measure
- ◇ Large deviations and metastability