

LECTURE

Selected topics in the dynamics of interacting systems (MSc.)

WS 2020/2021

André Schlichting (a.schlichting@uni-muenster.de)

<http://andre-schlichting.de/teaching>

The lecture concentrates on the qualitative description of dynamical systems understood in the broad sense: they either can be finite or infinite-dimensional on continuous or discrete state spaces and occur with or without stochastic influences. The considered systems possess a nonlinearity emerging through some form of interaction.

Some of the prototypes which we like to consider are:

- collective dynamics describing the interaction of systems consisting of many agents
- growth processes describing the formation of clusters
 - cloud and to galaxy formation mechanisms
 - population dynamics and wealth exchange
- opinion dynamics, consensus formation, and strategic decision making

One central question is investigating the longtime behavior, such as the trend to equilibrium and its convergence rate. This question is particularly interesting for dynamics close to phase transitions. Here, a phase transition is understood as a sudden change of the equilibrium states, if one of the system parameters crosses a critical threshold. This phenomenon is studied from several different aspects to highlight that this topic touches many different mathematics fields. The course uses and covers aspects from:

- variational methods, measure theory, and functional analysis
- infinite dimensional dynamical systems
- gradient flows and optimal transport

Background in some of the fields mentioned above, such as functional analysis, dynamical systems, partial differential equations, or Markov processes, is useful, but not required.

I would appreciate it if interested students could send me a short message with their background.