

'Partial Differential Equations in Mathematical Physics'

Lecture WS 2023/2024

In the lecture, we will consider fundamental partial differential equations which appear in physics and introduce basic techniques to study these equations mathematically (existence of solutions and qualitative behavior of solutions).

- **Euler- and Navier-Stokes equations:** The Euler- and Navier-Stokes equations are the basic equations in continuum mechanics. The continuum mechanics describes many important phenomena for example flows of gases and liquids. Here, one describes the time evolution of a density, the mean velocity, the temperature and the pressure.
- **The Boltzmann equations:** The Boltzmann equation is a statistical description of gases which are not in equilibrium.
- **Radiative transfer equation:** The equation of radiative transfer equation describes the time evolution of photons and the interaction with a medium (absorption, emission, scattering). The transport of radiation plays a large role for example in astrophysics or the greenhouse effect in the atmosphere.
- **Vlasov equation:** The Vlasov equation is used to describe the time evolution of a plasma consisting of charged particles. It takes into account forces which appear due to the charges by a mean-field created by the charged particles.

The lecture is intended for students who want to specialize in the field of applied analysis and partial differential equations. A background on partial differential equations is useful, but not mandatory.