Abstracts:

The aid of a gradient flow structure in the analysis of nonlinear diffusion equations

Prof. Dr. Daniel Matthes (Technische Universität München)

Quite a lot of the (idealized) nonlinear diffusion processes that are used to model many-particle systems in physics, chemistry and biology are of gradient flow type, at least formally. Usually, this is considered as a decorative feature and possibly as an indicator for where to get the estimates from, but this additional structure is hardly ever employed for the rigorous analysis of the PDE. In my talk, I will give several examples of diffusion equations --- second and fourth order, scalar and systems --- that can be written as gradient flows in metric spaces, and in which that variational formulation provides a key tool for proving existence of solutions and studying their long time asymptotics. In particular, I will focus on the technical device of auxiliary flows, which allows to prove a priori estimates directly for the implicit Euler discretization in time, without any need for further regularization, Galerkin approximation or the like.

The joy of free boundary problems and maximal regularity

Prof. Dr. Mathias Wilke (University of Halle)

In this talk, I try to convince the audience that the concept of maximal regularity plays an important role in order to solve certain classes of free boundary problems and to study their long-time behaviour.