TULKKA – Konstanz, 18.2.20.25 – Abstracts

Simon Bau (Konstanz):Evolution equations with dynamical boundary conditions in Banach scales

We study semilinear evolution equations with dynamical boundary conditions in Banach scales. The underlying linear operator is defined in $L^q(G) \times L^q(\partial G)$, and admits a bounded H^∞-calculus. To study the equation in the corresponding interpolation-extrapolation scale of the operator, we rely on time-weighted maximal L^p-regularity techniques and the theory of critical spaces for nonlinear parabolic evolution equations.
This can be applied to the study of random attractors for stochastic evolution equations with dynamical boundary conditions in $L^q(G)$, which can be transformed into a PDE with random coefficients.

Manuel Schlierf (Ulm): Gradient flow approaches to the Canham–Helfrich model

In biology, the shape of lipid bilayers (such as red blood cells) can be described by spheres which are critical points of a certain bending energy. We study gradient flow approaches to this model, that is, we consider geometric flows determined by quasilinear, fourth order parabolic evolution equations. First, motivated by biological modeling, we study how certain parameters affect the asymptotic behavior of solutions to such an equation. Surprisingly, even though these parameters only appear in lower order terms, the asymptotic behavior ranges from finite time singularities to global existence and convergence as the parameters vary. Finally, in the second gradient flow approach, we aim to conserve surface area and enclosed volume of the surface along the evolution. This leads to nonlocal terms in the equation which may in general degenerate, introducing new challenges in the study of the asymptotic behavior.

Siliang Weng (Karlsruhe): Phase space methods for magnetic evolution equations

In this talk we introduce phase space methods adapted to magnetic evolution equations, aiming to treat wave or Schrödinger equations in the presence of a strong magnetic field, which in the most basic form:

$$\partial_t^2 u + Lu = 0 \quad \text{or} \quad i\partial_t u + Lu = 0, \quad \text{where} \quad L = (-i\partial_x - A)^2 + V,$$

with $A : \mathbb{R}^d \to \mathbb{R}^d, V : \mathbb{R}^d \to \mathbb{R}$ denoting the magnetic potential (with growth at infinity) and electric potential respectively.

Using this adapted method, we obtain new well-posedness results for a family of magnetic evolution equations including the basic examples above, on modulation spaces adapted to the magnetic potential A. The new results allows larger classes of potential A and V comparing to the literature, and we will demonstrate that the method is flexible enough for further extensions. Originally, the phase space methods were designed for the usual wave and Schrödinger equations, as seen in the works of Daniel Tataru or Hart Smith. We adapt the methods by working in a framework of magnetic pseudo-differential operator theory, introduced by Marius Măntoiu and Radu Purice.

This talk is based on a joint work with Dorothee Frey.

Yuxi Hu (Beijing): The initial boundary value problem for relaxed compressible Navier-Stokes equations

In this talk, we present results on the initial boundary value problem for the relaxed compressible Navier-Stokes system, where Fourier's law is replaced by Cattaneo's law, and the Newtonian law is substituted with Maxwell's law. After transforming the system into Lagrangian coordinates, the resulting system possesses a structure with uniform characteristic boundary. We first construct an approximate system with non-characteristic boundary and show the global well-posedness of smooth solutions for the approximated system. With the uniform estimates at hand and using usual compactness argument, we obtain a unique global solutions of the original system. Moreover, the global relaxation limit is also obtained. The work is based on basic energy estimates.