

Nonlinear PDEs in Fluid Dynamics

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The field of Nonlinear PDEs in Fluid Dynamics has seen very many scientific activities in the last years, which are due to the facts that the underlying governing equations have a very complex structure and, on the other hand, that these equations form a building block for other disciplines in science.

These lectures will investigate current questions arising in the theory of the Navier-Stokes equations, in fluid-structure interactions with porous media, in geophysical flows and in the theory of liquid crystals. In particular, topics include

- modern theory of quasi- and semilinear parabolic equations
- properties of the Stokes operator and its variants
- well-posedness and regularity theory for the Navier-Stokes equations in critical spaces
- compressible primitive equations
- liquid crystals described by the Q-tensor- or the Ericksen-Leslie model
- fluids coupled to porous media by the Beaver-Joseph interface condition
- fluids coupled to chemotaxis systems