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Speaker: Felix Brandt
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Interaction of liquid crystals with a rigid body

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Abstract

This talk addresses the interaction problem of liquid crystals with a rigid body. The physical motivation for such problems is the presence of so-called liquid crystal colloids formed by dispersion of colloidal particles in the liquid crystal host medium, where a colloidal particle is viewed as a rigid body.

In the first part of the talk, we investigate the interaction problem involving a simplified Ericksen-Leslie model. We verify that the director condition $|d| = 1$ is preserved in the interaction problem. After transforming the moving boundary problem to a fixed domain, we establish the local strong well-posedness by showing maximal L^p-L^q-regularity of the linearized problem. Moreover, we prove global strong well-posedness close to constant equilibria, where we perform a splitting argument of the director into its mean value zero and average part to overcome the lack of invertibility.

The second part of the talk is dedicated to the study of the interaction problem of a general Beris-Edwards Q-tensor model. In contrast to Ericksen-Leslie models, which are vector models, Q-tensor models build on symmetric, traceless 3×3-matrices Q to describe the biaxial alignment of molecules. In order to tackle the resulting quasilinear mixed-order problem with moving boundary, we first transform it to a fixed domain and then establish maximal L^p-regularity in an anisotropic ground space of the form $L^2 \times H^1$ by means of a "monolithic" approach. The proofs of the local strong well-posedness for large data and the global strong well-posedness for small data are completed by suitable nonlinear estimates.

The talk is based on joint work with Tim Binz, Matthias Hieber and Arnab Roy.