COUPLED FLOW AND TRANSPORT WITH ADDITIONAL ELECTROSTATIC INTERACTION

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The talk is about coupled flow and transport with additional electric interaction, coming from the presence of charged species. This phenomenon is described by the so called Stokes-Nernst-Planck-Poisson System which models the electric potential via a Poisson equation, the (water) flow via the Stokes system including an additional electric force and the transport of the charged species via a parabolic equation. This model is widely used in the field of electrokinetic flow phenomena, but most investigators consider only a reduced version by making a priori some simplifying assumptions. In the given talk we present theoretical and numerical results for the fully coupled system. Our spatial discretization starts from a mixed formulation since it leads to local mass conservative schemes and allows the direct calculation of the electric field. For the temporal discretization we use an implicit Euler scheme with a fixed-point iteration in each time step, proving convergence of the scheme analytically. Further we prove non-negativity and L^{∞}-estimates for the weak solution of the transport equation in arbitrary dimensions. For the special case 3D we need only assumptions on the flow field which are satisfied by every weak solution of the Navier-Stokes system.