

Abstract Submitted  
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**Electrokinetic instability and hydrodynamic chaos near electrodes** SCOTT M. DAVIDSON, MATHIAS B. ANDERSEN, ALI MANI, Stanford University — It is known that ion-concentration-polarization (ICP) near ion-selective membranes can lead to electrokinetic instability of an aqueous solution. Consistent with experimental observations, recent DNS studies demonstrate these instabilities and even predict hydrodynamic chaos when ICP is subject to high voltage. Through direct numerical simulation (DNS) of the coupled Poisson-Nernst-Planck and Navier-Stokes equations in two dimensions, we demonstrate that this phenomena is not limited to membranes, but is much more general. Our DNS results predict sustained chaotic behavior between blocking parallel electrodes under applied AC forcing and at an ideally polarizable cylinder in a DC electric field. Comparison with asymptotic predictions in the linear, nonlinear, and chaotic regimes is performed as well as analysis of transport effects.

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