Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

The Electrohydrodynamics of Lipid Bilayer Vesicles in AC and DC Fields LANE MCCONNELL, University of New Mexico, PETIA VLAHOVSKA, Brown University, MICHAEL MIKSIS, Northwestern University — Vesicles, which are closed, fluid-filled lipid bilayers, provide an ideal model to study cellular electro and hydrodynamics. Recent experiments and small deformation analysis of vesicles exposed to an electric field have revealed several interesting phenomena, including transitions from oblate to prolate ellipsoidal shapes and poration of the vesicle membrane. Here we use the boundary integral method to numerically investigate the dynamic behavior of a vesicle in various electric field types, including a DC field, an AC field, and a combination of the two. The vesicle membrane is modeled as an infinitely thin, capacitive, area-incompressible interface, with the surrounding fluids presumed to act as leaky dielectrics which allow for charge advection. Vesicle dynamics are determined by balancing the viscous, elastic, and electric stresses on the membrane. We present a comparison of the full nonlinear numerical results with small deformation theory and recent experimental data, then analyze our results in the relevant parameter space and discuss the role of symmetry in the problem.

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Date submitted: 02 Aug 2013 Electronic form version 1.4