Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Ion Altered Fluorescence Imaging (IAFI): A Non-invasive, Visualization Method Which Simultaneously Images Scalar Fields and Quantifies Local Ion Concentration[1] VIKTOR SHKOLNIKOV, JUAN G. SANTIAGO, Stanford University — Electrokinetic flows are leveraged for a wide range of microfluidic and lab-on-a-chip systems, and are often used to mix, preconcentrate, and/or separate analytes. Traditionally, temperature, conductivity, electrochemical, and UV absorbance detectors have been used to indirectly estimate analyte concentration profiles in these flows. However, these typically are point detectors and thus do not permit dynamic, full-field visualization of unsteady scalar fields. To address this, we propose a novel visualization and quantitation method we term ion altered fluorescence imaging (IAFI). IAFI leverages florescence quenching or enhancement of electrically neutral dyes by ions. IAFI therefore provides a non-intrusive quantitation of full-field concentration of non-fluorescent ions endogenous to the flow and its application. We demonstrate this method in visualization of two non-linear electrokinetic flows: isotachophoresis (ITP) and electrokinetic instability (EKI) in an electrokinetic focusing flow. We have quantified shock propagation and ion concentrations upstream and downstream of shocks in cationic and anionic ITP. We quantified and visualized chaotic EKI flow, including complex secondary flows and local ion densities as the flow develops downstream.

[1]This work was supported by National Science Foundation (NSF) grant CBET-0967600-000. V.S. was supported by NSF GRF.

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Date submitted: 07 Aug 2012 Electronic form version 1.4