Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Space charge in pneumatically assisted electrospray JULIA ZAKS, Agilent Technologies, TRYGVE RISTROPH — The importance of coulombic repulsion due to space charge on the trajectories of ions and droplets in pneumatically assisted electrospray depends on numerous physical properties of the spray. The influence of space charge has practical implications for systems that use electrospray, including ion sources for mass spectrometers. We develop a simplified theoretical model system representing an electrospray plume with high-pressure nebulizing gas. We solve Poissons equation and the continuity equation for this model system to find the radius of the plume, and use this result to quantify the effect of space charge on the trajectories of charged liquid droplets in the spray. These results are applied to ion sources for liquid chromatography-mass spectrometry by considering the effects of space charge on the trajectories of ions of various mobilities. We find that the effects of space charge can be ignored in the case of modest electrospray currents, which correspond to low liquid flow rates. At higher currents and flow rates, the magnitude of the electric field from the space charge of the spray itself is comparable to that of electric fields from externally applied sources, suggesting that the role of space charge influences ion source behavior at high flow rates.

Julia Zaks
Agilent Technologies

Date submitted: 01 Aug 2019 Electronic form version 1.4