Electrospray is an atomization method subject to intense study recently due to its monodispersity and the wide size range of droplets it can produce, from nanometers to hundreds of micrometers. This thesis focuses on the numerical and theoretical modeling of the interaction of charged droplets from the single and multiplexed electrospray. We studied two typical scenarios: large area film depositions using multiplexed electrospray and fine pattern printings assisted by linear electrostatic quadrupole focusing. Due to the high computation power requirement in the unsteady n-body problem, graphical processing unit (GPU) is used to dramatically speed up the numerical simulation. Both the spray profile and deposition number density are studied for different arrangements of electrospray and electrodes. The results demonstrate uniform films with variation < 5% in thickness across arbitrarily wide substrate for multiplexed electrospray arrays can be achieved. Moreover, the linear quadrupole can rapidly focus the charged droplets within a few nanometers. This study will shed light on using electrospray as a scalable nanomanufacturing approach.

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The public is welcome to attend.