Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Numerical analysis of 2D and 3D electrohydrodynamic convection instability with crossflow[1] YIFEI GUAN, JAMES RILEY, IGOR NOVOSSELOV, University of Washington — The study focuses on the electrohydrodynamic (EHD) instability for flow between to parallel electrodes with unipolar charge injection with cross-flow. Lattice Boltzmann Method (LBM) with two-relaxation time (TRT) model is used to study flow pattern [1]. Under strong charge injection and high electrical Rayleigh number, the system exhibits electroconvective vortices. Disturbed by different perturbation patterns, the flow patterns develop according to the most unstable modes. The unstable modes are obtained by dynamic mode decomposition (DMD) on the transient numerical solutions. Once the steady-state solution is obtained, Couette and Poiseuille cross-flow are applied. The flow patterns change according to the strength and direction of the cross-flow. When the cross-flow velocity is greater than a threshold value, in the 2D scenario, the vortices are suppressed [2], and in 3D the instability flow patterns would develop into streamwise rolling patterns. References: [1] Y. Guan and I. Novosselov, Two Relaxation Time Lattice Boltzmann Method Coupled to Fast Fourier Transform Poisson Solver: Application to Electroconvective Flow, Journal of Computational Physics (accepted for publication) (2019). [2] Y. Guan and I. Novosselov, Numerical Analysis of Electroconvection Phenomena in Cross-flow, arXiv preprint arXiv:1812.10899 (2018).

[1]This research was supported by DHS Science and Technology Directorate, and UK Home Office and by the National Institutes of Health.

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Date submitted: 29 Jul 2019 Electronic form version 1.4