

PURDUE FLUIDS SEMINAR SERIES

Shocks and caps in drop electrohydrodynamics

FRIDAY OCTOBER 4TH, 2024
SEMINAR 2:15PM-3:00PM ARMS 1010
DISCUSSION 3:30PM-4:00PM ARMS 1109



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Abstract:

The problem of electrohydrodynamic drop deformation is well understood in the case where the external electric field is weak. In one of his many celebrated papers (Proc. R. Soc. A, 291 1425 159-166, 1966), G. I. Taylor worked out a complete theory in this limit, including analytical expressions for the electrohydrodynamic flow engendered within and outside of the drop by the electric field acting on its own induced interfacial charge, and a simple function of the permittivity, conductivity and viscosity drop-to-background ratios, discriminating between prolate or oblate deformation.

In this talk, we will employ numerical and asymptotic tools to explore the effects of interfacial-charge convection, which were neglected by Taylor but become important at strong electric fields. In particular, we will analyze (in 2D, for simplicity) how Taylor's fore-aft symmetric solution evolves as the electrical Reynolds number is increased from zero to arbitrarily large values. What we shall find is hinted by the title of the talk.

This is joint work with Gunnar G. Peng, Rodolfo Brandão and Ory Schnitzer.

Biography

Professor Yariv received his PhD in 2001 from the Technion. He spent 3 years as a post-doc at MIT chemical engineering. In 2004 he joined the Technion faculty, where he is a professor at the math department. Since 2022 he has been a visiting Professor at Princeton University.



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