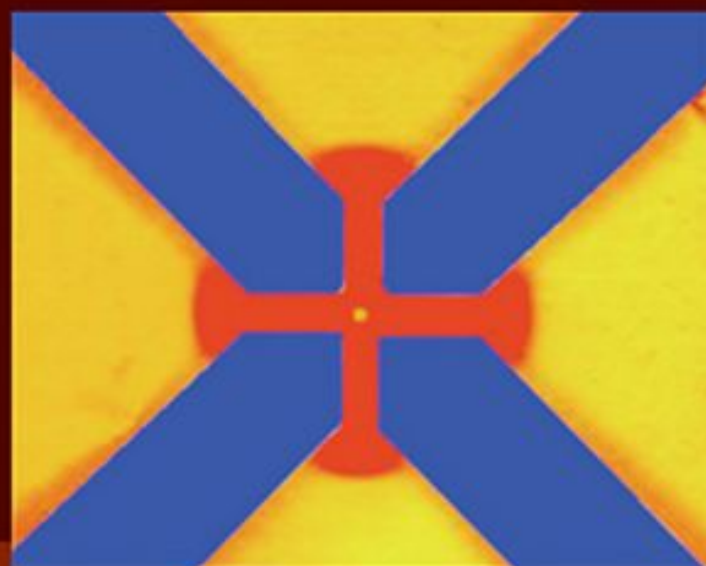


# Electrokinetically Driven Microfluidics and Nanofluidics

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Electrokinetics is currently the mechanism of choice for fluid actuation and bioparticle manipulation at microscale and nanoscale dimensions. There has recently been widespread interest in the use of AC electric fields, given the many advantages they offer over DC electrokinetics. Nevertheless, a fundamental understanding of the governing mechanisms underlying the complex and nonlinear physicochemical hydrodynamics associated with these systems is required before practical microfluidic and nanofluidic devices can be engineered. This text aims to provide a comprehensive treatise on both classical equilibrium electrokinetic phenomena and the more recent nonequilibrium phenomena associated with both DC and AC electrokinetics in the context of their application to the design of microfluidic and nanofluidic technology. In particular, Hsueh-Chia Chang and Leslie Yeo discuss the linear and nonlinear theories underlying electro-osmosis, electrophoresis, and dielectrophoresis pertaining to electrolytes as well as dielectric systems. Interfacial electrokinetic phenomena such as electrograzing, electrospraying, and electrowetting are also discussed.

Dr. Hsueh-Chia Chang is Bayer Professor in the Department of Chemical and Biomolecular Engineering and Director of the Center for Microfluidics and Medical Diagnostics at the University of Notre Dame. He received his Ph.D. from Princeton University, after which he joined the University of California, Santa Barbara as an Assistant Professor and subsequently the University of Houston as an Associate Professor. Dr. Chang has received numerous awards, including the National Science Foundation's Presidential Young Investigator's Award, the Sigma Xi Outstanding Research Award at the University of Notre Dame, and the American Physical Society Division of Fluid Dynamics Francis W. Frankel Award. In 1999, he was elected as a Fellow of the American Physical Society. Dr. Chang is the founding Editor-in-Chief and Co-Editor of the American Institute of Physics journal *Biomicrofluidics*. He has also served on the editorial board of the *SIAM Journal of Applied Mathematics*, and the *International Journal of Bifurcation and Chaos in Applied Sciences and Engineering*. Dr. Chang's research has culminated in more than 200 journal publications and 13 patents. He is also coauthor of *Complex Wave Dynamics at Thin Films*. Dr. Chang has delivered more than 10 keynote lectures and 100 seminars. His former Ph.D. students and postdoctoral researchers currently hold positions at 18 universities worldwide and several major chemical and pharmaceutical research facilities.

Dr. Leslie Yeo is currently an Australian Research Fellow and Associate Professor in the Department of Mechanical and Aerospace Engineering and Co-Director of the Micro/Nanophysics Research Laboratory at Monash University, Australia. He received his Ph.D. from Imperial College London in 2002, for which he was awarded the Dudley Newitt prize for a computational/theoretical thesis of outstanding merit. Prior to joining Monash University, he was a Mathematical Modeller at Del Norte Vertus UK and a postdoctoral research

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