Abstract

Theory and Modeling of Ultrafast and Nanoscale Interfacial Electron Transport

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Electron transport across interfaces of dissimilar materials (including vacuum) is of fundamental importance to current-carrying components and devices, including pulsed power systems, ultrafast electron sources, compact accelerators, and miniaturized electromagnetic radiation sources (microwave to millimeter wave to THz to x-ray). The rapid development in nanotechnology and ultrafast lasers has opened up great opportunities to control electron beam dynamics at ultrashort spatial-temporal scales, which offers unprecedented scientific advances. This talk will review recent modelling efforts on ultrafast and nanoscale diodes. The physics of quantum tunneling, ultrafast electron emission and transport, and electrical contact resistance will be highlighted. Future research prospects will be discussed.

Biographical Summary

Peng Zhang is an Assistant Professor at Michigan State University in the Department of Electrical and Computer Engineering. He received his Ph.D. in Nuclear Engineering and Radiological Sciences at the University of Michigan, Ann Arbor in 2012. His research interests are in theory and modeling of nanoelectronics, electromagnetic fields and waves, plasmas, and accelerator technology. He has worked on electrical contacts, thin films, classical, ballistic, and quantum diodes, space-charge-limited current flows, beam-circuit interaction, microwave absorption on rough surfaces, multipactor and breakdown, slow wave structures, z-pinches, laser-plasma interaction, and more recently on quantum tunneling plasmonic junctions and ultrafast photoemission. He is currently serving as an Editorial Board Member for Scientific Reports, a journal by the Nature Publishing Group.