Institute for Materials Science

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IMS Distinguished Lecture Series

David Emin
Adjunct Professor - Department of Physics & Astronomy
University of New Mexico

Polarons Today

Wednesday, March 29, 2017
2:00 to 3:00 pm
MSL Auditorium (TA-03 - Bldg 1698 - Room A103)

Abstract: Eighty years ago Lev Landau suggested that a slow moving electronic charge carrier could become "self-trapped" in a polar medium upon shifting the equilibrium positions of surrounding ions. The quasi-particle comprising an electronic charge and the vibrating atoms with which it interacts was subsequently dubbed a "polaron." In the intervening time we have come to recognize several distinct types of polaron. Indeed our understanding of how self-trapping occurs has changed dramatically. Often modest disorder is found to trigger the collapse of an electronic charge carrier into a severely localized self-trapped state thereby forming a "small polaron." Different types of polarons are distinguished by their optical absorptions and transport properties. Large polarons move coherently albeit unlike quasi-free carriers. Small polarons move incoherently by phonon-assisted hopping. Our understanding of small-polaron and small-bipolaron hopping has developed extensively in recent years. The frequently observed anomalous signs of small-polarons' Hall Effect are a means by which they are identified. Polaron-based models also have been advanced to explain doped semiconductors' novel superconductivity and the electronic switching that is observed in some low-mobility semiconductors.

Biography: David Emin received his Ph. D. in Physics from the University of Pittsburgh in 1968. After a post-doctoral position at UCLA, he joined the technical staff of Sandia National Laboratories in Albuquerque, New Mexico. He was elected a Fellow of the American Physical Society in 1977. In 1983 he was in the very small inaugural group promoted by Sandia National Laboratories to be a Distinguished Member of Technical Staff. He retired from Sandia but continues his research. He still resides in Albuquerque where he is an Adjunct Professor in the Department of Physics and Astronomy of the University of New Mexico. In 2008 David Emin was named an "outstanding referee" by the American Physical Society in its first round of selectees.

Professor Emin is best known for his works on small-polaron formation and motion in condensed matter. He has made seminal contributions to the theories of self-trapping, hopping transport, phonon-assisted transition rates, the Seebeck and Hall effects in hopping conduction, transient electronic and optical phenomena, high-electric field effects and large-bipolaron superconductivity. He has addressed electronic transport phenomena in ionic crystals, non-crystalline solids, magnetic semiconductors, organic polymers, and boron-rich solids. He has also addressed light-interstitial atomic diffusion in metals, electronically stimulated desorption of atoms from surfaces and ionic transport in human tissue. His book on "Polarons" was published by Cambridge University Press in 2013.

To be on Professor Emin's Agenda, to participate in the Early Career Lunch, or for general information contact
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