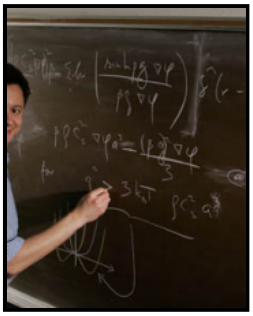

Special Guest Lectures

The Intrinsic Midgap Electronic States in Semiconductor Glasses

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Assistant Professor, Chemistry

Johnston Hall 338
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Abstract:
Semiconductor glasses show many electronic and optical anomalies that have resisted systematic efforts for decades, including: light induced ESR and midgap absorption, insensitivity to conventional doping, and several types of photoluminescence. We argue these anomalies result from deep midgap electronic states that reside on strained regions intrinsic to the activated transport above the glass transition. These states are a solid state analog of free radicals; their reverse charge-spin relation and topological characteristics are similar to those of the solitonic midgap states in trans-polyacetylene. We establish the specific chemical motifs responsible for the midgap states in a technologically important class of amorphous semiconductors, namely, chalcogenide alloys and related phase change materials. Alongside, we rationalize the stability of these materials, whose structure is argued to be a symmetry broken version of a highly symmetric, fully covalently bonded structure defined on a simple cubic lattice. The result is the first, to our knowledge, chemical bonding theory of a bulk glass.

Speaker's Bio:
Vassiliy Lubchenko is an Assistant Professor of Chemistry at the University of Houston. He earned his Ph.D. in Physical Chemistry in 2002 from University of Illinois Urbana-Champaign. Dr. Lubchenko's research includes theoretical studies of strongly non-equilibrium phenomena with applications to materials science and biophysics. He is a recipient of the 2008 Beckman Young Investigator Award and 2010 NSF CAREER Award.

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