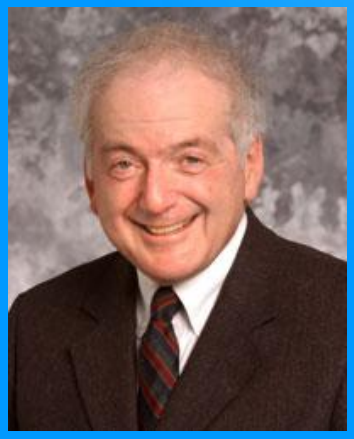
Columbia University
Department of Physics Colloquium

"Electrostatic Modification of Novel Materials"

Field effect transistor configurations have been employed as electrostatic alternatives to chemical doping of novel materials. In principle they provide exquisite control of important material properties, such as magnetism and superconductivity. A recent innovation has been to replace the gate insulator, which is usually a high-dielectric constant material, with an ionic liquid. Ionic liquids are molten salts at room temperature. When used as gate dielectrics, they can facilitate extraordinarily large charge transfers because of the formation of electronic double layers, which are in effect capacitors with nanometer scale spacings. These configurations have been used in a limited way to find new superconductors, and to explore in a detailed manner the complex phase diagrams and quantum critical behavior, of known superconductors such as the cuprates. In addition to surveying accomplishments using this technique, recent work on the properties of ultrathin films of YBa2Cu3O7−x and La2CuO4+x will be reviewed. The possibility of using electrostatic gating employing ionic liquids, as an alternative to chemical doping in the search for new superconductors, will be assessed.



** Supported in part by the NSF under grants NSF/DMR-0709584, 0854752, and 1209578, and performed in collaboration with Xiang Leng, Javier Garcia-Barriocanal, Joseph Kinney and Boyi Yang.*

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Monday, October 1, 2012 : 428 Pupin Hall / 4:10 PM