

# MATHEMATICAL SCIENCES LECTURE SERIES

College of Liberal Arts & Sciences

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**Mark Ratner**

Northwestern University

## *Molecular Transport Structures: Elastic Scattering and Beyond*

**Date:** Tuesday, April 5, 2005

**Lecture:** 4:05 – 4:55 pm

**Location:** Room 137 Norman Hall

**OPENING REMARKS BY**

**Neil Sullivan**

**Dean, College of Liberal Arts and Sciences**



### **Abstract:**

Current experimental efforts are clarifying quite beautifully the nature of charge transport in so-called molecular junctions, in which a single molecule provides the channel for current flow between two electrodes. The theoretical modeling of such structures is challenging, because of the uncertainty of geometry, the nonequilibrium nature of the process, and the variety of available mechanisms. The talk will center on the first formulation of the problem in terms of scattering theory, and then on the generalizations needed to make that simple picture relevant to the real experimental situation.

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Mark Ratner is Distinguished Professor of Chemistry at Northwestern University and a Member of the National Academy of Sciences. In an article published in 1974 that has been called visionary, Mark Ratner and Ari Aviram commented “It seems to us reasonable to examine the potential use of molecules as components of electronic circuitry”. 31 years later, and with Moore’s law reaching a breaking point, molecular electronics is coming of age. In the original article (Aviram, A. & Ratner, M.A. *Molecular Rectifiers* Chem. Phys. Lett. 29, 277 (1974)), the authors proposed that a simple, synthesizable molecule could serve as a molecular rectifier. In it there would be a current when a voltage was applied, and no current when the voltage was reversed. Such behavior would be the basis for molecular-level digital electronics. The field has moved from a highly theoretical enterprise into laboratory experiments, back to the development of better and faster theoretical methods. Mark has been at the forefront of the field from the beginning. He is known in some circles as a nano-guru. “He’s a theoretician, and theoreticians get to work well ahead of their time”, says Chad Mirkin, nanoscience pioneer, Chicago entrepreneur, and Ratner’s younger NU colleague. Chad joked, “Mark’s often considered the father of molecular electronics. I like to call him the grandfather.”

*This Lecture Series is co-sponsored by the Quantum Theory Project (QTP) and The Mathematical Sciences Committee. The Committee seeks to identify emerging scientific fields that have strong mathematical components; promote education in these fields; encourage and support collaborative research; coordinate responses to interdisciplinary proposal solicitations; and explore more formal organizational structures that will bridge the mathematical sciences and their applications.*