The Richard C. Lord Lecture is an annual event sponsored by the MIT Department of Chemistry and the G. R. Harrison Spectroscopy Laboratory to honor a scientist who has made important contributions to the field of spectroscopy. We thank the many friends and colleagues of Dr. Lord for their generous contributions to the endowment fund.

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The Department of Chemistry and
MIT Laser Biomedical Research Center
cordially invite you to attend the

2015 Richard C. Lord Lecture

by

Paul McEuen

on

Light and Fast: Probing carriers and Vibrations in 1D and 2D materials

Tuesday, April 28, 2015, 12 Noon
MIT, Grier Room (34-401)

Refreshments served following the lecture

Paul L. McEuen is the John A. Newman Professor of Physical Science at Cornell University. He directs the Laboratory of Atomic and Solid State Physics and the Kavli Institute at Cornell for Nanoscale Science. His research focuses on nanoscale electronic, optical, chemical, and mechanical properties of 1D and 2D materials. He received his B.S. degree in Engineering Physics from the University of Oklahoma in 1985 and his Ph.D. in Applied Physics from Yale University in 1991. He joined the faculty at UC-Berkeley in 1992 before coming to Cornell in 2001. Awards and honors include a Packard Foundation Fellowship, a National Young Investigator Fellowship, and the Agilent Europhysics Prize. He is a fellow of the American Physical Society, a member of the National Academy of Sciences and a member of the American Academy of Arts and Sciences. He is also a novelist, and his scientific thriller SPIRAL was named the debut thriller of the year by the International Thriller Writers Association.

One and two dimensional materials are arguably the most interesting new materials systems to arise over the past two decades. First, electrons confined to a plane or a line have quantized energy levels and band structures that are quite different than their three-dimensional counterparts. In addition their mechanical properties are dramatically modified, with transverse bending and thermal vibrational modes influencing basic materials properties in ways that are normally only seen in soft matter systems. But because of their diminutive size, these materials present particular challenges for measurement. As an example, a single nanotube or graphene sheet might only scatter 10^{-4} of the photons incident upon it, yet we wish to resolve information with *nm* spatial and *p*s temporal resolution. Here, we will discuss a number of unusual approaches to meet these challenges. First, we will discuss ultrafast photocurrent measurements that reveal the fundamental thermal relaxation processes for excited electrons. Next, we will discuss how circularly polarized light probes the "valley" polarization in a 2D semiconductor, leading to a Hall effect in the absence of a magnetic field. Finally, we will discuss experiments probing the static and dynamic physical fluctuations of graphene and carbon nanotubes using a combination of electronic and optical measurements, with implications for everything from nonlinear processes in nanoscale resonators to the fundamental bending stiffness of graphene.

Richard C. Lord was born in Louisville, Kentucky in 1910. He was graduated from Kenyon College, Ohio in 1931. He received the Ph.D. degree in physical chemistry form Johns Hopkins University in 1936, where he began a long and distinguished career as a scientist and educator. In 1942 Dr. Lord came to MIT. He was appointed Professor of Chemistry in 1954 and was Director of the Spectroscopy Laboratory from 1946 to 1976. He died in 1989.

Lord's research contributions were in the infrared and Raman spectroscopy of polyatomic molecules. His achievements include the observation and interpretation of Coriolis-activated forbidden vibrational transitions, the synthesis and complete vibrational analysis of a large number of deuterated molecules, and the discovery and exploitation of the anomalous far infrared spectra of ring molecules. Toward the end of his career he became interested in biomolecules. His studies of the laser Raman spectra of proteins and nucleic acids opened a new field of research.

Lord was also a dedicated teacher and an inspired supervisor of graduate students. His summer course in spectroscopy, held first at MIT and then at Bowdoin College, attracted more than 2000 scientists.

Lord had a major impact on the development of the Spectroscopy Laboratory. During his thirty year tenure as Director, the Laboratory became an Interdepartmental Laboratory of the School of Science, with broadened faculty participation. Research activities expanded from the study of atomic spectra using visible light and large gratings to include visible-UV electronic molecular spectra, molecular vibrational spectra using classical infrared and far infrared sources, and then to the use of lasers. During this period the Laboratory pioneered in a wide variety of vibrational studies of molecules and Raman studies of biomolecules, some of them mentioned above, as well as in seminal laser studies of the stimulated Raman and Brillouin effects and the use of lasers for precision measurements and ultra-high resolution spectroscopy.

Lord received the Presidential Certificate of Merit in 1948, and the Award in Spectroscopy from the Pittsburgh Spectroscopy Society in 1966. He served as president of the Commission of Molecular Spectroscopy of the International Union of Pure and Applied Chemistry, and was president of the Optical Society of America, and received the Lippincott Medal from them in 1976. He was also a fellow of the American Academy of Arts and Sciences.

The annual Richard C. Lord Lecture has been established as a tribute to the memory of Dr. Lord.