

Massachusetts Institute of Technology

The Department of Chemistry and
The George R. Harrison Spectroscopy Laboratory
cordially invite you to attend the

2010 Richard C. Lord Lecture

by

Wolfgang Ketterle

on

Quantum magnetism of ultracold atoms



Tuesday, April 27, 2010, 12 Noon
MIT, Grier Room (34-401)

Refreshments served following the lecture

Wolfgang Ketterle has been the John D. MacArthur professor of physics at MIT since 1998. He leads a research group exploring new forms of matter of ultracold atoms, in particular novel aspects of superfluidity, coherence, and correlations in many-body systems. His observation of Bose-Einstein condensation in a gas in 1995 and the first realization of an atom laser in 1997 were recognized with the Nobel Prize in Physics in 2001 (together with E.A. Cornell and C.E. Wieman).

He was born in Heidelberg, Germany, and received a diploma (equivalent to master's degree) from the Technical University of Munich (1982), the Ph.D. in physics from the University of Munich (1986). He did postdoctoral work at the Max-Planck Institute for Quantum Optics in Garching and at the University of Heidelberg in molecular spectroscopy and combustion diagnostics. In 1990, he came to MIT as a postdoc in Dave Pritchard's group and joined the physics faculty in 1993. Since 2006, he is the director of the Center of Ultracold Atoms, an NSF funded research center, and Associate Director of the Research Laboratory of Electronics.

His major accomplishments are the development of important tools to manipulate and study Bose-Einstein condensates, and several seminal studies of the properties of Bose-Einstein condensates and quantum degenerate Fermi gases. During the early '90s, his group developed techniques (a novel "dark" light trap, rf-induced evaporative cooling) which were crucial for the first observations of BEC both at Boulder (in rubidium, June '95) and at MIT (in sodium, Sept. '95). New tools which his group developed for the study of BEC include the cloverleaf magnetic trap, dispersive imaging techniques for in situ and non-perturbative observation of BEC, the rf output coupler (which triggered the field of atom lasers), an optical trap to confine condensates and transport them over large distances, and the use of Bragg scattering as a tool for spectroscopy of a condensate. An interference experiment between two BECs provided the first direct evidence for the coherent nature and long-range correlations of a Bose condensate and established Bose condensates as coherent atom sources. Further important work includes studies of collective excitations in a condensate, studies of spinor condensates, the discovery of superradiance of a condensate, the first observation of Feshbach resonances, and the study of vortex lattices. His research on ultracold fermions, started in 2000, led to the realization of a Bose-Einstein condensate of fermion pairs, the observation of superfluidity in fermions (through quantized vortices), the study of superfluidity in imbalanced fermion systems, and the study of itinerant ferromagnetism in a gas of fermions. More recently, the focus of his research has shifted towards quantum magnetism of ultracold atoms.

His honors include the Rabi Prize of the American Physical Society (1997), the Gustav-Hertz Prize of the German Physical Society (1997), the Fritz London Prize in Low Temperature Physics (1999), the Dannie-Heineman Prize of the Academy of Sciences, Göttingen, Germany (1999), the Benjamin Franklin Medal in Physics (2000), the Knight Commander's Cross (Badge and Star) of the Order of Merit of the Federal Republic of Germany (2002), the MIT Killian Award (2004), a Humboldt research award (2009) and memberships in several Academies of Sciences. He holds Honorary Degrees from Gustavus Adolphus College, St. Peter (2005), the University of Connecticut (2007), and Ohio State University (2007).

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 from Johns Hopkins University in 1936, where he began a long and distinguished career as a scientist and educator. In 1942, 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.

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.

Past Awardees:

Takeshi Oka 1992

Alexander Pines 1993

Charles Townes 1994

Richard Zare 1995

Carl Lineberger 1996

William Klemperer 1997

William Phillips 1998

Theodor Hänsch 1999

Daniel Kleppner 2000

Steven Chu 2001

Norman Ramsey 2002

Britton Chance 2003

Watt Webb 2004

Robert Field 2005

John Hall 2006

Graham Fleming 2007

Mildred Dresselhaus 2008

Michael Feld 2009