

2012

6th Annual Dasari Lecture

Robert Field, MIT

“Molecules behaving badly”

Robert Field was born in Wilmington, Delaware in 1944. He graduated from Amherst College in 1965 with an A.B. degree (major in Chemistry). As a graduate student at Harvard, he was a member of William Klemperer’s research group, and received his Ph.D. degree in 1972. He did three years of postdoctoral research with Herbert P. Broida and David Harris in the Quantum Institute at the University of California, Santa Barbara. Since 1974, he has been a member of the MIT Chemistry Department and has been the Haslam and Dewey Professor of Chemistry since 1999. His continuous connection with the MIT Spectroscopy Laboratory began with the Tunable Laser Facility in 1975. Aside from his appointment as Chair of the Graduate Committee in Chemistry, he has, for 38 years, successfully avoided all administrative positions at MIT and intends to keep that record intact.

Bob’s current favorite self-descriptors are “dynamics encoded in the frequency domain” and “molecules behaving badly.” He is a card-carrying high resolution spectroscopist, but likes to look “beyond molecular constants” in search of new classes of spectral patterns that reveal the far-from-equilibrium regions of a potential energy surface. As a graduate student he began his spectroscopic magical mystery tour as a collector of spectroscopic perturbations, especially those of the CO molecule. He invented the “matrix element method” for assigning the vibrational quantum numbers of nominally “dark” perturbing states from the vibration dependence of experimentally measured perturbation matrix elements. This led to “The Book” (Perturbations in the Spectra of Diatomic Molecules) and to perturbation facilitated optical-optical double resonance, by which perturbations provide excitation pathways to otherwise inaccessible electronic states. Two extreme and therefore extremely interesting forms of perturbations are vibrational polyads in polyatomic molecules and the interactions between multiple infinities of Rydberg states in Multichannel Quantum Defect Theory. His group’s invention of Stimulated Emission Pumping led to studies of vibrationally highly excited states of small polyatomic molecules and a 30 year long, still incomplete quest for the acetylene \leftrightarrow vinylidene transition state. Whenever possible he resorts to multiple-resonance spectroscopy, because it enables him to venture into regions of horrific spectral deviance. Brooks Pate’s Chirped Pulse Fourier Transform Microwave spectroscopy has become his fountain of youth.

Bob has received many research awards: the H. P. Broida Prize in Molecular Spectroscopy or Chemical Physics (1980), the Earle K. Plyler Prize in Molecular Spectroscopy (1988), and the Arthur L. Schawlow Prize in Laser Science (2009) from the American Physical Society; the Ellis Lippincott Award (1990), the William F. Meggers Award in Spectroscopy (1996) from the Optical Society of America; the

Bomem-Michelson Award (2006) from the Coblentz Society; the Nobel Laureate Signature Award (co-preceptor of Yongqin Chen, 1990), the Edgar Bright Wilson Award in Molecular Spectroscopy (2012) from the American Chemical Society; the Earll M. Murman Award for Excellence in Undergraduate Advising (2009) from MIT; and the Humboldt Research Award (2012) from the Alexander von Humboldt Foundation. He has been elected as a Fellow of the American Physical Society (1981), the Optical Society of America (1994), the American Academy of Arts and Sciences (1998), the American Association for the Advancement of Science (2002), and the Royal Society of Chemistry (2009). More than 55 graduate students have completed Ph.D. theses in Bob's group, one consequence of which has been more than 360 peer reviewed publications.