



Prof. Robert W. Field illustrating the process of optical–optical double resonance. Because of its familiarity to all of his students, this two-handed demonstration was used as the logo for a Field Group reunion held in 2004.

Preface to the Robert W. Field Festschrift

This special issue of *The Journal of Physical Chemistry A* is dedicated to Professor Robert Warren Field of MIT on the occasion of his 65th birthday. The issue includes his curriculum vitae and autobiography, as well as tabulations of his publications, group members, and collaborators, which serve to complement over 40 original research articles authored by his previous undergraduate and graduate students, postdoctoral fellows, and scientific colleagues. Anyone who has met Bob knows firsthand of his boundless enthusiasm for science; the research described in this special issue clearly illustrates his unique and far-reaching impact on an entire generation of chemists and spectroscopists.

Over the past four decades, Bob Field has insightfully revealed the molecular dynamics hidden behind seemingly random “perturbations”, using spectroscopy as an incisive tool to “go beyond molecular constants”. He also has pioneered the experimental approach of exploiting molecules as a laser gain medium so as to access new spectroscopic regimes that contain the answers to fundamental questions surrounding the nature of electronic structure and the origins of chemical reactivity. In short, Bob has found and exploited important new ways to make, watch, and interpret the reactive dance encoded in the spectra of small, yet tantalizingly complex, molecules.

Bob always has used colorful examples to illustrate his strong opinions regarding the importance of physical insight in a field

with sometimes outrageous proclivities for collecting and tabulating precise effective parameters, famously remarking, “A complete description is like a telephone directory, true but unmemorable. Mechanism is insight, even if it is neither as true nor complete as a telephone directory”. His wide scientific interests and insistence on mechanistic insight (with the predictive power of an area-code map) always have made interacting with him stimulating, even when the molecules themselves were not nice. Bob rarely has spent much time with a nice molecule, unless he suspected a dark secret that would reveal “insights into the evil that lurks in the hearts of even the smallest molecules”.

Bob Field’s persistence in envisioning and demanding chemically relevant answers from spectroscopy have paid-off handsomely in his extensive studies of rare-earth metal diatomics, which have exploited powerful double-resonance techniques to access low-lying electronic manifolds of key importance for unraveling molecular structure and reactivity. Here Bob consistently has taken a global view and has worked across large swaths of the periodic table, using spectra to gain insights into the chemical interactions between atoms so as to explore novel “two digit theories” based on oxidation numbers and “atomic-ion-in-molecule” viewpoints. In the case of Rydberg states, he has been asking questions about the tremendously improbable events in which the slow and light electron shakes the massive nuclei.

Bob’s broad interests also have included diverse practical applications of spectroscopy, ranging from the characterization and detection of explosives to the elaboration of methods for environmental monitoring and remote sensing. Indeed, his applied research in the realm of molecular electronic lasers led him to develop the technique known worldwide as Stimulated Emission Pumping. By using molecules as lasing media, Bob was able to explore the previously unknown vibrational motions of polyatomic molecules possessing enough energy to isomerize or dissociate. These efforts began (in collaboration with Jim

Kinsey) with an exciting exploration of the hitherto-inaccessible high-energy frontier, where ideas about chaos and “intrinsically unassignable” spectra resonated, and developed (in collaboration with Bob Silbey) into an effort to learn how nice young molecules born from good effective Hamiltonians (H^{eff}) grow up to commit unspeakable “spectrocities”. He trenchantly observed that “even when the H^{eff} model is dying, it whispers the name and weapon of its murderer”.

Bob is also an absolutely outstanding mentor for his graduate/undergraduate students and postdoctoral fellows, creating an environment for learning that is unparalleled in scope and freedom. As his graduate students, we were continually inspired by his unbridled passion for science and scientific discovery. Working with Bob was a pleasure because of the way he encouraged attempts to answer inherently difficult and vaguely formulated questions of fundamental importance through novel spectroscopic experiments and analyses. His ability to intuit and visualize complex molecular dynamics was amazing, as was his willingness to illustrate the envisioned choreography of light and matter through memorable whole-body dances. Besides the “two-handed” demonstration highlighted in the accompanying photograph, former group members vividly recall how Bob would often twist one leg around the other in a quite alarming way while simultaneously giving a wry smile that all would recognize instantly. Such fond personal memories are indelibly intertwined with the scientific excitement of collaborating with Bob Field.

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