Institute of Advanced Study

University of Bologna

IN COLLABORATION WITH

DIPARTIMENTO DI CHIMICA «GIACOMO CIAMICIAN»
COLLEGIO SUPERIORE ALMA MATER STUDIORUM DI BOLOGNA

PRESENT THE INSTITUTE LECTURE OF

JOSEPH S. FRANCISCO

Dep. of Chemistry and Earth and Atmospheric Sciences

Purdue University, West Lafayette, USA and ISA Visiting Fellow

"THE STRUCTURE AND REACTIVITY OF OPEN-SHELL COMPLEXES: NEW FRONTIER IN ATMOSPHERIC CHEMISTRY"

Wednesday, July 21st 2004, 5.00 p.m.

Dip. di Chimica «Giacomo Ciamician»

Aula 1, V. Selmi, 2 Bologna

ABSTRACT AND BRIEF CURRICULUM VITAE

JOSEPH S. FRANCISCO

In this talk, "THE STRUCTURE AND REACTIVITY OF OPEN-SHELL COMPLEXES: NEW FRONTIER IN ATMOSPHERIC CHEMISTRY", the various classes of chemical reactions that constitute the body of reactions that describe chemical processes in the atmosphere will be examined. Results that show a new class of reactions that involve radical-molecule association complexes will be presented. Radical-molecule complexes have unique stablitity and photochemistry, and their implication for atmospheric chemical significance will be discussed.

Joseph Francisco is Professor in Physical and Atmospheric Chemistry.
B.S., 1977, University of Texas at Austin; Ph.D., 1983, Massachusetts Institute of Technology; Postdoctoral Research Fellow, Cambridge University (England), 1983-1985; Provost Postdoctoral Fellow, Massachusetts Institute of Technology, 1985; Research Associate, California Institute of Technology, 1991; Alfred P. Sloan Research Fellow, 1990-92; Dreyfus Teacher-Scholar, 1990-1995; National Science Foundation Presidential Young Investigator, 1988-1993; Guggenheim Fellowship, 1993; Fellow of the American Physical Society, 1998; Fellow of the American Association for the Advancement of Science, 2001; Alexandar von Humboldt Research Award for Senior U.S. Scientists, 2001.

Research in his laboratory focuses on basic studies in spectroscopy, kinetics and photochemistry of novel transient species in the gas phase. These species play an important role in atmospheric, biochemical and combustion processes. Yet questions dealing with how structures correlate to reactivity and photochemical mechanisms have not been addressed for these systems. These problems are addressed by research efforts in his laboratory. Specific research areas of interest are: 1) Spectroscopic determinations of electronic and vibrational transitions in free radicals; 2) Measurement of the kinetics of individual gas-phase reaction steps involving free radicals in complex reaction mechanisms; and 3) Characteristics of primary photo chemical processes that free radicals can undergo.

Theoretical and experimental methods are used cooperatively in extending spectroscopic information on these species. His goal is to use state-of-the-art molecular orbital methods to predict properties that can be used as a guide in the experimental search. Using a variety of high resolution laser techniques, such as laser-induced fluorescence, vibrational and electronic emission, multiphoton and UV absorption spectroscopy, we aim to make spectroscopic measurements for these novel species in the gas phase, and fully characterize them.

Work in the laboratory includes measurements of the kinetics of elementary gas phase reactions of free radicals involved in complex reaction mechanisms. Using photolysis-laser induced fluorescence, photolysis-time resolved chemiluminescence, and photolysis-UV absorption techniques, we are able to study the reactions of specific intermediates in real-time. These techniques are used to study reactions involved in the gas phase atmospheric oxidation of chlorofluorocarbons and their potential replacements. This process is important toward understanding how the chemistry of man-made materials perturbs the ozone concentration profiles in the upper atmosphere.