Lecture #1

Sampling of Ions from Liquid Solution into the Gas Phase: The Physics and Chemistry of Electrospray Ionization and Field Induced Droplet Ionization

Abstract: The development of new methods to achieve transfer of intact molecules and molecular complexes from solids and liquids into the vapor phase invariably ushers in a broad range of new applications. This has certainly been the case with electrospray ionization, recognized by the 2002 Nobel Prize in Chemistry. This presentation will describe the life history of a charged droplet, from formation at the ESI tip to the completely desolvated ions that are eventually formed. The final stages of ion desolvation reveal details of the specific interaction of solvent molecules with charged functional groups. In addition, these investigations have led to the development of a new method for the controlled extraction of desolvated ions from neutral droplets in a process we call field induced droplet ionization or FIDI for short.

Lecture #2

Frontier Applications of Mass Spectrometry: Cosmochemistry, Environmental Science, Synthetic Chemistry with Nanoparticles, and New Approaches to Peptide Sequencing

Abstract: Recent developments in experimental methodology have facilitated a large number of novel applications of mass spectrometry at the frontiers of science. Examples will be given of the application of high performance mass spectrometry (including FT-ICR, quadrupole ion trap and time of flight instruments) to important scientific problems, including the chemical analysis of galactic dust particles, an analysis of the organic components of atmospheric aerosols, the chemistry of Titan's atmosphere, the study of highly controlled reactions in molecular clusters, and the development of new methods for peptide and protein sequencing.