

Departmental Seminar

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New Instrumental Approaches for Atomic and Molecular Mass Spectrometry

New instrumental approaches and chemical measurement strategies are often required in order to address emerging, increasingly complex, chemical questions. When new chemical measurement capabilities are realized, they often find use within a much wider community of chemists. In this presentation, several new instrumental approaches being developed with this aim will be briefly presented.

A new type of mass analyzer known as the distance-of-flight mass spectrometer (DOFMS) will be described. The DOFMS concept is best explained by comparison with traditional time-of-flight mass spectrometry (TOFMS). The TOFMS strategy measures the mass-to-charge (m/z) of an ion by imparting the same energy to all ions and then measuring the time required for each m/z to traverse a distance and arrive at a single detector. In contrast, DOFMS measures the m/z of an ion by measuring the distance each ion travels during a set time period. Because of this unique ability to physically separate ions according to m/z , new capabilities for ion detection and collection have emerged. Specifically, the development of a new type of semiconductor ion detection array application-specific integrated chip will be discussed as an advantageous detector for this new approach to mass spectrometry.

Second, several new approaches that exploiting focused microwaves fields in mass spectrometry will be examined. In microwave-assisted electrospray ionization source (μ AESI), microwave dielectric heating is shown to modifying the features of electrospray ionization, including Taylor-cone formation, droplet generation, ionization efficiency, and ion fragmentation. Highly-focused microwave fields are also shown to be advantageous for microwave-assisted proteolytic digestion in bottom-up proteomics experiments. The operating principles and current capabilities of these two novel approaches will be examined.