Electrospray Ionization Mass Spectrometry in the *femto* Regime: Softer and More Uniform Analysis

Seminar

Monday

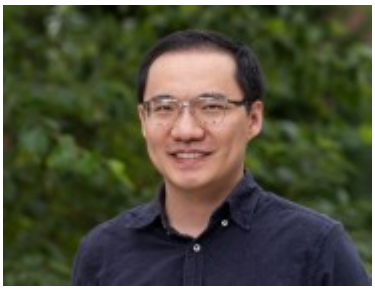
March 17, 2025

3:00 – 4:00 p.m.

Beaupre Center, Room 105

Anyin Li

University of
New Hampshire



Electrospray ionization (ESI) has become an indispensable mass spectrometry method. However, several aspects of ESI-MS still exhibit significant limitations, and a fundamental understanding of these issues remain insufficient. 1) The ionization efficiency in electrospray ionization (ESI) is non-uniform which hinders direct quantitative analysis. 2) The heterogeneous and potentially harsh chemical environment can degrade labile linkages and generate artifact peaks. 3) The onset ion current (nanoamps) significantly exceeds the detector's handling capacity (picoamps), leading to inefficient sample utilization and potential instrument contamination.

Lowering the electrospray ionization (ESI) flow rate to produce smaller droplets, which are more highly charged per unit volume, is a known approach for improving ESI performance. This principle has driven the development of microflow, nanoflow, and picoflow electrospray ionization (ESI) over the past two decades. Recently, we have developed methods to perform electrospray ionization (ESI) using femtoamp (fA) currents, femto flow rates (fL/min), and localized nanoscale menisci. This seminar will explore the novel properties of electrospray ionization (ESI) in femto regimes. Hydrophilic glycans, peptides, and intact proteins, were ionized with enhanced efficiencies and uniformity exceeding those reported in prior literature. Since nanodroplets fall below the detection limit of optical methods, new equations have been developed to calculate the size of initial charged nanoscale droplets. The femto ESI regime also enables direct extraction and analysis of environmental contaminants using nonpolar solvents, which were previously considered incompatible with ESI-MS. Finally, we demonstrate how these new ESI regimes facilitate individual ion mass spectrometry, enable analysis of ultra labile fullerene derivatives, and allow atomically efficient deposition of noble metal nanostructures.

THE UNIVERSITY OF RHODE ISLAND

Department of Chemistry
Spring 2025 Seminar Series

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