

Analytical Chemistry Seminar

Tuesday, April 2, 2024
3:30 p.m. ~ WTHR 320

***"Tunable Plasmonic Super Chiral Light: Towards
Ultrasensitive Detection of Chiral Molecules"***



Mousumi Saha
Graduate Student, Purdue University

Abstract:

The accurate detection, classification and separation of chiral molecules are crucial for developing pharmaceutical and biomolecular innovations. In many cases, while one enantiomer is safe, the opposite enantiomer can be toxic. The gold standard for chiral classification is circular dichroism (CD) or vibrational circular dichroism (VCD). However, they lack due to the requirement of a high concentration of samples and low signal intensity leading to lower detection sensitivity. Engineered chiral light presents a new avenue to enhance the light-matter interaction. Surface covered with metal nanoparticles (NP) for instance gold NP exhibits localized surface plasmon resonance (LSPR) by exciting directly through incident light waves. Geometrically modified surfaces with achiral nanostructure display CD enhancements for low concentrations of molecules when the system LSPR overlaps with molecular resonance. The resonance can be shifted by altering geometric parameters, consequently enabling superchiral field tunability. These superchiral plasmonic sensors offer several orders of magnitude signal enhancement compared to conventional VCD, leading to the measurement of enantiomers with very low concentrations and determining enantiomeric excesses. This system has great potential in pharmaceutical industries where highly sensitive, fast and low-cost enantiomeric purity determination is critically important.

Bio:

Mousumi Saha got her bachelor's degree in chemistry in 2021 from the University of Dhaka, Bangladesh. While there, she did undergraduate research in the Material Chemistry Research Laboratory where she focused on developing electrocatalysts for the anodic water oxidation reaction. She was also involved in The Red-Green Research Centre, a private laboratory, where her research was focused on developing molecular dynamics simulations to study diverse liquid structures. In fall of 2022, she joined Aston Labs for Mass Spectrometry guided by Prof R Graham Cooks at Purdue where she works on developing quantitation methods for small molecules using reactive ambient ionization methods and high throughput reaction screening for drug discovery.

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"Microneedle Sensors for Rapid Real-Time Drug Monitoring"



Aiming (Murphy) Zheng
Graduate Student, Purdue University

Abstract:

Microneedles (MN) are syringe needle analogous with micron-sized needle body, which allow them to breach through epidermis layer of skin and reach the interstitial fluid (ISF) located in the dermal layer. Recent studies have shown that microneedles have great potential in medical care, such as drug delivery and monitoring, oncology therapy, vaccination and wound healing¹. Huge developments have been made in the area of microneedle drug monitoring, which combines customized microneedle sensors with analytical methods to provide point-of-care testing. A variety of analytical techniques have been studied based on the application of microneedles, such as electrochemical sensing², spectroscopic measurements³, and colorimetric sensing⁴. By using electrochemical sensing microneedle sensors, drugs of interest can be measured on a timescale of several minutes, with a limit of detection at the micromolar level⁵.

Bio:

Aiming (Murphy) Zheng is a graduate student in the Julia Laskin research group. She graduated from Purdue University with B.S. in Chemistry in Spring 2021, where she did undergraduate research under Prof. Dor Ben-Amotz to study the binding effect between cyclodextrins and hydroxides using Raman Spectroscopy. Murphy is currently focusing on special mapping of glycolipids with nano-DESI mass spectrometry imaging.