

# University of Miami, Physics Department Colloquium

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**Date:** Wednesday, Feb 22, 2023  
**Time:** 4:00 pm – 5:00 pm  
**Location:** Wilder Auditorium – Rm 112, Knight Physics Building

## The Development of Nanotechnology Enabled New Tools for Catalysis and Precision Medicine

**Dr. Jin He**

Physics Department, Florida International University

### **Abstract**

Nanoscience and nanotechnology have greatly impacted many fields in the last two decades. In this talk, I would like to share my research journey and the recent research progress in this field. We have assembled gold-molecule-gold junctions with various nanostructures and studied the electron transport through these junctions. By shining visible light on these junctions, they become efficient nanoscale chemical reactors and the chemical reactions can be catalyzed and modulated by surface plasmon generated hot carriers, electrode potential and local chemical environment. We have monitored the time-resolved chemical changes in these junction down to the single-molecule level using surface enhanced Raman spectroscopy (SERS). The precision (personalized) medicine is a paradigm shift and provides exciting new opportunities for biomedical research. A lot of exciting new approaches of this field, such as DNA sequencing, wearable and portable sensors, organ-on-chip devices, have been benefited from the rapid developments in nanoscience and nanotechnology. Originated from the nanopore based DNA sequencing project, we have developed the multifunctional nanopipette for biomolecule analysis and detection at the single-molecule level. The nanopipette has also been used for live cell/tissue imaging, quantitative intracellular delivery, intracellular single-molecule detection and nanoelectrophysiology. In another project, we developed engineered cardiac tissues. By introducing nanomaterials such as nanoparticles in the extracellular matrix, the engineered cardiac tissues show prolonged lifetime and greatly improved maturation.