

Thursday, March 14, 2024

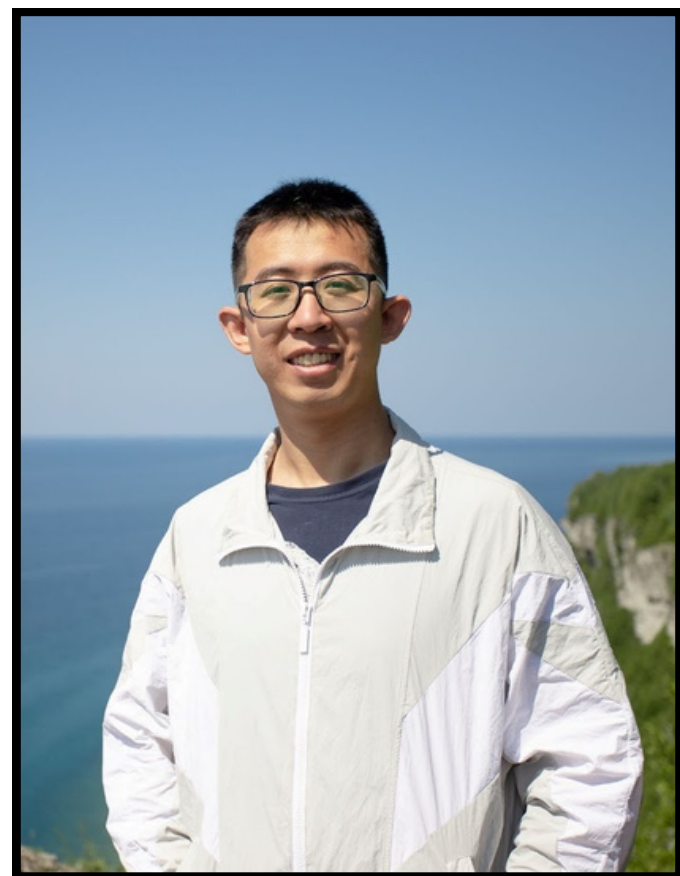
Refreshments at 3:15pm in PSF 101

Colloquium from 3:30pm - 4:30pm outside PSF 101

Molecular Biophysics from Conventional NMR and Optically Detected Quantum Sensing

Professor Mouzhe Xie

Arizona State University



Abstract:

Quantum sensing technologies enable some of the most precise measurements that human beings have ever achieved. In recent years, optically addressable nitrogen-vacancy (NV) color center hosted by diamond crystal has been used as a quantum bit (qubit) possessing microseconds to milliseconds coherence at room temperature, which has exquisitely sensitive response to local magnetic field fluctuations. This diamond-based solid-state quantum sensor is therefore capable to perform micro-/nano-scale NMR experiments, displaying enormous potential to study biological systems on extremely small sample volume – even down to single-molecule regime.

This colloquium is divided into two sections. In the first section, I will discuss how conventional NMR spectroscopy serves as a powerful technique to probe protein conformational dynamics on a wide range of time scales at atomistic resolution. This includes the investigations on both the loop dynamics of globular proteins and the ensemble behavior of intrinsically disordered proteins (IDPs). In the second section, I will explain how to build a quantum sensing platform to prepare, manipulate, and read out the NV qubit system, as well as how to use such a platform to perform nanoscale NMR experiments. It is followed by some comprehensive efforts to improve diamond surface functionalization and diamond material engineering for a wide range of applications in biology and chemistry. Finally, I will conclude by providing an outlook of utilizing NV-based quantum sensing platforms, combined with other advanced spectroscopy and microscopy methods, to address important biophysical and bioanalytical questions with unprecedented sensitivity and spatial resolution, which will enhance our understanding of molecular interactions and cellular processes and ultimately improve human health.

Biography:

Mouzhe Xie is an Assistant Professor at Arizona State University working on optically detected magnetic resonance techniques enabled by diamond-based quantum sensor for biological applications. He conducted postdoctoral research at l'École polytechnique fédérale de Lausanne and the University of Chicago from 2019 to 2023. He received Ph.D. in Physical Chemistry from The Ohio State University in 2018 and B.S in Chemical Biology from Xiamen University in 2013.

Host: Prof. Sara Vaiana

View our Spring 2024 Physics Colloquium schedule at <https://physics.asu.edu/colloquia>