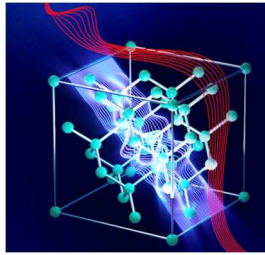


# Physics Seminar

## Deep Microscopic Quantum Electrodynamics: Spotlight on Quantum Science and Technology



**Thursday, April 10<sup>th</sup>**  
**11:00 am – noon**  
**Higgins Lab 116**

### **Abstract:**

Quantum science and technology holds the potential to deliver transformative innovations in computing, ultra-precision measuring devices, and next-generation materials. In this talk, I will showcase a synergistic development of predictive computational strategies to guide the development of quantum technologies. First, I will discuss the development of a deep microscopic quantum electrodynamics (QED) framework coupled with scientific software development to unveil several sub-nanoscale optical phases of matter including hidden optical polarization texture, and light-induced topological phases of quantum materials. I will show how this photonic material design framework has led to the development of spectro-polarimetric imagers to capture hidden polarization data, spin-polarized infrared beacons for defense technology, and deep ultra-violet radiation sources for semiconductor metrology. Second, I will discuss the development of a full stack of multiscale computational QED framework to design hybrid quantum devices. I will show the applicability of the computational design guidelines to develop Nitrogen vacancy (NV) center-based quantum sensors, gate circuits for silicon and NV center-based quantum computing architectures, and superconducting single-photon detectors. Looking ahead, I will discuss how this computational quantum design framework establish a roadmap for advancing quantum computing, sensing, and communication.

### **Bio:**



Sathwik Bharadwaj is a Research Scientist at the Birck Nanotechnology Center, Purdue University, USA. He obtained his Ph.D. from Worcester Polytechnic Institute, USA. His research interest focuses on developing predictive theoretical and computational methods for designing emerging photonic materials and hybrid quantum devices for quantum sensing, communication, and computing technologies. He has received several accolades for his research, including the Japan Computational Mathematical Science and Engineering Lecture Award, the Bravo+ Award from Purdue University, Sigma Xi Doctoral Dissertation Award, and Gold Medal from the University of Hyderabad, India.