MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

# Physics Colloquium

**Thursday, March 9th**
**4:10 – 5:00 PM**
**Roberts Hall Room 101**

## Light-Matter Interactions in 2D Quantum Materials Integrated Photonic Nanostructures for Quantum Information Science Applications


## Dr. Sriram Guddala, City College of New York



Abstract:

The light-induced quantum transitions between electronic or vibrational states are the fundamental motives for the technological development of lasers, photodiodes, light-emitting diodes, thermal imaging, and biological sensors, as well as for the envisioned quantum revolution unfurling before our eye. The developments in quantum sciences and technologies demonstrated so far are fascinating yet the future progress requires the exploitation of novel light-matter interactions in quantum materials integrated into photonic devices. In this stride, there have been significant efforts for the development of novel materials with advanced optical properties, especially, photonic nanostructures (like cavity QEDs, photonic topological insulators1, and metamaterials2, etc.) and quantum materials3 (like 2D HgTe, graphene, and transition metal dichalcogenides (TMD), etc.).

My research focused on understanding and controlling the light-matter interaction in 2D materials integrated photonic nanostructures for optical routing, quantum confinement, and optoelectronics applications. In this talk, I will present our recent work on demonstrations of novel topological polaritonic phases by leveraging the strong-coupling between the photonic topological boundary states and material degrees of freedom in 2D materials such as in-plane lattice vibrations (phonons) in a hexagonal boron nitride (hBN) thin film4 or excitons in 2D semiconductors5. Later I will also present my work on employing valley degree of freedom of 2D materials for optoelectronics and quantum information science applications6-8.


Host: Randy Babbitt

**** Refreshments served in the Barnard second floor atrium at 3:45 ****