RICE QUANTUM GROUP MEETING SEMINAR SERIES

III-N Wide Bandgap Semiconductor-based Topological Photonic Devices in Visible Spectrum

Tao Li

Prof. Yuji Zhao group

Electrical and Computer Engineering

Tao Li is a graduate student in Prof. Yuji Zhao's research group. His work has focused on III-N wide bandgap semiconductor-based topological photonic devices operating in the visible spectrum. His research interests include nanophotonic design and nanoscale light-matter interaction.

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ABSTRACT

Topological photonics, which bridges the fields of topology and photonics, has emerged as a mutually beneficial paradigm. Photonics offers a simple yet powerful platform for constructing and observing novel topological phases, while topology enables the design of photonic systems with unique functionalities such as backscattering suppression and unidirectional light routing. However, most existing topological photonic devices are limited to microwave or near-infrared regimes due to constraints in material properties and nanofabrication techniques.

In this talk, I will share our progress in realizing visible-spectrum topological photonic devices based on III-N wide bandgap semiconductors. I will first present a GaN-based two-dimensional topological photonic crystal cavity with resonances in the visible range, detailing the design principles, fabrication techniques, and preliminary experimental characterization results. In addition, I will discuss experimental results from a GaN-based one-dimensional topological photonic crystal cavity that exhibits strong polarization-dependent second-harmonic generation (SHG). Beyond cavity-based devices, I will also introduce an hBN-based topological photonic router operating at visible wavelengths and explore its potential as a quantum photonic interface.

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