SEMINAR SERIES

PHOTONICS INITIATIVE

ADVANCED SCIENCE RESEARCH CENTER
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Heterogeneously integrated photonic systems for quantum science

Abstract: Metasurfaces, subwavelength optical interfaces that control the amplitude, phase, and polarization of light, have transformed flat optics, yet extending this control from static wavefront shaping to dynamic, real-time manipulation remains a central challenge. In this talk, I will present our research that addresses this challenge across increasing levels of complexity: from steering coherent laser beams, to directing spontaneous emission, to controlling quantum light.

I will first discuss dynamic metasurface platforms for coherent light control, including i) ultrafast steering of circularly polarized light via chiral bound states in the continuum, ii) spatiotemporal streaking of ultrafast fs-pulses using passive, low-Q semiconductor metasurfaces, and iii) electronically tunable liquid-crystal-integrated CMOS and III-V metasurfaces for LiDAR and LED platforms. These results establish metasurfaces as a versatile platform for manipulating coherent light across ultrafast and electronic timescales.

I will then turn to the harder problem of steering spontaneous emission, where conventional phased-array concepts fail because the emitted light is incoherent. I will demonstrate how static GaN metasurface gratings could arbitrarily re-direct polarized photoluminescence and how sub-picosecond directional control of emission from high-density InAs quantum dots in GaAs metasurface resonators can be achieved by optically reconfiguring spatial refractive-index profiles. To navigate this high-dimensional inverse-design problem, we developed a self-driving laboratory (SDL) that combines generative modeling, active learning, and interpretable machine learning in a closed experimental loop. Within 300 experiments, the SDL achieved a fourfold enhancement in peak emission directivity over a 74° field of view and uncovered unexpected design rules beyond standard Fourier-optics intuition.

Finally, I will discuss how these design principles extend to the quantum limit, where coupling single GaAs quantum dots to bound-state-in-the-continuum dielectric metasurface resonators enables tunable control over nonclassical photon emission statistics, including both anti-bunched and super-bunched light from the same emitter. Together, this work outlines a path toward AI-guided metasurface platforms for autonomous discovery of light-matter interactions spanning classical and quantum photonics

Bio: Prasad Iyer is a senior member of technical staff at the Center for Integrated Nanotechnologies (CINT) at Sandia National Laboratories. He received his PhD in Electrical and Computer Engineering from the University of California, Santa Barbara, where he worked on reconfigurable optical metasurfaces. He subsequently joined Lumotive in Seattle, where he helped commercialize beam-steering metasurfaces for LiDAR. He also served as a scientific advisor to Neurophos, developing liquid-crystal metasurface-based optical processing units, and to Q-Boltz, a startup building photonic Ising machines for combinatorial optimization. At Sandia and CINT, Prasad currently leads multiple projects at the intersection of AI-driven materials discovery, fundamental light-matter interactions, and computation with light. His research vision centers on building autonomous experimental platforms that accelerate discovery in nanophotonics, quantum light sources, and machine learning-guided material design.

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Date:
Friday, March 20, 2026

Time:
11:00 - 12:00 p.m.

Location:
ASRC — 5th floor AV room | 5.210
85 Saint Nicholas Terrace
New York, NY 10031

Host:
Andrea Alù

Zoom:
Meeting ID: 869 1553 7863
Passcode: 073925
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