SEMINAR SERIES

PHOTONICS INITIATIVE

ADVANCED SCIENCE RESEARCH CENTER
THE GRADUATE CENTER
CITY UNIVERSITY OF NEW YORK

This is a two-part Photonics Initiative Seminar, the first part describing information in light structure and the second part about structuring light in the lab.

7 July 2025, 1:30pm in the ASRC Auditorium

https://gc-cuny-edu.zoom.us/j/83601898127?pwd=JgFROicFhdgwgNush0IbJqyOSfdpP6.1
Meeting ID: 836 0189 8127 Passcode: 677460

Dr. Eileen Otte
Beyond the Beam: The Potential of Light's Structure

When light interacts with a medium, its spatial structure – including amplitude, phase, polarization, angular momenta, and more – is shaped by the medium's properties across scales, from the macro to the nanoscale. For example, sunlight scattered in the blue daylight sky exhibits intriguing polarization patterns that encode the sun's position—imperceptible to humans but used by insects like bees for navigation. At much the smaller, molecular level, the emission pattern of a single fluorescent molecule depends on its dipole orientation, allowing nanoscale features to be decoded from the structured light it emits.
Inversely, structured light can also be deliberately engineered, making it a powerful tool across a wide range of applications, including optical micro- and nano-manipulation, motion sensing, material machining, and classical as well as quantum communication and encryption. Used in quantum key distribution, structured light increases the dimension, enhancing the information capacity per photon, noise resilience, and transmission distance.
We will explore how encoding and decoding information in the structure of light opens new avenues for advancing cutting-edge applications and emerging technologies.

Bio -- Dr. Eileen Otte joined the Institute of Optics at the University of Rochester as a new faculty member in January 2025. Before, she was a postdoctoral fellow at the Geballe Laboratory for Advanced Materials (GLAM), Stanford University, advised by Prof. Mark Brongersma. Eileen's research concentrates on the fundamental properties and diverse applications of structured light fields, in areas such as singular optics, nanoscale imaging and sensing, quantum cryptography, optical manipulation, and more. In her postdoctoral research, Eileen focused on nanoscale light-matter interactions, combining structured light and nanophotonics.

Eileen performed her PhD work at the University of Muenster, Germany, and University of the Witwatersrand, South Africa; it was honored with summa cum laude as well as the WWU Dissertation Award, and published as a book in the Springer Theses series. She has also received the Research Award 2020 of the Industrial Club Duesseldorf, was appointed a junior class member of the NRW Academy of Sciences, Humanities, and the Arts, and was listed among the Emerging Leaders 2021 and Emerging Talents 2021 of IOP's Journal of Optics. Her postdoctoral research was supported by the PRIME fellowship of the German Academic Exchange Service as well as Stanford's GLAM Postdoctoral Fellowship.

Dr. Michael de Oliveira
Shaping Light on Demand (with a Few Lines of Code)

Imagine sculpting light—twisting, shaping, and imprinting it with structure—as effortlessly as editing an image on a screen. In today's photonics labs, this is no longer a fantasy. Spatial light modulators (SLMs) have become versatile, programmable tools that enable real-time control over light's spatial and temporal properties, driving advances in areas like microscopy, optical tweezing, quantum optics, and beyond. This talk offers an accessible introduction to the principles and practice of shaping light with SLMs. We'll unpack how these devices work, how phase-only modulation can be used to encode both phase and complex amplitude, and how to generate a wide range of structured beams—from optical vortices and exotic modes to dynamic space-time beams. We'll walk through intuitive examples, practical strategies, and common challenges, making this tutorial especially valuable for those new to SLMs or curious about integrating them into automated experimental setups. Whether you're steering beams, engineering light fields for nonlinear optics, or encoding information for quantum communication, this session will provide a clear and engaging foundation for shaping light in the lab.

Bio -- Michael de Oliveira spends most of his time convincing light to do increasingly strange and complicated things—twist, spin, heal, or dance through space-time—using devices like spatial light modulators, metasurfaces and a generous dose of stubborn optimism. His research focuses on shaping light across multiple degrees of freedom—phase, polarization, amplitude, frequency, and time—to unlock new effects in photonics, from ultrafast and nonlinear optics to quantum experiments. He firmly believes that light is just misunderstood—and that with enough patience, whispered incantations to Maxwell, and elaborate alignment rituals, it can be made to do almost anything. Probably.

Michael joined the ASRC and Prof. Andrea Alù's group in 2025 as a Postdoctoral Research Fellow. He earned his PhD in Physics from the Politecnico di Milano in collaboration with the Italian Institute of Technology, where he worked under the supervision of Dr. Antonio Ambrosio on multi-degree-of-freedom control of light for advanced photonic applications. Before that, he completed his BSc in Astronomy & Astrophysics, BSc (Honors), and MSc in Physics with distinction at the University of the Witwatersrand in South Africa, where he began working with structured light under Prof. Andrew Forbes.