THE INSTITUTE OF OPTICS
INDUSTRIAL ASSOCIATES

Program & Resource Guide
Spring 2024
March 27 – March 29

HAJIM SCHOOL OF ENGINEERING & APPLIED SCIENCES
UNIVERSITY of ROCHESTER

Contents

Agenda

Wednesday, March 27, 7:30 AM – 8:00 PM Rochester Riverside Convention Center, 123 E Main St

7:30 – 8:15 AM: Networking Breakfast
Riverside Court

8:15 – 8:45 AM: Institute of Optics Overview and Eclipse 2024
Tom Brown, Director and Professor
Jim Zavislan, Professor
University of Rochester | The Institute of Optics
Lilac Ballroom

8:45 – 9:00 AM: Welcome from Rochester Institute of Technology
Emmet Ientilucci, Associate Professor
Rochester Institute of Technology | Center for Imaging Science
Lilac Ballroom

9:00 – 9:15 AM: Vision for the Next Generation
Susana Marcos, Director and Professor
Center for Visual Science | The Institute of Optics
Lilac Ballroom

9:15 – 9:45 AM: Faculty Innovation Showcase
University of Rochester | The Institute of Optics
Rochester Institute of Technology | Center for Imaging Science
Lilac Ballroom

9:45 – 10:15 AM: What's happening in Washington?
David Lang, Senior Director, Global Policy and Affairs, Optica
Jennifer O'Bryan, Government Affairs Director, SPIE
Lilac Ballroom

10:15 – 10:30 AM: Master's Student Showcase
University of Rochester Master's Candidates
Lilac Ballroom

10:30 – 10:45 AM: Coffee Break
Foyer

10:45 – 11:15 AM: Senior Design Showcase
University of Rochester Senior Class
Lilac Ballroom

11:15 AM – 1:00 PM: Student Poster Session
University of Rochester | The Institute of Optics
Rochester Institute of Technology | Center for Imaging Science
Highland Ballroom

12:00 – 1:00 PM: Networking Lunch
Lilac Ballroom

1:00 – 1:30 PM: Ph.D. Showcase
University of Rochester | The Institute of Optics
Rochester Institute of Technology | Center for Imaging Science
PhD Students
Lilac Ballroom

2:00 – 2:30 PM: Company Connection Showcase Introductions
Lilac Ballroom

2:30 – 2:45 PM: Optica and SPIE Student Chapter Updates
Farhan Ejaz, Optica Chapter President
University of Rochester | The Institute of Optics

Rushnan Islam, SPIE Chapter President
University of Rochester | The Institute of Optics
Lilac Ballroom

2:45 – 3:15 PM: Company Connection Showcase Introductions
Lilac Ballroom

3:15 – 5:30 PM: Company Connection Showcase
Highland Ballroom

4:45 – 5:30 PM: Women in Optics Happy Hour
Hosted by the SPIE/Optica Student Chapters
Riverside Court

5:30 – 8:00 PM: Networking Reception
Lilac Ballroom

Thursday, March 28, 9:00 AM – 5:00 PM The Institute of Optics, 480 Intercampus Drive

9:00 AM – 12:00 PM: Company/Student Interviews
Goergen & Wilmot Buildings

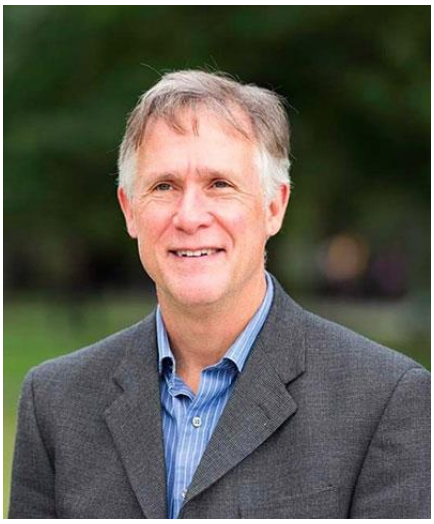
12:00 – 1:00 PM: Lunch for Interviewers
Munnerlyn Atrium, Goergen Building

1:00 – 5:00 PM: Company/Student Interviews
Goergen & Wilmot Buildings

Friday, March 29, 9:00 AM – 12:00 PM The Institute of Optics, 480 Intercampus Drive

8:00 AM – 12:00 PM: Company/Student Interviews
Goergen & Wilmot Buildings

Opening remarks from the Director



Thomas G. Brown, Director & Professor
The Institute of Optics

Welcome to the Spring 2024 meeting of the Industrial Associates (I.A.). We currently have 55 active members, with a significant number of guest members this year. We continue to see growth in both the enrollment and the course offerings for our programs. Our I.A. program is a big reason for our continued strong enrollment; both the students and the faculty appreciate the energy and opportunity that your participation brings to the programs through encouragement, instructional support, and employment opportunities. The annual financial report to The Institute provided through the I.A. program provides instructional support (Adjunct, Instructional Faculty, and TAs), Student conference travel, Graduate student stipends, Outreach activities, and, of course, our semiannual meetings.

The spring 2024 symposium will feature an update from our partners at the RIT Chester Carlson Center for Imaging Science, an innovation showcase from faculty at UR and RIT, PhD presentations from both institutions, and a poster session featuring student research from The Institute, RIT, and from some of our close partner departments at UR. Later in the afternoon we will have updates from out student outreach groups, hear from senior design groups, and conclude with the company showcase. There is networking throughout the day, but we have a special opportunity at the women in optics networking event.

This year's symposium includes three featured speakers: ***Professor Susana Marcos*** will bring us an update on the exciting activities at the Center for Visual Science as part of the inauguration of a new 'vision package' supplement to out I.A. membership offerings. This is a pilot program geared especially for groups of companies interested in investing in vision-related research and workforce development through CVS. We are exploring a similar supplement designed around laser science and engineering as part of the planning for our STELLAR program. ***Jennifer O'Bryan*** (SPIE) and ***David Lang*** (Optica) Will each offer perspectives on Washington DC, the world, and the intersection of politics and public policy with optics and photonics.

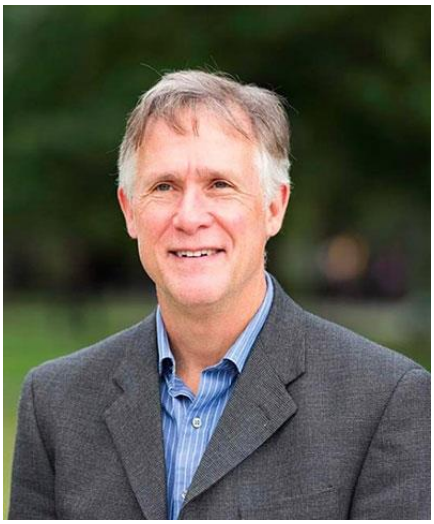
This year marks our first symposium in many years that is organized without Tal Haring. Tal has moved across the courtyard to serve as administrator of the Chemical Engineering department in the Hajim School. We know he will do a great job there and we wish him the best. With Tal's departure, we welcome two new staff members: ***Cynthia Daher*** is joining us as the new Undergraduate Coordinator, and ***Casey Schultz*** has joined us as a program specialist to manage the I.A. program and our STELLAR initiative.

We had other, more permanent, farewells since our last meeting. In December, we lost Jim Wyant, Institute Alumnus, UR Trustee, and Dean Emeritus at the Wyant College of Optics in Tucson. In January, we lost Dennis Hall, long time faculty member and former director of The Institute and also Brian Thompson, former director and professor at The Institute and later Dean, Provost and Provost Emeritus at UR. In appreciation of Jim Wyant, our first colloquium of the year will be named in his honor. A memorial gathering for Dennis Hall is being held on Friday; arrangements to remember the legacy of Brian Thompson are still in the planning stages.

Finally, thanks to our I.A. members and guest members for attending. We are thankful that our students have more opportunities than ever for productive and fulfilling careers. I am thankful for the Staff who have worked so hard on putting this program together: ***Dustin Newman*** has managed the I.A. program in Tal's absence, with ***Casey Schultz*** stepping in to communicate; ***Cynthia Daher*** and ***Kai Davies*** facilitate your access to our students, including collecting resumes, arranging for student transportation, and organizing the student poster session; ***Lori Russell*** manages the staff; ***Aylin Tunay*** and ***Lindsay Anderson*** manage the logistics; ***Adrienne Snopkowski*** and ***Meir Brea*** manage the finances behind the scenes in order to assure a smooth event.

Welcome

Title: “Institute of Optics Overview and Eclipse 2024”



Thomas G. Brown

Professor and Director
The Institute of Optics | University of Rochester

Biography:

Thomas G. Brown has been on the faculty of the Institute of Optics since July of 1987, has held the rank of full professor since 2008 and is currently the director of the Institute of Optics and a Mercer Brugler Distinguished Teaching Professor. Professor Brown is a Fellow of Optica and SPIE, is Editor in Chief of the Journal of Modern Optics, and serves as chair of the annual multidimensional microscopy conference (Photonics West). He was the founding director of the Robert E. Hopkins Center for Optical Design and Engineering, the architect of the optical engineering curriculum at the Institute of Optics, served as a program co-chair for the centennial program of Optica, and is former president and honorary member of the Rochester Local Chapter of Optica. He was foundational in establishing the plans for the Test, Assembly and Packaging program within AIM Photonics and currently serves on the leadership council of AIM Photonics.

Title: “Welcome from the Rochester Institute of Technology”

Emmet Ientilucci

Associate Professor
Center for Imaging Science | Rochester Institute of Technology

Biography

Dr. Emmett Ientilucci is the Gerald W. Harris Endowed Professor and Graduate Admissions Chair in RIT's Chester F. Carlson Center for Imaging Science. He works in the Digital Imaging and Remote Sensing (DIRS) group. He has degrees in optics and imaging science. Prior to his faculty position, he was a Postdoctoral Research Fellow for the Intelligence Community. His research interests are in General Remote Sensing, Spectral Image Processing and Exploitation, Hyperspectral Target Detection, Shadow Detection, Radiative Transfer, Radiometric Calibration, Hardware and Atmospheric Compensation. He is the recipient of the 2020-21 Richard and Virginia Eisenhart Provost's Award for Excellence in Teaching at RIT and is the IEEE Region 1 (NE USA) Area Chair.

Vision for the Next Generation

Susana Marcos

Biography

Susana Marcos is currently the David R Williams Director of the Center for Visual Science, Nicholas George Professor of Optics at the Institute of Optics and Professor of Ophthalmology at the Flaum Eye Institute, at the University of Rochester, New York. She is the former Director of the Institute of Optics at the National Research Council in Spain. Susana Marcos obtained her PhD in Physics at the University of Salamanca, Spain, and was a Fulbright and Human Frontier Postdoctoral Fellow at the Schepens Eye Research Institute of Havard University. She is a leading researcher in visual optics, having pioneered multiple technologies of eye optical imaging diagnostics and treatments, including novel IOL designs. Shas published more than 200 highly cited publications, is a co-inventor of 26 patents and participated in two spin-out companies (Plenoptika and 2EyesVision). She is a Fellow of Optica, European Optical Society and the Association for Research in Vision and Ophthalmology. Her work has been recognized with numerous awards including the Adolph Lomb Medal and the Edwin Land Medal of Optica (formerly Optical Society of America), the ICO Prize by the International Commission for Optics, the Ramon y Cajal Medal by the Royal Academy of Sciences, the Alcon Award, the Physics, Innovation and Technology Award by the Royal Society of Physics, or the National Research Award in Engineering by the Spanish Government, the Jaime I Award (the last two presented by the King of Spain).

Faculty Innovation Showcase

Greg Schmidt

Biography

Greg Schmidt received his PhD from The Institute of Optics, University of Rochester. His thesis focused on the modeling and design of bio-inspired compound lens arrays and fabricating polymer tapered gradient index lenses that mimic the gradient index (GRIN) lenses found nature. After graduating in 2009 he became a Research Engineer at The Institute of Optics and in 2019 became a research professor. His primary projects involve research in freeform GRIN materials, including modeling, design, optimization, fabrication, and metrology of GRIN optics. Other significant research efforts have focused on other areas of optical design and engineering including lightfield optics, non-imaging design for illumination, and high concentration solar thermal and photovoltaic systems.

Jie Qiao

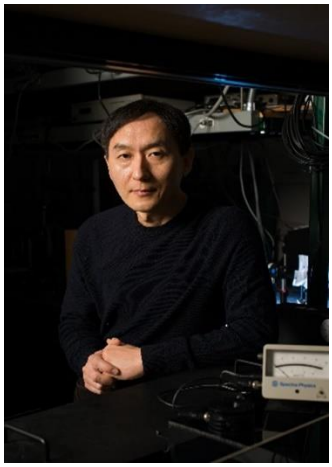
Biography

Jie Qiao is currently an Associate Professor in the Carlson Center for Imaging Science at Rochester Institute of Technology. She leads the Advanced Optical Fabrication, Instrumentation & Metrology Laboratory where her team of graduate students and postdocs work on ultrafast-lasers-enabled advanced photonics/optics / waveguide laser fabrication, wavefront sensing, and spatial-temporal control of laser beams. Prior to joining RIT, she was a laser system scientist at the Department -of-Energy-funded Laboratory for Laser Energetics, the University of Rochester from 2005 to 2013. She led the demonstration of the world's first 1.5-meter coherently-phased-grating pulse compressor for petawatt lasers. Dr. Qiao has worked on various innovative photonics devices, optical imaging, and metrology systems, for two photonic startups and one optics company. Dr. Qiao earned her Ph.D. in Electrical and Computer Engineering from the University of Texas at Austin and her M.S. in Precision Instruments and Fine Mechanics from Tsinghua University. She has an M.B.A in entrepreneurship, strategy, finance, and marketing from the Simon Graduate School of Business, University of Rochester.

Michele Cotrufo

Biography

Michele Cotrufo joined the Institute of Optics in 2023 as an assistant professor. He received a BS degree in physics from University of Bari, Italy (2010) and MS degree in physics from University of Padova, Italy (2012). He then joined the Eindhoven University of Technology (Netherlands) as a doctoral student, where he investigated novel light-matter interactions in nanophotonics and hybrid optomechanical systems. After graduating in 2017, he performed postdoctoral research at the University of Texas at Austin and at the CUNY Advanced Science Research Center (New York City). In 2023, he was awarded the Photonics Young Investigator Award from MDPI. His research focuses on the investigation of metamaterials—artificially structured materials that manifest optical properties not available in bulk materials—for a broad range of applications in classical and quantum optics. His group is particularly interested in exploring the use of quantum metamaterials for the generation, manipulation, and detection of quantum states of light.



Chunlei Guo

Biography

Chunlei Guo is a Professor in The Institute of Optics and Physics at University of Rochester. His primary research revolves around femtosecond laser-matter interactions, with recent ventures into nanophotonics and advanced materials. His work at Rochester led to the discovery of a range of highly functionalized materials through laser surface patterning, including the so-called black and colored metals, and superhydrophillic and superhydrophobic surfaces. These discoveries may find a range of applications and have been featured 4 times in The New York Times. He is a Fellow of the American Physical Society, Optica, and Int'l Academy of Photonics and Laser Engineering. He served as the Editor-in-Chief for the recently released 2nd edition of CRC Handbook of Laser Technology and Applications, which serves as the most comprehensive handbook in the field of lasers to date.

What's Happening in Washington

Jennifer O'Bryan

Government Affairs Director, SPIE

Biography:

Jennifer O'Bryan, Government Affairs Director for SPIE, is head of SPIE's government affairs activities. Jennifer advocates for a host of priorities on behalf of the community including federal research and development funding, export control and trade issues, and growing the STEM workforce. Additionally, she is the current chair of the Sensors and Instrumentation Technical Advisory Committee within the U.S. Department of Commerce, which advises the U.S. government on export control regulations. Before joining SPIE, she worked as a senior policy aid in the U.S. House of Representatives for two members of congress.

David Lang

Senior Director of Global Policy and Affairs, Optica

Biography:

David Lang is the Senior Director of Global Policy & Affairs at Optica (formerly OSA) in Washington, D.C. where since 2018 he has directed the organization's advocacy and public affairs programs. Prior to joining Optica, David was with the National Academies of Sciences for 14 years where he worked on more than 20 projects spanning space and Earth sciences, physics, and telecommunications. He received his Master of Engineering and Public Policy in energy policy and technology from the University of Maryland, College Park and his Bachelor of Science in Astronomy and Astrophysics from the University of Michigan, Ann Arbor.

Master's Student Showcase

Mario Marckwordt - University of Rochester: HOME Program

Ruichen Yang - University of Rochester: MS Program

Abhinandan Ambastha - University of Rochester: MS Program

Ph.D. Research Presentations

David Spiecker - University of Rochester: Optics PhD
"Simultaneous Polarimetry and Wavefront Sensing with Stress Engineered Optics"

Ben Moon - University of Rochester: Optics PhD
"Precision Eye-Tracking Using High-Resolution Retinal Imaging"

Anna Starynska - Rochester Institute of Technology: Imaging Science PhD
"Text Restoration in Palimpsested Historical Manuscripts Using Deep Learing Methods"

Jeremy Goodsell - University of Rochester: Optics PhD
"Deriving the Limits of Augmented Reality Waveguide Displays"

Poster Competition

Voting by ballot in Highland Ballroom A; voting ends at 1:00pm

Andrea Avendano Martinez – *RIT Color Science MS*

"The Impact of Background Luminance on the Brightness Perception of Chromatic Colors"

Reproducing saturated colors on an emissive display often causes them to appear brighter than its actual luminance. This phenomenon can be explained by the Helmholtz-Kohlrausch (H-K) effect, which describes an increase in perceived brightness when increasing the chroma of a color. Although recent studies have attempted to incorporate the H-K effect into their modeling, none of these studies have directly explored how the perception of chromatic stimuli changes with background luminance.

We present results from a psychophysical brightness-matching experiment conducted across different levels of background luminance. The experimental results show that as background luminance is increased for highly saturated, low luminance colors, current models overestimate perceived lightness changes by more than double. To maintain the intent of creative content, there is a need for color appearance models to accurately predict perceived brightness under changes to the background luminance level.

Jordan Butt – *UR Chemistry PhD*

"Disposable Photonics Platform for Antigen and Antibody Detection"

Quick detection of clinical analytes improves turnaround time for clinical diagnosis. As demonstrated by the COVID pandemic, rapid diagnostics are needed to guide proper patient care and save lives. In previous work, we demonstrated a "disposable photonics" platform for detection of clinical analytes using ring resonators. Ring resonators measure shifts in refractive index, which occurs when an antibody binds to an antigen. Using a two-ring sensor allowed detection of antibodies to SARS-CoV-2 to measure vaccine response, but it was limited to measuring only the response against one strain of the virus at a time.

Here, we have developed a multiplex photonic sensor that allows for simultaneous detection of up to 8 analytes. We show use of this platform to measure the concentration of antibodies to different SARS-CoV-2 strains in post vaccinated and infected individuals. We demonstrate use of this sensor in a variety of different circumstances, including breakthrough infection, vaccination with previous infection, and booster shots. We also demonstrate the use of saliva as an alternative to serum, which would be easier to use in clinical settings.

Gong Chen – *RIT Imaging Science PhD*

"Optical Structuring and Finishing Toward Mid-Spatial-Frequency Error Reduction Using Femtosecond Lasers"

We demonstrate nano-structuring and the reduction of mid-spatial-frequency errors using femtosecond laser figuring and finishing. For the first time, to the best of our knowledge, we have corrected mid-spatial-frequency errors from 17 nm to one nanometer in magnitude. We established a method for creating and predicting periodic nanostructures. This demonstration opens the path of using femtosecond lasers to correct surface errors that inherently result from sub-aperture manufacturing techniques.

Sofie Herbeck – *RIT Color Science PhD*

"Understanding Limits of Face Transparency Perception in Augmented Reality"

Optical see-through augmented reality (OST-AR) is an increasingly popular display technology which superimposes rendered objects onto an observable view of the real world via a translucent pane. The inherent see-through nature of OST-AR displays carries its own set of challenges, however, especially around the appearance of objects with lower chroma (purity) or value (lightness/darkness). These may produce weaker percepts, or create visual dissonance in the case of mismatched lighting between the real scene and the rendered object(s). Still, some transparency in the rendered object is not necessarily negative we have not yet characterized peoples preference for transparency levels when interacting with other humans in AR-mediated modalities. Psychophysical experiments asked observers to use the method of adjustment to perceptually match transparency in AR to an emissive display's image opacity, and then to judge the visual acceptability of each transparency level. These allowed probing of the effect of skin color on observed transparency perception and acceptability judgments. Assessing transparency perception and visual acceptability will convey useful guidance to OST-AR developers, pointing toward the highest-impact areas of future OST-AR innovation.

Vincent Fittos– *RIT Imaging Science BS*

"Characterization of Silicon On-Chip Photon Sources"

Silicon microring resonators are used to create entangled photon pairs. These pairs are generated by utilizing a third-order nonlinear property of silicon called spontaneous four wave mixing. The wavelengths and efficiency of coupling light into and out of the ring are fixed and depend on the relative phase of the light and the gap length between the waveguide and ring. We characterized an array of on-chip designs that incorporate thermal tuning to change the wavelengths and efficiency of pair generation at telecom wavelengths. Here, we present the characterization of our best design which yields the highest efficiency.

Sabyasachi Goswami – *UR Brain & Cognitive Sciences PhD*

"Accommodative response with simulated contact lenses in myopes"

This study aimed to evaluate through-focus visual performance and accommodative response in emmetropic and myopic individuals using novel myopia control optical designs simulated with an adaptive optics visual simulator (AOVS). Segmented testing conditions from Clerio Vision (USA) were simulated in a customized AOVS equipped with a spatial light modulator (SLM). Visual acuity was study in two difference condition: natural and paralyzed accommodation. We found on average a difference between natural and paralyzed accommodation of -0.15/-0.12 on emmetropes vs myopes respectively. Pupil size was higher on myopes 0D than emmetropes, with a standard deviation of in a range of 0-4.5D on emmetropes/myopes respectively. Accommodation lag was higher on myopes than emmetropes and statistically significant (p=0.04). Taking account that accommodation plays an important role in the development of myopia, being able to characterize the difference between myopes and emmetropes establishing a new perspective to approach myopia control.

Elphas Khata – *RIT Imaging Science PhD*

"Towards a Low-Cost Radiometer for Validation of Level-2 Landsat Land Surface Temperature (LST) Products"

Accurate surface temperature retrieval is crucial for various applications in environmental monitoring, agriculture, and climate research. Sensors play a pivotal role in this process, and their calibration significantly influences the quality of temperature data obtained. For example, the Landsat mission aims to provide products that are error-validated. To achieve this, validation datasets are mined and used for calibration of

temperature products retrieved through remote sensing. The limitation of these validation datasets is evident through sparse SURFRAD networks and water-based Buoy stations like NASA JPL.

This study proposes a portable radiometer sensor model with capabilities to monitor surface-leaving radiance to measure kinetic surface temperature. A model radiometer was developed to sense this radiance to help validate ST products from Landsat 8/9 missions. We assess the impact of sensor calibration on surface temperature retrieval through a comprehensive analysis of measured chamber data with respect to various blackbody temperatures. Through empirical data analysis and modeling, we have quantified the extent to which sensor calibration affects the accuracy, precision, and consistency of surface temperature retrieval. The current study has shown a dependency on the linear calibration model with a calibration standard deviation tolerance of 0.81 to 1.06. The radiometer is susceptible to environmental parameters such as wind and humidity changes. This has prompted a deep dive into instrument aesthetics studies besides the initial focus on the best calibration practice. The findings of this study have provided valuable insights into optimizing sensor calibration strategies for enhancing the reliability of surface temperature measurements, thus facilitating more accurate assessments of land-surface temperature products towards the validation of Landsat Level-2 surface temperature data.

Siladitya Khan – *UR Biomedical Engineering PhD*

Chanseung Lee – *UR Optical Engineering BS*

“Metrology of 1970s Humphrey-Alverez Freeform Vision Analyzer”

The objective of this study is to develop a measurement method for the Humphrey Alvarez lens and determine the unknown coefficients of the mathematical formula associated with it. The findings contribute to a better understanding and characterization of the lens for potential future applications.

Xiaoyu Ma – *UR Optics MS*

“New Method for OMEGA EP Simulation”

Our existing OMEGA EP simulation model uses a rough approximation of Fresnel diffraction, and a new approach needs to be proposed to provide a more accurate and efficient way to simulate using NLSE and improved single-precision Rayleigh-Sommerfeld diffraction.

Ovishek Morshed – *UR Optics PhD*

“Transforming Quantum Chemistry: Unveiling Exciton-Polarization Dynamics with CdSe Nanoplatelets in Fabry-Perot Cavities”

Exciton–polaritons, arising from the strong coupling between electronic states of molecules and confined photons within an optical cavity, represent an emerging platform for exploring nanoscale light–matter interactions. Prior studies on molecular polaritonic systems have typically involved low exciton oscillator strength, necessitating large numbers (millions) of molecules and operation at low temperatures. Here, we report the generation of room-temperature exciton–polaritons through the coupling of CdSe nanoplatelets (NPLs) with a Fabry–Pérot (FP) optical cavity. The large oscillator strength of NPLs, along with their in-plane transition dipole moment and exceptionally narrow fluorescence linewidth, makes them particularly suited for achieving strong light–matter coupling. Our studies show that NPLs strongly couple to FP cavities, evidenced by a 74.6 meV Rabi splitting at room temperature in a metal–dielectric design, as characterized by angle-

resolved reflectance and photoluminescence measurements. Additionally, we explore the strong coupling behavior in a metal–metal cavity, with preliminary data suggesting a Rabi splitting exceeding 100 meV. Simulations of the electric field intensity of resonant modes in both metal–dielectric and metal–metal FP cavities support our experimental findings. We further demonstrate the significant impact of the coupling of dark exciton states on the light emission properties of the upper and the lower polaritons, influenced by their relative photonic character along with the cavity loss. Our work provides a promising platform for advancing polariton chemistry, potentially unlocking new chemical reaction pathways and facilitating novel quantum applications.

Jose Nazareno Gabriel Macalintal – *RIT Imaging Science PhD*

"Hyperspectral VNIR-SWIR Image Fusion on Cultural Heritage and Remote Sensing Datasets using Image Sharpening Techniques"

Mohammad Saif – *RIT Imaging Science PhD*

"UAS-Enabled Monitoring for Cercospora Leaf Spot Disease in Table Beets"

Cercospora leaf spot (CLS), caused by the fungus, Cercospora beticola Sacc., is a severe foliar disease that affects the health of table beet crops. Unmanned aerial systems (UAS) present an innovative and promising method to enhance the management of CLS via precise estimation of disease severity to define action thresholds. We conducted UAS flights over C. beticola-inoculated table beet plots at Cornell Agritech in Geneva, NY, USA between June and September of 2021 2022, and 2023. Five wavelength band (475, 560, 668, 717 and 840 nm) multispectral images were collected for the 2021 and 2022 flights, while for the 2023 flights a different sensor was used (four bands; 560, 650, 730 and 860 nm). CLS disease severity was quantitatively evaluated by visual assessments at regular intervals coinciding with the flights. Various vegetation indices and texture features were derived from the UAS multispectral imagery, which then were used to train a machine learning model to predict CLS disease severity. Our best performing model produced an R2 = 0.81 and RMSE of 9.40%, based on field-based (visual) disease severity. This study demonstrates the efficacy of multispectral imagery via UAS as a surveillance tool, offering a streamlined and accurate approach to monitoring CLS in table beet production, which is critical for timely and targeted disease management interventions.

Jesus Sanchez-Juarez – UR Electrical Engineering PhD

"Passive Automated Fiber-Chip Alignment System Based on Image Processing and Deep Learning"

This research shows the development of an algorithm for passive Fiber-Chip alignment without human interaction. A methodology was developed to apply Digital Image Processing and the Fourier Transform spectrum to identify alignment patterns using AI. The Deep Learning model controls a motorize three axis stage to perform the alignment process. By implementing computer vision and AI technologies with the optical fiber-to-chip alignment process, we intend to significantly reduce alignment times compared to current industry standards.

Kendall Smith – UR Optical Engineering BS

"Using Scattering Elements to Analyze Resonance Ring Coupling on Photonic Integrated Circuits"

Photonic integrated circuits utilize a ring structure within the main cavity for a wide range of applications from sensing to information multiplexing/de-multiplexing. Resonance rings are extremely sensitive to any losses, which can cause issues with coupling and establishing resonance within the fabricated ring. Because of this, identically designed rings typically have different fundamental resonant wavelengths. Determination of the resonance wavelength is typically done through analyzing the output spectra of a ring through input/output fiber coupling. Previous metrology applications have utilized engineered scattering elements as a means of determining the polarization of a waveguide and to monitor the relative power coupled into the waveguide. Using the engineered scattering elements, we demonstrated how the resonance condition of ring resonators can be evaluated with only one fiber input. Simulations showed that the scattering elements were not a source of meaningful loss, to provide backing for experimental analysis without introducing shifts in resonance or quality factor.

David Spiecker – UR Optics PhD

"Single-shot, Spatially Resolved, Simultaneous Polarimetry and Wavefront Sensing"

A single-shot, spatially resolved wavefront gradient measurement and polarimetry technique is proposed by combining a Shack-Hartmann Wavefront Sensor (SHWFS) and a Star Test Imaging Polarimeter (STIP). This is achieved by combining polarimetry and wavefront sensing techniques, a Star Test Imaging Polarimeter (STIP) and a Shack-Hartmann Wavefront Sensor (SHWFS) respectively. The SHWFS creates an array of point sources from an input field that become displaced in presence of wavefront errors and those spots acquire a polarization-dependent irradiance pattern with STIP. The polarization state and spot displacement are retrieved from a single irradiance measurement to determine the input field's gradient and polarization states. The retrieval algorithm utilizes a gradient descent approach by performing sequential normalized cross correlation between the measured irradiance pattern and an irradiance pattern produced by an estimated polarization state (represented as a Stokes vector) until the degree of correlation is maximized. The Stokes vector and the spot location can be retrieved from the results of the maximum cross correlation.

Biswa Swain –RIT Imaging Science PhD

"High Performance Optical Differentiation Wavefront Sensing Towards Freeform Metrology"

We report the demonstration of freeform optics metrology with an optical differentiation wavefront sensor that relies on spatially dithered distributions of binary pixels to synthesize a far-field amplitude filter. Analysis of experimental results and comparison with a commercial low-coherence-length interferometer shows that freeform phase plates with different magnitude of wavefront slopes can be accurately characterized. RMS accuracy of ~ Î»/10 and precision of ~ Î»/70 at 633 nm were achieved with pixelated filters having 2.5-Âµm pixels. Simulations that describe the characterization of a freeform optical component in the presence of photodetection noise and filter nonlinearity demonstrate the robustness of this wavefront-sensing approach for freeform optics characterization.

Aldo Tecse – UR Biomedical Engineering BS

"Second Harmonic Generation Microscopy of Rat Scleral Remodeling by Collagenase and Reparative Collagen Mimetic Peptides"

Myopia affects over 20% of the population and is expected to rise to 50% by 2050. Scleral remodeling in myopia involves extracellular matrix proteases. Collagen-mimetic peptides (CMPs) show reparative potential in sclera. Second Harmonic Generation (SHG) Microscopy was used to analyze structural changes in collagen induced by collagenase, CMP1 and CPM2 in dissected sclerae. Collagenase digestion reduced collagen interweaving and density. CMP2 treatment restored collagen organization ($p < 0.05$) to untreated levels, while CMP1 effect was not significantly different. These changes may represent a reparative effect on enzymatically digested scleral collagen that could be useful in the treatment of myopia progression.

Angelina Yang– UR Optical Engineering BS & Glory Linebach – UR Optical Engineering BS

"High-resolution Retinal Imaging and Stimulus Delivery Using a High-Refresh-Rate External Display"

Combining an Adaptive Optics Scanning Laser Ophthalmoscope (AOSLO) with a high-refresh-rate external display expands the effective AOSLO imaging field of view by a factor of seven. This innovation enables high-resolution retinal imaging and stimulus delivery over a retinal area that is 50 times larger than the standard AOSLO imaging area of one degree squared. We designed and assembled a custom optical relay for use with a high-refresh-rate color display operating at 360 frames per second. We validated the performance of the assembled relay by measuring the wavefront error across the full field of view and the full refractive error correction range of -8 to +4 diopters. The AOSLO, optical relay, and display were integrated with the use of an alignment laser to ensure coalignment of the optical axes and pupils. We assessed the image quality of the completed assembly by measuring the contrast of high acuity optotypes from a calibrated Snellen eye chart rendered on the display. The measured contrast was greater than 40% across the full field of view at 36 cycles per degree, demonstrating the capability to display high acuity stimuli beyond the standard 20/20 line of the eye chart and approaching the 20/10 sampling resolution limit of human vision. We conducted human retinal imaging over an area spanning 9.4 by 5.4 degrees of visual angle and constructed a continuous retinal montage that encompasses the entire fovea. The combined external display and AOSLO system enables presentation of color stimuli at high spatial and temporal resolution, thus greatly expanding the range of psychophysics experiments that can be conducted beyond the current AOSLO-based paradigms.

Yeidi Yuja Vaquiz – UR Biomedical Eng. BS with Optics Minor

"Ultrasound and Photoacoustic Guided Gastrostomy to Prevent Colonic Injury"

Gastrostomy tube (G-tube) placement is a common surgical procedure, and pediatric surgeons prefer laparoscopic-assisted percutaneous endoscopic gastrostomy. However, a limitation of this approach is the lack of a noninvasive image-guidance modality to identify the presence of the transverse colon in the pathway of the puncture needle. A new approach has been proposed that utilizes externally induced bio-safe agents to detect the transverse colon through photoacoustic (PA) imaging, which has the potential to distinguish the stomach and transverse colon. A feasibility study was conducted using colon- and stomach-mimicking phantoms. The colon was coated with IR-806 indocyanine green (ICG), while the stomach remained with natural blood contrast. Co-registered ultrasound (US) and PA images were acquired in real time as the two fibers moved closer to the tissue boundaries. While navigating the puncture needle, the difference between the

acquired PA signals at the two wavelengths was used to identify the tissue in front of the needle. At a distance of about 1 mm from the colon mimic, a stronger PA signal was observed at 800 nm compared to 532 nm, indicating the presence of the colon. In contrast, a weaker PA signal at 800 nm compared to 532 nm was observed on the stomach side, where blood is the primary absorber. The presence of the contrast agent-coated colon can be detected non-invasively and distinguished from the stomach by exploiting the difference in the PA signals. This novel approach overcomes the limitations of traditional imaging techniques and minimizes the risk of colonic injury during G-tube placement. The use of a low-cost, bio-safe, and FDA-approved PA contrast agent provides a cost-effective and accessible clinical solution that has the potential to revolutionize G-tube placement procedures. This development has led to a novel non-invasive US and PA-guided gastrostomy, consistently minimizing colonic injury risks during G-tube placements.

Tianlun Zou – UR Optics PhD

"The Impact of Eye's Longitudinal Chromatic Aberration on Visual Acuity and Accommodation Response Measured in an Adaptive Optics Visual Simulator"

Chromatic composition of displays might affect vision and accommodation, possibly influencing myopia development. We investigated differences in visual acuity (VA) and accommodative lag for steady accommodative demands (up to 5D,1D steps) with visual stimuli illuminated by monochromatic wavelengths (480,555&630nm,3nm bandwidth) and white light. Data was obtained on 3 young emmetrope using an Adaptive Optics system with a supercontinuum laser, a DMD for stimuli, and a optunable lens to change vergence. Best focus for far was set at 555nm. VA was measured using QUEST(tumbling E).Accommodative lag was obtained from the peak shift of through-focus Visual Strehl, calculated from HS aberrometry. All subjects showed myopic shifts in blue consistent with longitudinal chromatic aberration. However, the response to wavelength differed across subjects. S#1 showed a sustained VA across distances (average VA standard deviation 0.054,-0.005logMAR),low accommodative lag (slope:0.3 D/D) and systematic SA negative shift (slope:-0.04um/D),similar across monochromatic and white light. S#2 showed a more sustained VA, lower accommodative lag and higher SA change in blue (0.09logMAR std,0.3D/D,-0.02um/D) than in white light (0.14logMAR std,0.52D/D,-0.013um/D). S#3 showed a steeper decrease in VA at near and higher accommodative lag for monochromatic light (0.218logMAR std,0.78D/D, on average)than in white light (0.05logMAR std,0.38D/D).Different subjects use chromatic cues in different ways to accommodate, likely affected by the interplay of chromatic blur, depth-of-focus and defocus sign perception.

Tyler Howard – UR Optics PhD

"Benchmarking and Feature Enhancement of Optomechanical Stress-Induced Birefringence Modeling Code"

Polarization of the electric field has become a critical component in the modeling and design of optical elements for high energy laser systems. Thermal and optomechanical stresses induce a birefringence in what otherwise may be isotropic materials; leading to an unknown polarization state that decreases the performance of an optical component. Accurate modeling of these effects allows for the optical design to compensate for these effects and achieve a greater efficiency. Previous models have been developed to function for a collimated on-axis bundle of rays but lack the capability to work for oblique rays. Inclusion of obliquely propagated rays allows for accurate modeling over a more diverse design space. Using a prebuilt optomechanical birefringence model, a new user-friendly feature was included to propagate a ray bundle at any orientation. Results of this propagation were compared to previous experimental work establishing a new benchmark of an optical window with stress-induced birefringence.

Professional Organizations

SPIE Student Chapter

SPIE is the International Society for Optics and Photonics. The University of Rochester Student Chapter was established in 2009 and has since grown to be the largest student chapter in North America, with over 70 registered student and alumni chapter members. We promote optical science and engineering while supporting the professional development of our chapter members. To accomplish this, we regularly engage in optics outreach in the Rochester community, invite speakers to visit with students on campus, and schedule tours of local optics companies.

Current Officers:

President: Rushnan Islam
Vice President: Rebecca Swertfeger
Secretary: Robert Johnson
Treasurer: Renuka Manjula Narayanan
Web Administrator: Connor Hewson
Communications Officer: Angelica Guzmán Thompson
Outreach Chair: Shravan Gupta
Faculty Advisor: Greg Schmidt
Senior Faculty Advisor: Jannick Rolland

If you would like to host a company tour or collaborate with us on outreach or professional development events, please contact urspie@gmail.com.

Optica Student Chapter

The University of Rochester's Optica student chapter is a pre-professional organization and academic club. Our mission is to promote and advance the science of light amongst the student body of the University of Rochester. One of our largest goals each year is to provide students with professional development opportunities aimed at giving them the skills they need to succeed. We have been working to find creative ways to engage with and teach optics to the campus and community at large, as well as host social events to promote interaction between students. Our biggest event of the year, bringing together Institute undergraduates, graduates, and faculty, is our annual Photon Cup soccer match with the Physics department.

Current Officers:

President: Farhan Ejaz
Professional Development Chair: Ryan Malarkey
Social Chair: Brendan Habert
Business Manager: Samuel Edrogen
Outreach Chair: Katelyn Buscetto
Secretary: Jack Maness
Senior Advisor: Natalie Fullerman
Digital Media Officer: Henry Chen

Please contact the chapter at RochesterStudentOSA@gmail.com if you are interested in getting involved in our chapter programming through outreach, event sponsorships, company tours, talks and/or presentations.

Industrial Associate Members

Industrial Associate members are listed alphabetically within membership levels: Strategic, Select, Standard, Associate and Society & Trade Associations.

Strategic IA Members

ASML	**ASML** *www.asml.com*
CORNING	**Corning Incorporated** *www.corning.com*
Edmund optics | worldwide	**Edmund Optics** *https://www.edmundoptics.com/*
L3HARRIS	**L3Harris Technologies (NY)** *www.l3harris.com*
Lawrence Livermore National Laboratory	**Lawrence Livermore National Lab** *www.llnl.gov*
mks Spectra-Physics® Newport™ Ophir® ESI®	**MKS Instruments** *www.mksinst.com*
OPTIPRO	**OptiPro Systems, Inc.** *www.optipro.com/index.html*
SYNOPSYS®	**Synopsys** *www.synopsys.com*
Ansys + Zemax	**Zemax | Ansys** *www.zemax.com*
zygo® AMETEK® ULTRA PRECISION TECHNOLOGIES	**Zygo | Ametek** *www.zygo.com*

Select IA Members

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amazon Lab126	**Amazon Lab 126** https://amazon.jobs/en/teams/lab126/
	Apple www.apple.com
AOM Arizona Optical Metrology	**Arizona Optical Metrology** https://cghnulls.com/
DANBURY	**Danbury Mission Technologies** ***(formerly Collins Aerospace)*** *www.dmtllc.org*
LEONARDO DRS	**DRS Daylight Solutions** *https://daylightsolutions.com/*
FIBERTEK, INC.	**Fibertek, Inc.** https://www.fibertek.com
Google	**Google** https://arvr.google.com/ar/
COHERENT	**Coherent** https://www.coherent.com/
KLA	***KLA*** *https://www.kla.com/*

Lockheed Martin
www.lockheedmartin.com

Luminar Technologies
https://www.luminartech.com

MIT Lincoln Laboratory
https://www.ll.mit.edu/

Microsoft
www.microsoft.com

Northrop Grumman
https://www.northropgrumman.com/

Sunny Optical Technology Group Co., Ltd.
www.sunnyoptical.com

Viavi Solutions
https://www.viavisolutions.com/en-us

Standard IA Members

Alcon	**Alcon** https://www.alcon.com/
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INTUITIVE	**Intuitive Surgical** *https://www.intuitive.com/en-us*
JENOPTIK	**JENOPTIK Optical Systems** *www.jenoptik-inc.com*
NAVITAR	**Navitar** *www.navitar.com*
Optikos The Optical Engineering Experts®	**Optikos** *www.optikos.com*
OPTIMAX	**OPTIMAX Systems, Inc.** *www.optimaxsl.com*
SONY	**SONY Electronics Inc.** *www.sony.com*

Associate IA Members

	**412th Test Engineering Group - Edwards Air Force Base** ***https://www.edwards.af.mil/About/Fact-Sheets/Display/Article/393902/412th-test-wing/***
	**Aperture Optical Sciences** ***https://apertureos.com/***
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	**Labby** ***https://www.labbyinc.com/***
	***Metalenz*** ***https://metalenz.com/***
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	**OptoSigma Corporation** ***www.america.optosigma.com/***
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	**Soter Technology**
	**TOPTICA Photonics, Inc.** ***www.toptica.com***
	**Wavefront Research, Inc.** ***www.wavefrontresearch.com***

Society, Trade, & Academic Association IA Members

NEW YORK STATE AIM photonics	**AIM Photonics** https://www.aimphotonics.com/
UR LLE	**The Laboratory for Laser Energetics** https://www.lle.rochester.edu/
MCC Monroe Community College STATE UNIVERSITY OF NEW YORK	**Monroe Community College** *www.monroecc.edu*
NEW YORK PHOTONICS PHOTONICS ROCHESTER	**New York Photonics** *www.newyorkphotonics.org* *www.rrpc-ny.org*
nextcorps LUMINATE	**NextCorps | Luminate** ***www.nextcorps.org*** *www.luminate.org*
OPTICA Advancing Optics and Photonics Worldwide | Formerly OSA	**The Optical Society** *https://www.optica.org/en-us/home/*
RIT	**Rochester Institute of Technology** https://www.rit.edu/
SPIE.	**The International Society for Optics and Photonics** *www.spie.org*