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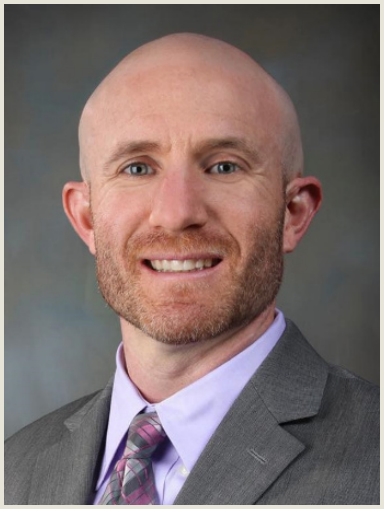
Wyant College of Optical Sciences

INDUSTRIAL AFFILIATES WORKSHOP

KEYNOTE SPEAKER PROFILE



MATTHEW EICHENFIELD

SPIE ENDOWED CHAIR IN OPTICAL SCIENCES & ASSOCIATE PROFESSOR OF OPTICAL SCIENCES
DISTINGUISHED FACULTY JOINT APPOINTEE AT SANDIA NATIONAL LABORATORIES

Tuesday, February 21, 2023 | 9:17 AM - 9:57 AM

Title: "Piezoelectric Microsystems for Classical and Quantum Information Processing"

Abstract:Piezoelectricity is a property of a special class of materials that allows coupling between electric fields and strain. In this talk, I will discuss my work in using this property in specially designed microsystems to radically enhance the performance of and enable completely novel functionalities in two very different classes of microsystems. First, I will discuss how piezoelectrically actuated and optomechanically tuned photonic integrated circuits have enabled a flood of novel and highly scalable systems for quantum computing. Then I will discuss how we have coupled together piezoelectric acoustic waves and semiconductors to create systems that may completely revolutionize wireless communications systems.

Bio: Matt Eichenfield is the SPIE Endowed Char in University of Arizona's College of Optical Sciences and is also a Distinguished Faculty Joint Appointee at Sandia National Labs'. Prior to joining UA this fall, he was a Distinguished Member of the Technical Staff and the founder and group leader of the MEMS-Enabled Quantum Systems group at Sandia National Labs. He received his BS in physics from UNLV in 2004, MS in physics from Caltech in 2007, and his PhD from Caltech in 2010, with his thesis winning the Demitriades Prize for best Caltech thesis in nanoscience. He became the first Kavli Nanoscience Prize Postdoctoral Fellow at Caltech in 2010 before joining Sandia as a Harry S. Truman Fellow in 2011.

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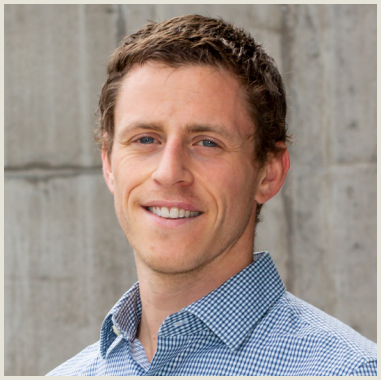

JACK MANLEY, POSTDOCTORAL RESEARCH ASSOCIATE

Tuesday, February 21, 2023 | 9:58 a.m.

Title: "Searching for Vector Dark Matter with an Optomechanical Accelerometer"

Abstract: The Quantum Optomechanics Group at OSC is working on a dark matter search using optomechanical accelerometers as detectors. I'll discuss the concept of dark matter detection with optomechanical accelerometers and present our lab's progress toward realizing a sensitive detector based on centimeter-scale silicon nitride membranes..

Bio: Jack Manley is a postdoctoral research associate in the Quantum Optomechanics Group at OSC. He completed his PhD at the University of Delaware as a theorist, where he developed detection schemes for ultralight dark matter with primarily optomechanical detectors. His current research focuses on sensing applications for optomechanical devices, including tests of fundamental physics.

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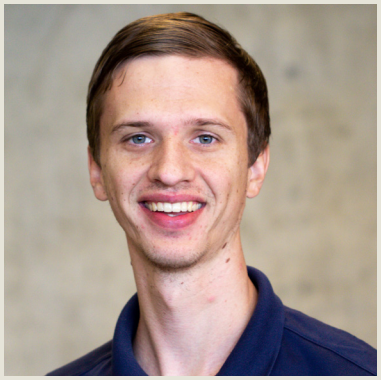

JACOB BARKER, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: Pavel Polynkin

Tuesday, February 21, 2023 | 10:19 a.m.

Title: "Ultrafast Parametric Laser Sources in MIR and LWIR for Filamentation Research"

Abstract: Ultrashort-pulse lasers (USPLs) enable a wide range of applications in remote sensing, laser wakefield accelerations and directed energy. The underlying physical effects for many of those applications scale favorably with the laser wavelength and can benefit from using optical sources operating in the mid-infrared (MIR) and long-wave infrared (LWIR) spectral ranges. Yet to-date, most of the investigations in strong-field laser-matter interactions utilized high-energy USPLs operating in the relatively narrow wavelength range in the near-infrared. Developments of new nonlinear optical materials and optical parametric chirped-pulse amplification (OPCPA) technology enable efficient conversion of widely available near-infrared laser sources to longer wavelengths favored by applications. We will discuss two projects targeting the construction of energetic long-wavelength USPL OPCPAs: a TW-class LWIR source at the University of Arizona and a GW-class MIR source at the AFRL Kirtland.

Bio: Jacob Barker is a 4th year PhD student under Dr. Pavel Polynkin. Research interests include new USPL sources, filamentation, turbulence effects, and adaptive optics.

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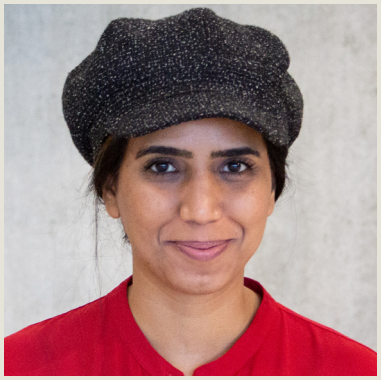

KHAWLAH ALYAHYAEI, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: Nasser Peyghamberian

Tuesday, February 21, 2023 | 10:32 a.m.

Title: "Low-Quantum-Defect Single Frequency Fiber Laser"

Abstract: Low quantum defect lasers generally suffer from less thermal issues due to the less heat generation in the laser operation. In this talk, we will present a single-frequency distributed-Bragg-reflector fiber laser emitting at 980 nm with quantum defect of less than 0.6%. A maximum output power of 275 mW with a slope efficiency of 50% with respect to the launched pump power was obtained with a 1.5-cm high ytterbium-doped phosphate fiber. This research demonstrated the possibility to achieve single-frequency laser source with ultra-low thermal noises.

Bio: Khawlah Al Yahyaei is currently a PhD student at the Wyant College of Optical Sciences at the University of Arizona. She got her bachelor's degree in Physics and master's degree in material science and engineering from The United Arab Emirates University. Khawlah is a Research Associate at the Fiber Laser and Device group under the supervision of Professor Nasser Peyghamberian and Dr. Xuishan Zhu. Her research interest includes single-frequency fiber lasers, wavelength tunable fiber lasers, photo-darkening in fiber lasers, and fiber Bragg grating fabrication.

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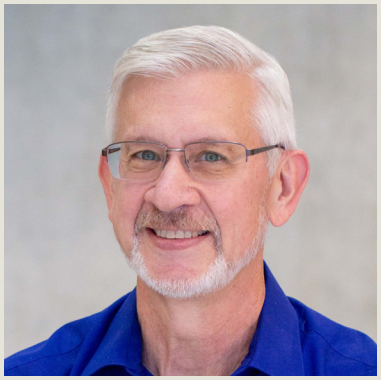

TOM MILSTER,
PROFESSOR OF OPTICAL SCIENCES

Tuesday, February 21, 2023 | 10:56 a.m.

Title: "MODE Lenses for Space Telescopes"

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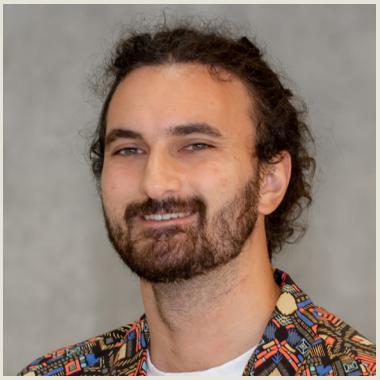

NICK BRAR, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: Tom Milster

Tuesday, February 21, 2023 | 11:17 a.m.

Title: "Development of Glass Molding Technology for the MODE Lens Telescope"

Abstract: Recent developments in spaceflight technology have drastically decreased the cost of space launches and projections show that this trend will continue. For space telescopes to properly take advantage of this decrease in cost, they must be designed to be very lightweight and fabricated in a scalable method. The design of the MODE lens telescope offers a design with a very lightweight objective lens which is designed as an achromat. By fabricating MODE lens objective using a molding process, we will be able to make a large number of lightweight telescopes which can simulate the effect of single, extremely large telescope.

Bio: Nick Brar is a PhD student at the Jim C. Wyant College of Optical Sciences. His research involves fabrication and testing of freeform optical elements. He recieved his BS in Optical Sciences and Engineering for the University of Arizona in 2021.

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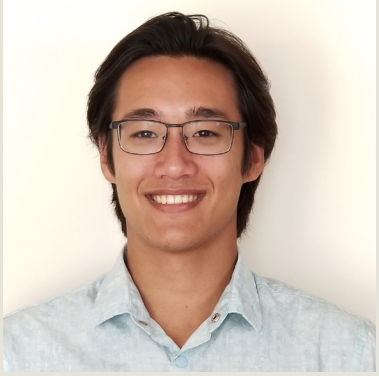

KEVIN DERBY, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: Poul Jessen

Tuesday, February 21, 2023 | 11:30 a.m.

Title: "Pinwheels: a Curved Aperture Segmentation Topology for Improved Astrophysical Science on Future Observatories"

Abstract: Pinwheel segmentation is a novel curved-edge segmentation topology capable of emulating a monolithic circular aperture by generating a "quasi-Airy" point spread function. A brief overview of the theory and construction of pinwheel apertures is given. In addition, pinwheel segmentation for coronagraphy and crowded field imaging is demonstrated in simulation and compared with a circular monolithic aperture and a hexagonally segmented aperture.

Bio: Kevin Derby is a 3rd year PhD student in the Wyant College of Optical Sciences working with Drs. Daewook Kim and Ewan Douglas. He research is focused on the physical optics modeling and simulation of astronomical instruments with an emphasis on high contrast imaging.

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DK KANG,
ASSISTANT PROFESSOR OF OPTICAL SCIENCES

Tuesday, February 21, 2023 | 1:30 p.m.

Title: "Low-cost, In Vivo Microscopy"

Abstract: I will present the development of various low-cost, in-vivo microscopy imaging technologies, including portable confocal microscopy and light sheet microscopy.

Bio: Dr. DK Kang is an Assistant Professor of Optical Sciences and Biomedical Engineering. His lab develops low-cost optical imaging devices for medical applications in low-resource settings.

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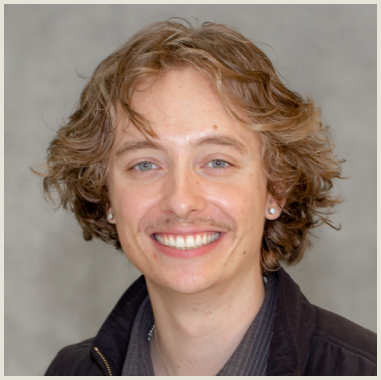

KENNETH LANG, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: Euan McLeod

Tuesday, February 21, 2023 | 1:51 p.m.

Title: "Lens-Free Time-Gated Fluorescence Microscopy"

Abstract: Our research aims to develop a lens-free time-gated fluorescent imaging technique for high-resolution imaging of labeled cells. Unlike lens-based microscopes, lens-free techniques generally have large field of views limited only by the size of their sensor arrays. Unfortunately, due to the incoherence of fluorescent emitters and the necessary barrier filter placed between the sample and sensor, lens-free methods struggle to reach micron size resolution. Our design overcomes this issue by removing the chromatic filter and implementing a time-gated exposure technique, decreasing the sample to sensor distance. We demonstrate that this method reaches sub-10 μm resolution when placed directly upon the sensor. Additionally, we propose a nanoparticle-based shift variant scattering mask to help repropagate diffraction limited information to the detector for use in a computational reconstruction technique.

Bio: Kenneth Lang is a first year PhD student at the Wyant College of Optical Science. He has research interests in nano-photonics, metamaterials, and computational imaging. Kenneth is currently working on developing lens-free imaging systems and utilizing nanoparticle structures for computational image reconstruction methods.

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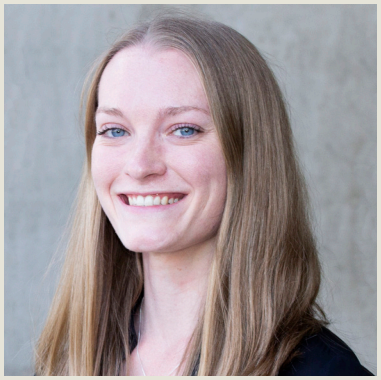

NATALIE SHULTZ, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: Euan McLeod

Tuesday, February 21, 2023 | 2:04 p.m.

Title: "Particle Population Analysis for Automated Assembly Using Optical Tweezers"

Abstract: The optical positioning and linking (OPAL) platform has enabled the assembly of complex 3D microstructures and augmentation of existing devices using optical tweezers and a biochemical linking mechanism. While the assembly process is currently semi-automated, a fully automated system would increase efficiency but requires knowing how many particles are trapped at any given time. The backscattered signal from trapped particles is characteristic of the particle size, material, and number of particles in the trap and can be analyzed using a quadrant photodiode (QPD). By applying principal component analysis and a support vector machine to processed data from the QPD, we show it is possible to classify the number of trapped particles for a given particle size and material. Incorporating this data collection and processing into the current assembly procedure will allow for particle population determination that can be used for automated assembly and increased throughput.

Bio: Natalie is a second year PhD student working in the Soft Nano-Photonics Systems Laboratory under Dr. Euan McLeod. The focus of her research is the design and assembly of microstructures using optical tweezers. Natalie earned her BS in optical engineering from the University of Arizona and was awarded the DoD NDSEG Fellowship. Her research interests include optical materials and understanding how light interacts with materials to create systems with novel properties.

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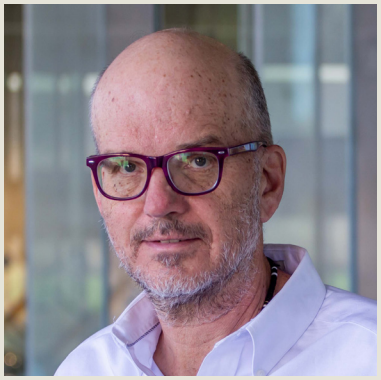

DAVID BRADY,
J.W. AND H.M. GOODMAN ENDOWED CHAIR IN OPTICAL SCIENCES
PROFESSOR OF OPTICAL SCIENCES

Tuesday, February 21, 2023 | 2:17 p.m.

Title: "Ptychographic Array Cameras for Synthetic Aperture Lidar"

Abstract: Under partially coherent illumination the structure of images changes with camera position. This effect can be used to coherently combine data from camera arrays for super-resolution and 3D imaging. This talk describes the theory of actively illuminated array cameras and presents recent experimental progress in implementing such systems.

Bio: David Brady is a graduate of Macalester College and Caltech. He was on the faculty at the University of Illinois and Duke University prior to joining the College of Optical Sciences in 2021. His work focuses on computational imaging and spectroscopy with a particular focus on the estimation of high-dimensional objects from low-dimensional measurements. At Duke Brady led the AWARE program to create the first terrestrial gigapixel cameras. His recent work focuses on camera arrays for extreme multidimensional imaging. Brady also has a long-standing interest in artificial neural networks ranging from his PH. D. thesis on optical networks to current work on real-time neural processing of large-scale array data.

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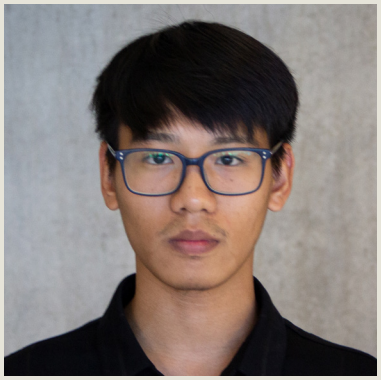

ZHIPENG DONG, PH.D. STUDENT

Wyant College of Optical Sciences
Advisor: David Brady

Tuesday, February 21, 2023 | 2:38 p.m.

Title: "Scatter Ptychography"

Abstract: Diffraction limits the minimum resolvable feature on remotely observed targets, and the resolution will be further reduced by scatter or turbulence. Here we demonstrate the analysis of scattered coherent illumination that can use to achieve a resolution proportional to the range between the scatter and the target and the diameter of the observed scatter. We present laboratory results demonstrating >30X and field experiment >10X improvement.

Bio: Zhipeng Dong received B.S. degrees in Optical science engineering and Mathematics from the University of Arizona in 2021. He is currently working toward a Ph.D. degree in Optical science with the College of Optical Science, at the University of Arizona. His research interests include computational imaging, imaging architecture development, and super-resolution.

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