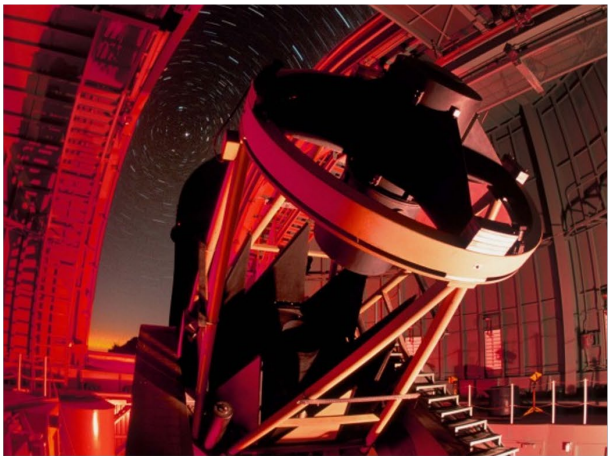
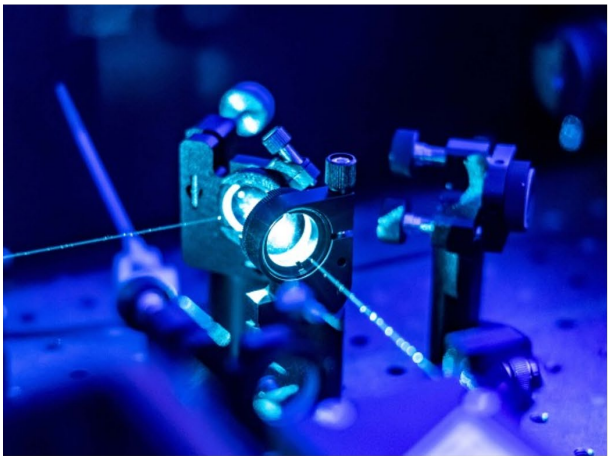
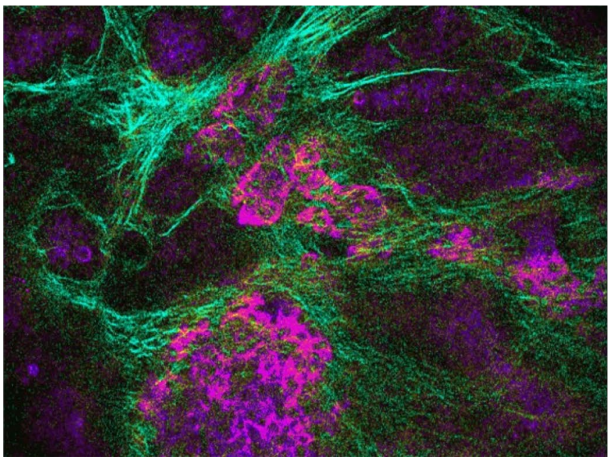
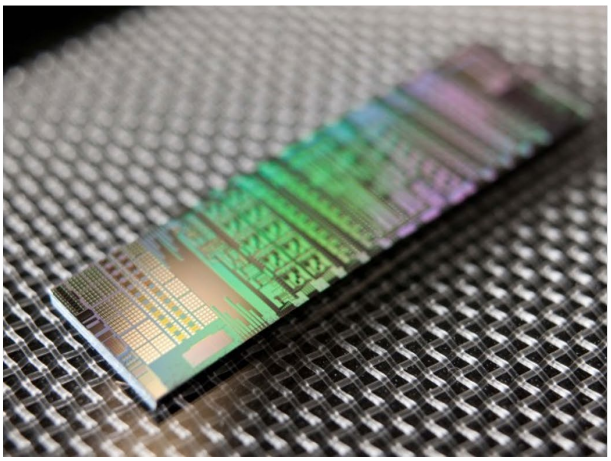
Optical Sciences Winter School And Workshop

Wyant College of Optical Sciences
University of Arizona
Tucson, Arizona
Jan. 7 - Jan. 10, 2025









Optical Sciences Winter School 2025

College of Optical Sciences Organizing Committee

Brandon Chalifoux
Lars Furenlid
Poul Jessen
Jason Jones
Dongkyun Kang
Daewook Kim
John Koshel
Channel Lemon
Masud Mansuripur

Special Thanks to Our Sponsors:

DeMund Foundation
Gretler Foundation
SPIE
Optica
State of Arizona Technology and Research Initiative Fund
James C. Wyant College of Optical Sciences

Schedule – Optical Sciences Winter School 2025

(All sessions at Optical Sciences building, Room 307)

Tuesday, Jan. 7, 2025

8:00	Breakfast	
8:45	Welcome	Prof. Daewook Kim
9:00	*Introduction to Photonics*	Dean Thomas Koch
10:00	Break	
10:20	*Quantum Nanophotonics*	Prof. Mohamed ElKabbash
10:50	*Ultra-sensitive, Selective, and Label-Free Optical Sensing for Fundamental Science, Environmental Monitoring, and Translational Medicine*	Prof. Judith Su
11:20	Break	
11:40	*Optics of Photography*	Prof. Lars Furenlid
12:10	Lunch (Optical Sciences building)	
1:30	*Introduction to Optical Physics*	Prof. Jason Jones
2:30	Lab tours	
4:00	*How to Measure Gravity by Holding Atoms*	Prof. Cris Panda
4:30	*A Brief Tour of Quantum Optomechanics*	Prof. Dalziel Wilson
5:00	Break	
6:00	Dinner (No Anchovies Restaurant)	

Wednesday, Jan. 8, 2025

8:00	Breakfast	
9:00	*Introduction to Optical Engineering*	Prof. Daewook Kim
10:00	Open labs and Richard F. Caris Mirror Lab tour	
11:20	Lunch (Optical Sciences Building)	
1:20	*In Vivo Confocal Endomicroscopy*	Prof. Dongkyun Kang
1:50	*Advanced Infrared Systems*	Prof. Ron Driggers
2:20	*Optics in virtual and augmented reality displays*	Prof. Hong Hua
2:50	Break	
3:10	*Introduction to Image Science*	Prof. Travis Sawyer
4:10	Break	
4:30	*Seeing the Invisible: How Light Reveals Metabolism in Single Cells*	Prof. Yeran Bai
5:00	*Machine Learning for Image Science*	Prof. Weimin Zhou
5:30	Break	
6:30	Dinner and Poster Session (Bear Down Gymnasium)	

Thursday, Jan. 9, 2025

8:00 Breakfast

8:30 Daewook Kim, University of Arizona
Welcome, Introduction to Optical Sciences at the UA

8:40 Session Chair: Jason Jones
Zach Newman and David Carlson, Octave Photonics
Star(tup) Trek: The Next Generation (of Photonics)

9:10 Cecile Carlson, University of Colorado
From Basements to Stratospheric Planes: Adventures in Optical Engineering

9:40 Break, Winter School photo

10:10 Session Chair: Khanh Kieu
Kyle Myers, Former U.S. Food and Drug Administration Official and SPIE representative
Image Science Applied to Medical Device Regulation: The Impact of an Optical Sciences Degree and an SPIE Community

10:40 Tom Hausken, Optica
The Future of Optics and Photonics

11:10 Panel: Cecile Carlson, Zach Newman, David Carlson, Laura Coyle, Kyle Myers, Tom Hausken

12:10 Lunch (Optical Sciences building)

1:10 Session Chair: Masud Mansuripur
Tom Brown, University of Rochester
Stress Engineering and Single Molecule Microscopy

1:40 Darren Hudson, University of Central Florida (CREOL)
High Power Lasers in Hollow-Core Fibers

2:10 Malvin Carl Teich, Boston University
LED Lighting

2:40 Break

3:10 Session Chair: John Koshel
Joe Shaw, Montana State University
Pretty colors in clouds related to lidar and polarization imaging

3:40 Glenn Boreman, University of North Carolina - Charlotte
Career Advice

4:10 Break

4:40 Session Chair: Dongkyun Kang
Brian Monacelli, NASA Jet Propulsion Laboratory
Optical alignment of the Roman Coronagraph Instrument

5:10 Laura Coyle, BAE Systems
Imaging Exo-Earths: Technology Development for NASA's Habitable Worlds Observatory

5:40 Break

6:10 Banquet (Cork and Craft) led by Dongkyun Kang

7:45 Session Chair: Dalziel Wilson (Flandrau Science Center and Planetarium)
Keynote: Garrett Cole, ThorLabs
Semiconductor Supermirrors: An Unexpected Spin-off of Fundamental Research

Friday, Jan. 10, 2025

8:00 Breakfast

9:00 Session Chair: Dongkyun Kang
Keynote: Elizabeth Hillman, Columbia University
High Speed 3D Microscopy of Living Things

10:00 Break

10:20 Session Chair: Poul Jessen
Susana Marcos, University of Rochester
Customizing vision correction with optical technologies

10:50 Bob Norwood, University of Arizona
The Science and Business of Infrared Optical Polymers

11:20 Brie Anderson, American University
Physics at a Liberal Arts College

11:50 John McCauley, University of Arizona
Frequency Comb Spectroscopy in the Deep Ultraviolet

12:20 Lunch (Optical Sciences)

1:20 Session Chair: Lars Furenlid
Jay Matthews, University of North Carolina - Charlotte
GeSn Thin Film Alloys on Si for Integrated Photonic Devices

1:50 Andrea Blanco, University of Central Florida (CREOL)
Topology: Quantum on the Edge

2:20 Poul Jessen, University of Arizona
Closing remarks

2:30 Break

3:15 Buses to outing (Optical Sciences)

5:00 Dinner and outing (Tohono Chul) led by Dongkyun Kang and Daewook Kim

Keynote abstracts – Optical Sciences Winter School 2024

Semiconductor Supermirrors: An Unexpected Spin-off of Fundamental Research

Dr. Garrett Cole
ThorLabs
Thursday, January 9th, 7:45 pm
Flandrau Planetarium

This presentation provides an overview of the commercialization of a novel optical coating technology, combining semiconductor materials and microfabrication techniques, yielding mirrors with ultralow optical and elastic losses. First demonstrated in 2013 as a derivative of foundational work in cavity optomechanics, substrate-transferred crystalline coatings, or "semiconductor supermirrors", now achieve optical losses below 5 ppm for near-IR wavelengths (1-1.6 μm) enabling a cavity finesse over 700,000. Their structural perfection reduces Brownian noise, crucial for precision measurement systems such as optical atomic clocks and gravitational wave detectors. Recent advancements include the demonstration of low-loss mirrors up to 20 cm in diameter and mid-infrared reflectors capable of a finesse over 400,000 at 4.5 μm, the latter promising significant improvements in the performance of trace gas analysis systems. In this presentation I will cover the underlying technology, as well as the supporting infrastructure, customers, collaborators, and funding agencies that facilitated the transition from academia to industry. These efforts enabled the founding and successful growth of Crystalline Mirror Solutions (CMS), a multinational photonics company focused on high-performance optics for laser-based precision measurement and manufacturing. CMS was acquired by Thorlabs Inc. in December 2019, marking the culmination of a decade of R&D and seven years of commercial operation.

High Speed 3D Microscopy of Living Things

Dr. Elizabeth Hillman
Professor of Biomedical Engineering and Radiology, Columbia University
Friday, January 10th, 9:00 am

Abstract forthcoming