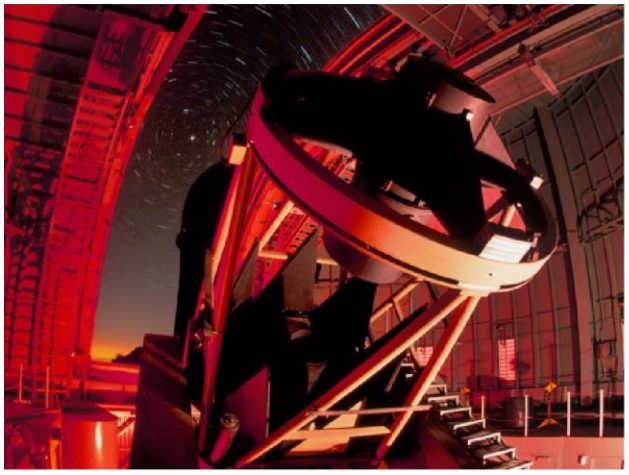
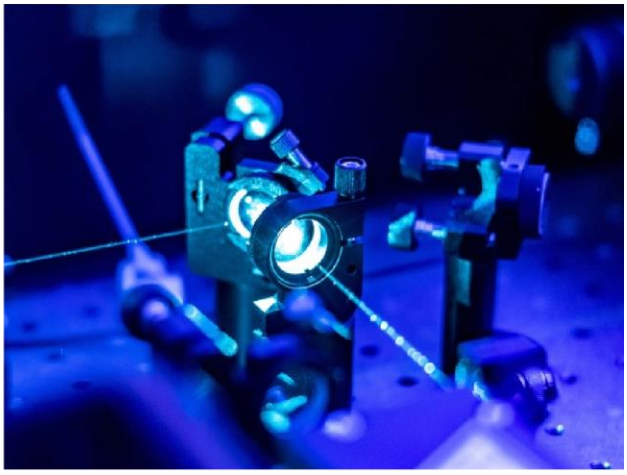
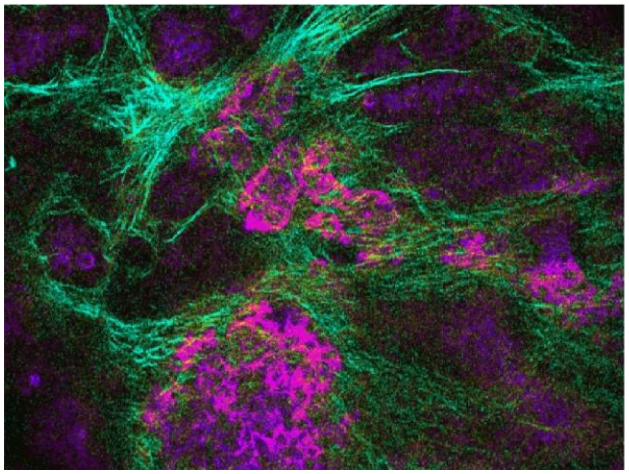
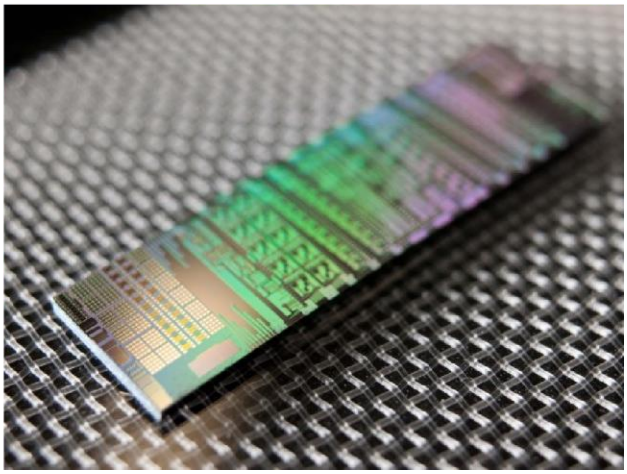
OPTICAL SCIENCES WINTER SCHOOL

Wyant College of Optical Sciences
University of Arizona
Tucson, Arizona
Jan. 3 - Jan. 6, 2024









Optical Sciences Winter School 2024

College of Optical Sciences Organizing Committee

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

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 2024

(All sessions at Optical Sciences building, Room 307)

Wednesday, Jan. 3, 2024

8:00	Breakfast	
8:45	Welcome	Prof. Euan McLeod
9:00	*Introduction to Optical Physics*	Prof. Jason Jones
10:00	Break	
10:20	*Atom-photon interactions*	Prof. Kanu Sinha
10:50	*Quantum optomechanics*	Prof. Dalziel Wilson
11:20	Break	
11:40	*Stress engineering and single molecule microscopy*	Prof. Thomas Brown
12:10	Lunch (Optical Sciences building)	
1:30	*Introduction to Optical Engineering*	Prof. Daewook Kim
2:30	Lab tours	
4:00	*Optical technologies for gravitational astrophysics and Earth sciences*	Prof. Felipe Guzmán
4:30	*Optical fabrication and alignment with ultrafast lasers*	Prof. Brandon Chalifoux
5:00	Break	
6:00	Dinner (No Anchovies)	

Thursday, Jan. 4, 2024

8:00	Breakfast	
9:00	*Introduction to Photonics*	Dean Thomas Koch
10:00	Break	
10:20	*Nanophotonics*	Prof. Euan McLeod
11:00	*Ultra-sensitive, selective, and label-free optical sensing for fundamental science, environmental monitoring, and translational medicine.*	Prof. Judith Su
11:40	Lunch (Optical Sciences building)	
1:00	*Introduction to Image Science*	Prof. Dongkyun Kang
2:00	Lab tours (including the Richard F. Caris Mirror Lab, ThorLabs Mobile Lab, and graduate program discussions)	
3:40	*Optics of photography*	Prof. Lars Furenlid
4:20	Break	
4:40	*Detecting biomedical signatures with snapshot multispectral imaging*	Prof. Travis Sawyer
5:20	Break	
6:30	Dinner and Poster Session (Bear Down Gymnasium)	

Friday, Jan. 5, 2024

8:00 Breakfast

8:30 Brandon Chalifoux, University of Arizona
Welcome, Introduction to Optical Sciences at the UA

8:40 **Keynote:** Amy Mainzer, University of Arizona
Finding and characterizing the asteroids and comets that get close to Earth

9:30 Break, Winter School photo

10:00 Session Chair: Travis Sawyer
Kyle Myers, Former U.S. Food and Drug Administration Official (SPIE representative)
Image science applied to medical device regulation: the impact of an Optical Sciences degree and an SPIE community

10:30 Greg Quarles, Applied Energetics (Optica representative)
Your path to Leadership: Navigating a dynamic career in optics and photonics

11:00 Panel discussion: K. Schwertz, K. Myers, C. Bradley, N. Lima, G. Quarles

12:00 Lunch (Optical Sciences building)

1:10 Session Chair: John Koshel
Ian Marsh, University of Arizona
Closed-loop RF magnetometry below the standard quantum limit with a collective spin ensemble

1:35 Glenn Boreman, University of North Carolina – Charlotte
Impedance modification of infrared antennas

2:00 Lab tours (including Richard F. Caris Mirror Lab, ThorLabs Mobile Lab, and graduate program discussions)

3:40 Session Chair: Poul Jessen
Jenny Magnes, Vassar College
Multi-channel measurements of C. elegans largest Lyapunov exponents using optical diffraction

4:05 Samir Bali, Miami University
Observation of stochastic resonance in directed propagation of cold atoms randomly diffusing in an optical lattice

4:30 Break

4:50 Session Chair: Masud Mansuripur
Joe Shaw, Montana State University
Smart photonic remote sensing systems

5:15 Christine Bradley, NASA Jet Propulsion Laboratory
Imaging spectrometer development for space-based applications

5:40 Break

6:00 Banquet (University of Arizona Sands' Club)

7:45 Session Chair: Lars Furenlid. (Flandrau Science Center and Planetarium)
Keynote: Sabrina Nagel, Lawrence Livermore National Laboratory
Fusion ignition in the laboratory and the role of diagnostics at the National Ignition Facility

Saturday, Jan. 6, 2024

8:00 Breakfast

9:00 Session Chair: Daewook Kim
Keynote: Marcia and George Rieke, University of Arizona
JWST: a triumph of engineering for science

10:00 Break

10:30 Session Chair: Brandon Chalifoux
Steve Eikenberry, University of Central Florida
Astrophotonics

10:55 Thomas Bifano, Boston University
MEMS deformable mirrors for optical wavefront control

11:20 Brian Monacelli, NASA Jet Propulsion Laboratory & Pasadena City College
Applications of spectroscopy at JPL from Earth to Mars

12:20 Lunch (Optical Sciences)

1:20 Session Chair: Jason Jones
Hong Hua, University of Arizona
Optics in virtual and augmented reality displays

1:45 Scott Sayres, Arizona State University
Gas phase optics

2:05 Brandon Chalifoux, University of Arizona
Closing remarks

2:15 Break

3:15 Buses to outing (Optical Sciences)

6:00 Dinner and outing (Tohono Chul)

Keynote abstracts – Optical Sciences Winter School 2024

Finding and Characterizing the Asteroids and Comets That Get Close to Earth

Dr. Amy Mainzer
Professor of Planetary Sciences, University of Arizona
Friday, January 5th, 8:40 am

Asteroids and comets impact the Earth infrequently, and they are not a daily concern compared to other natural hazards. However, we would like to understand the potential for a major impact to occur in the next century, and this question is best addressed by conducting thorough searches that can identify any object years to decades before any close approaches. NASA's Near-Earth Object Surveyor mission is designed to perform such a search using a thermal infrared imager instrument that can detect the objects as well as provide measurements of their effective size and potential impact energy. The mission will launch in late 2027 with a primary science objective of finding, cataloging, and characterizing the asteroids and comets that get closest to Earth.

Fusion ignition in the laboratory and the role of diagnostics at the National Ignition Facility

Dr. Sabrina Nagel
X-ray Measurement & Diagnostic Science Group Leader, Lawrence Livermore National Laboratory
Friday, January 5th, 7:45 pm

On December 5th, 2022, the National Ignition Facility (NIF) in Livermore, California, USA performed the first experiment demonstrating controlled fusion ignition in the laboratory. With a 2.05 MJ UV laser drive energy delivered to the target, a yield of 3.15 MJ was released by the fusion reactions in the capsule, providing a net target gain of ~1.5×. Part of that success has been facilitated by increasingly sophisticated x-ray and nuclear diagnostics making experimental observations that have continuously advanced our understanding, and guided experimental improvements in targets and laser drive. Here we present several examples of the impactful ways that diagnostics helped identify and highlight detrimental issues in implosions and describe how new or improved diagnostics capabilities and pursuing the resulting, sometimes unexpected, observations paved the way for the recent successes on the NIF. We will discuss the ignition result as well as the next steps for NIF and provide an outlook on future applications and technologies, including the reinvigorated pursuit of Inertial Fusion Energy.

James Webb Space Telescope: A triumph of Engineering for Science

Drs. Marcia Rieke and George Rieke
Regents' Professors of Astronomy, University of Arizona
Saturday, January 6th, 9:00 am

JWST is a triumph of high technology, engineering and management. The University of Arizona had central roles in two of its four instruments, as a continuation of our central role in infrared astronomy. We will review this history briefly, and show the importance of JWST in the context of astronomy overall. Some of the technical features of the telescope, NIRCam and MIRI will be described in depth. We will finish by showing off some of our favorite and spectacular science results.