NSF’s OIR Astronomy Lab

A New Vision for a National Center for Optical IR Astronomy

Patrick McCarthy
Director
Beth Willman
Deputy Director

AAAC Meeting - Jan 23, 2020
Enabling breakthrough discoveries in astrophysics with state-of-the-art ground-based observatories, data products and services for a diverse and inclusive community.
OIR Lab Domains

Kitt Peak and WIYN

Cerro Tololo and SOAR

Gemini North and South

Rubin Operations

Directorate

Discovering our Universe Together
Organizational Goals

- Promote diversity and inclusion in everything we do
- Provide state-of-the-art capabilities on the largest telescopes
  - Gemini adaptive optics and instruments
- Continue to lead in wide-field big-data OIR Astronomy
  - DECam, DESI, Rubin Observatory
- Be the US center for data intensive OIR Astronomy
  - Community Science and Data Center
- Build a world-leading time domain astronomy capability
  - Alert systems, event brokers
  - Rubin Observatory
Key Team Members

Lori Allen  
MSO

Bob Blum  
LSST Ops

Beth Willman  
Deputy Director

Jennifer Lotz  
Gemini Obs

Adam Bolton  
CSDC

John MacLean  
Center Operations

Michiel van der Hoeven  
Engineering

Lars Christensen  
Communications

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New Capabilities

• Revitalization of adaptive optics at the national center
  • Gemini North Multi-Conjugate Adaptive Optics
  • Upgrades to GeMS & GPI

• Stage IV Dark Energy Experiments
  • Dark Energy Spectroscopic Instrument
  • Rubin Observatory Legacy Survey of Space and Time

• Precision Radial Velocities
  • NEID at WIYN
  • MAROON-X at Gemini

• Data Intensive Astronomy & Astrophysics
  • Rubin Obs. Operations, with specialized Science Platform (2023)
  • Astro Data Lab & ANTARES
DESI@Mayall
Dark Energy Spectroscopic Instrument
P.I. Suvrath Mahadevan (Penn State)

NEID@WIYN

NEID is Tohono O’odham for “to see”

Illuminated science, sky, and calibration filters

Discovering our Universe Together
Towards an all-sky digital archive

Video Credit: R. Nikutta, K. Olsen, & Data Lab

Exposure time at 2-4m telescopes in NSF's OIR Lab Science Data Archive
Telecon with Elon Musk in December

*Committed to ensuring that Starlink does not inhibit our ability to study the universe*

Tony Tyson, Pat Seitzer, and others engaged in dialog with the SpaceX team

NSF has asked the OIR Lab to convene a discussion among experts and concerned parties (planning underway)

LSST is the most at-risk project – if we can mitigate the impact on LSST, everyone else is better
Light Pollution

Figure 12. Measurements of the sky brightness performed with SQC in Cerro Pachón.
What are we doing?

• OPCC – Office for the Projection of the Quality of the Skies of Northern Chile
  • Non-Profit charged with working with the government of Chile to address light pollution and related issues
• Foundation for the Chilean Skies
  • Works independently, but coordinated with, the OPCC
• Chilean Norms
  • Regulate lighting in regions near observatories
  • Not enforced as rigorously as desired
• OPCC working with local governments and lighting concessions
  • Replacing fixtures along the Pan American Highway
OIR Lab by the Numbers

- 12+ observing platforms with D \geq \sim 1 \text{ meter}
- 220 \text{ m}^2 \text{ collecting area} (1300 \text{ m}^2 \text{ with the ELTs})
- Full sky coverage with all aperture classes
- 30 instruments available in 2020
- 15-hour continuous time span
- Over 1,000 nights allocated in 2019
- Investigators from more than 300 institutions
- 5 Petabytes of archived data
- 800+ publications in 2019
What Does the OIR Lab Do For Your Science?

• Provide peer-reviewed access to a broad suite of capabilities
• Support state-of-the-art instrumentation
• Provide platforms for large surveys and experiments
• Serve data bases supported by modern Python-based software tools
• Provide User support tailored to user’s experience level and needs
• Open a path to growth & competitive capabilities for decades to come
Leadership in Big-Data Astronomy

From generation... … to analysis... … to follow-up