



W. M. KECK OBSERVATORY
Maunakea, Island of Hawai'i

Photo: Andrew Richard Hara

INVESTING IN THE FUTURE: 2024 INTERNSHIPS

Talented students take the lead

Each year, W. M. Keck Observatory participates in several internship programs and also invites individual interns with unique talents and backgrounds. Internships provide an opportunity for students to gain valuable hands-on experience, bridging the gap between academic learning and real-world application.

By participating in these programs, interns have a chance to work on the Observatory's latest projects, gaining practical skills and insights that may be difficult to acquire in a classroom setting. Internships also benefit the organizations that host them. Students bring fresh perspectives, innovative ideas, and the latest academic knowledge to their projects. This can lead to new approaches and solutions that might not have been considered otherwise. The experience provides an important stepping stone toward a successful career in the interns' chosen fields.



Mahalo to Keck Observatory staff that serve as mentors to the students, as these internships would not be a success without the knowledge and expertise they share. Mentors take the time to create a space where each individual intern has the space to grow and thrive. As a result, we are proud to be part of a community of bright and talented professionals within our network.

Investing in an internship is, therefore, an investment in the future of both the interns and the organizations they work with, ensuring continued innovation and progress in various fields.

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Keck Visiting Scholars Program

The Keck Visiting Scholars Program (KVSP) focuses on developing the next generation of instrument scientists and operators by providing an opportunity for scholars to participate in active instrument operations and real-time problem solving. Scholars help design both hardware and software for observational astronomy. Funds for KVSP help early career scientists (graduate students and postdoctoral students)

reside at Keck Observatory for a period of one to three months, working with resident astronomers and instrumentalists. The scholars bring unique talent and knowledge, enriching the pool of brilliant minds on campus. This is a rare opportunity to work with some of astronomy's most highly-regarded researchers at one of the world's most productive observatories on Earth. This program is generously supported by our Keck Family of Supporters.



SAM WALKER

Keck Visiting Scholar Sam Walker is a graduate student at the University of Hawai'i Institute for Astronomy. His research interest is in the direct imaging of exoplanets and protoplanetary disks. With Keck Observatory Head of Adaptive Optics Antonin Bouchez as his mentor, Sam worked on the Keck All-sky Precision Adaptive optics - Infrared (KAPA-IR) project to increase the sky coverage of the KAPA tomographic adaptive optics system. The current design of KAPA relies on the use of a relatively bright star at visible wavelengths for target acquisition, closing the near-IR tip-tilt loop, and low-bandwidth wavefront sensing. Shifting these functions to infrared wavelengths will enable fainter guide stars to be used. During his internship, Sam altered the target acquisition sequence to remove the reliance on optically bright targets and improved the performance of the TRICK (Tip-tilt Removal with Ir Compensation at Keck) infrared tip-tilt sensor's performance.



Akamai Internship Program

The Akamai Internship Program offers college students from Hawai'i an opportunity to gain real-world work experience at an observatory, company, or scientific/technical facility in Hawai'i. The program is open to a wide range of students who are pursuing science, technology, engineering, and mathematics (STEM) majors.

Keck Observatory staff welcomes Akamai interns for an 8-week summer program, during which the interns work on valuable and unique projects under the leadership of dedicated Keck Observatory mentors.

(Akamai interns, continued on next page...)



ANTHONY LAU

Anthony Lau is a graduate of the University of Hawai'i at Manoa with a Bachelor of Science in Computer Science. Keck Observatory operates several spectrographic instruments used to identify and classify celestial objects. To extract scientifically useful data from these instruments, users must process raw spectra, perform wavelength calibrations, and remove artifacts introduced by the atmosphere. Under the guidance of Keck Observatory Scientific Software Engineer Max Brodheim, Anthony's Akamai internship involved feeding real-time meteorological data into the data processing software for the Keck Cosmic Web Imager instrument to improve current atmospheric models and provide researchers with more accurate and precise data.



**CARINA
MCCARTNEY**

Carina McCartney is a fourth year Aerospace Engineering student at Colorado State University. With Keck Observatory Mechanical Engineer Jason Worden as her Akamai mentor, Carina designed structures that mount off-the-shelf components to build an optical alignment and measuring system. She modeled these components in CAD, created an assembly with them, then designed the mounting structures needed to attach everything together, adhering to project requirements. She analyzed the components using Finite Element Analysis and hand calculators to maximize stiffness. When the design was complete, Carina worked with Keck Observatory Mechanical Engineer Adam Vandenberg on fabricating and assembling the components to create a fully functional system.



TATUM UMIAMAKA

Tatum Umiamaka is in her fourth year at the University of Hawai'i at Manoa, majoring in Computer Science. She spent her Akamai internship working on the adaptive optics (AO) operations software for the High order All-sky Keck Adaptive optics (HAKA) deformable mirror upgrade. Under the guidance of Keck Observatory Adaptive Optics Postdoctoral Fellow Charlotte Guthery, Tatum rewrote the AO calibrations into a more modular python environment. She helped to test and deploy new calibration software that will be easy to update once the ALPAO deformable mirror is installed.



Scott Scholars Internship Program

The Scott Scholars Engineering Internship Program provides early career engineers from Colorado State University (CSU) and the University of Nebraska Omaha with experience in state-of-the-art astronomical instrumentation, adaptive optics, and telescope infrastructure projects. The program has been running at Keck Observatory for three years, hosting to date, a total of 10 scholars

who participated in either a summer or year-long internship. This program is generously supported by the Susanne and Walter Scott Foundation of Omaha. In addition, Keck Observatory sponsors and supports senior mechanical engineering design teams at CSU working on a variety of projects.



ANISHA KALLA

Scott Scholar Anisha Kalla is in her third year at Colorado State University, majoring in both Biomedical Engineering and Mechanical Engineering. Under the mentorship of Keck Observatory Optical Engineer Luke Gers, she worked on two projects. First, she analyzed the lens doublet bonding, and the testing of thermally mismatched glasses for future spectrograph camera designs. Anisha learned about glass fracture toughness and how effective flat plate theory is at predicting glass breaking. While the glass was thermal cycling, Anisha worked on a second project which involved the mechanical design of a spectral metrology test station for large optical surfaces such as primary, secondary, and tertiary telescope mirror segments.



AVA DE LA GARZA

Ava De La Garza is in her fourth year at the University of Nebraska at Omaha, majoring in both Computer Science and Spanish with a minor in Mathematics. During her Scott Scholars internship, Ava worked on two projects under the mentorship of Keck Observatory Scientific Software Engineers Max Brodheim, Jo Hayashi, and Tyler Coda. Ava developed back-end tools for a data reduction pipeline dashboard, effectively helping staff to monitor the status of automatic nightly data processing. Secondly, she developed a program to transfer historical radial post offset and segment coating data to a portable database and designed a system for the collection and storage of new segment data.

(Scott Scholars, continued on next page...)



JIMMIE NGUYEN

Jimmie Nguyen is in his fourth year at Colorado State University, majoring in Electrical Engineering. With Keck Observatory Electronics Engineer Ben McCarney as his Scott Scholars mentor, Jimmie designed test hardware and software for the various components of the Primary Mirror Active Control System (ACS) Upgrade Project. Ideally, this hardware will be used for validation of the production equipment and serve as a test and development bed for the hardware once the system is in operation.



TYLER ARCHER

Scott Scholar Tyler Archer is in his third year at Colorado State University, majoring in Mechanical Engineering. He created 3D scanned images of the Keck I Telescope secondary socket and the old f/25 secondary module. With Keck Observatory Mechanical Engineers Truman Wold and Joel Payne as his mentors, Tyler incorporated these 3D scans into interactive SolidWorks files. Instrument vendors will use these files to help design a deformable secondary mirror and a prime focus instrument.



Other Keck Observatory Interns



KA'ALA DEITCH

Ka'ala Deitch is in his fourth year at the University of Hawai'i at Mānoa, majoring in Mechanical Engineering and Hawaiian Language. He returned for a second summer internship with Keck Observatory's mechanical engineering team after spending the summer of 2023 as an Akamai intern. During his first internship, Ka'ala worked on a concept for a surface addition to improve the Keck II Telescope's M6 platform. Impressed by Ka'ala's work, Keck Observatory invited him back in the summer of 2024 to move his concept through the next stages and toward production. The platform will be used by several instrument projects that are underway.

(Other Keck Observatory Interns, continued on next page...)



COLE ODEGARD

Cole Odegard is in his fourth year at Carroll College in Helena, Montana, majoring in Software Engineering. As part of the Keck Observatory – Carroll College Data Sciences Internship, Cole worked under the mentorship of Keck Observatory Senior Software Engineer Shui Kwok on three projects integral to the Observatory’s operations: outside temperature prediction, importing star catalog data into databases, and improving exposure time calculators. Enhancing these three components ensures that astronomers can make the most of their observation sessions, leading to higher-quality data and more significant scientific results and discoveries.



JESSE CRANNEY

Jesse Cranney is a Postdoctoral Fellow with the Advanced Instrumentation and Technology Centre, Research School of Astronomy & Astrophysics at the Australian National University – a partner institution of Keck Observatory. He worked on the management and development of the Adaptive Optics control work-package for the Multi-Conjugate Adaptive Optics Visible Imager and Spectrograph (MAVIS) Instrument, destined later this decade for the European Southern Observatory’s Very Large Telescope. His main contribution to MAVIS is the design of its tomographic wavefront estimation and control schemes. Jesse also worked on benchmarking and testing the Keck All-sky Precision Adaptive Optics (KAPA) technology algorithms.



**LAUREN
HENDERSON**

Lauren Henderson is a third year graduate student in the Physics and Astronomy Department at the University of Notre Dame. Her work focuses on the evolution of dwarf galaxies around the Milky Way and how heavy elements are made in the universe. Lauren worked with Keck Observatory Staff Astronomer Carlos Alvarez to update the Flexure Compensation System (FCS) software on the Deep Extragalactic Imaging Multi-Object Spectrograph (DEIMOS) – an instrument that observes in visible light spectrum. She helped with preparations for the upcoming DEIMOS Throughput Upgrade that will be installed in the first half of 2025. As scientists observe a celestial object in the sky, DEIMOS rotates and flexes under its own weight, following the target of interest. The FCS corrects for these shifts throughout the night so that the spectra will stay aligned.



ABOUT W. M. KECK OBSERVATORY

The W. M. Keck Observatory telescopes are among the most scientifically productive on Earth. The two 10-meter optical/infrared telescopes atop Maunakea on the Island of Hawai'i feature a suite of advanced instruments including imagers, multi-object spectro-graphs, high-resolution spectrographs, integral-field spectrometers, and world-leading laser guide star adaptive optics systems. Some of the data presented herein were obtained at Keck Observatory, which is a private 501(c) 3 non-profit organization operated as a scientific partnership among the California Institute of Technology, the University of California, and the National Aeronautics and Space Administration. The Observatory was made possible by the generous financial support of the W. M. Keck Foundation. The authors wish to recognize and acknowledge the very significant cultural role and reverence that the summit of Maunakea has always had within the Native Hawaiian community. We are most fortunate to have the opportunity to conduct observations from this mountain.

