AKAMAI WORKFORCE INITIATIVE

2023 Akamai Internship Symposium Project Abstracts

This booklet includes the biographies and project abstracts for all of our 2023 Akamai interns:

Aug 4, 2023
W.M. Keck Observatory Headquarters, Waimea, Hawaiʻi Island

Aug 7, 2023
UH Hilo, Hawaiʻi Island

Aug 9, 2023
Pacific Disaster Center Training room, Kihei, Maui

Aug 14, 2023
University of California, Santa Cruz

Presenters at each symposium are listed in symposia programs

Akamai is led by the Institute for Scientist & Engineer Educators at the University of California Observatories in Santa Cruz CA, in partnership with the University of Hawaiʻi Institute for Astronomy (UH IfA) and University of Hawaiʻi at Hilo (UH Hilo).

2023 Akamai Internship Program

Akamai: smart, clever, expert, skill[1]

The Akamai Internship Program is a unique program that supports Hawai‘i college students in completing an authentic science or technology project in a professional setting. Students are prepared through an intensive one-week short course, followed by seven weeks at an observatory or industry setting where they complete a project under the guidance of a mentor. Throughout the entire eight-week program, interns complete a communication course that begins in the short course and continues through a series of meetings and intensive coaching sessions. The Akamai Internship Program uses a model designed by the Center for Adaptive Optics (CfAO), originally funded by the National Science Foundation (NSF) Science and Technology Center. The goals of the program are to address the technical workforce needs in Hawai‘i and advance students from diverse backgrounds into science, technology, engineering, and mathematics (STEM) careers. Interns receive college credit from UH Hilo.

2023 Host Organizations

Hilo, Hawai‘i Island

- Academia Sinica Institute of Astronomy and Astrophysics
- Gemini Observatory
- NASA Infrared Telescope Facility
- University of Hawai‘i Institute for Astronomy
- Subaru Telescope

Waimea, Hawai‘i Island

- W.M. Keck Observatory
- Canada-France-Hawai‘i Telescope

Kona, Hawai‘i Island

- Natural Energy Laboratory of Hawai‘i Authority
- Blue Ocean Barns

Kihei, Maui

- KBR
- Pacific Disaster Center
- Privateer Space

Pukalani, Maui

- Daniel K. Inouye Solar Telescope

Santa Cruz, California

- University of California Observatories

[1]As shown in wehewehe.org

AKAMAI WORKFORCE INITIATIVE

Akamai Team 2023

Akamai is led by the Institute for Scientist & Engineer Educators (ISEE) at University of California Observatories, in partnership with the University of Hawaiʻi Institute for Astronomy (UH IfA) and the University of Hawaiʻi at Hilo (UH Hilo). The following individuals were part of the 2023 Akamai team, and served in these roles:

Lisa Hunter UC Santa Cruz
Director, short course instructor, communication instructor

Jerome Shaw, UC Santa Cruz & UH IfA
Associate Director, short course instructor, communication instructor

Heather Kaluna, UH Hilo
Program Manager, short course instructor, communication co-lead instructor

Nicole Mattacola, UC Santa Cruz
Program & Event Coordinator

Mike Nassir, University of Hawaiʻi at Manoa
Short course instructor, communication co-lead instructor

Stacey Sueoka, Daniel K. Inouye Solar Telescope
Short course instructor, communication instructor

Austin Barnes, UC San Diego
Short course instructor, communication instructor

David Harrington, Daniel K. Inouye Solar Telescope
Short course instructor

Mahalo

The Akamai team appreciates all the ways that people and organizations contribute to making Akamai a success. We extend a special mahalo to the following individuals who contributed to mentoring, fundraising, teaching, advising, coordinating logistics, and advocating for the program in many ways in 2023.

Akamai Mentor Council
Peter Konohia (Akimeka), Renate Kupke (UCO), Ivan Look (CFHT), Luke McCay (IfA), Chriselle Nagata (DKIST/NSO), Lucio Ramos (Subaru), Marianne Takamiya (UH Hilo), Laura Ulibarri (KBR), Truman Wold (W.M. Keck).

Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
Derek Kubo, Momi Jeschke, and Geoff Bower.

Blue Ocean Barns
Caroline Harmon, Hanna Resetarits, and Cole Bolton.

Canada-France-Hawaii Telescope (CFHT)
Greg Barrick, Mary Beth Laychak, Marc Baril, Tom Vermeulen, and Raycen Wong.

Daniel K. Inouye Solar Telescope (DKIST)
David Harrington, Stacey Sueoka, Andre Fehlmann, Gary Foster, Stephanie Guzman, James Hoag, Heather Marshall, Brialyn Onodera, Thomas Rimmele, Tom Schad, Sebastien Poupar, James Hoag, Paul Jeffers, Sarah Jaeggli, and Lucas Tarr.

Gemini Observatory
Andy Adamson, Chas Cavedoni, Emanuele Paolo Farina, Emma Kurz, Jennifer Lotz, Clara Martinez-Vazquez, Ross Megargel, Ricardo Salinas, Logan Sato, Anthony Sylvester, and Hawi Stecher.

University of Hawaiʻi Institute for Astronomy
J.D. Armstrong, Christoph Baranec, Mark Chun, Johanna Estrella, Haosheng Lin, Luke McKay, Garry Nitta, James Ou, and Doug Simons.

NASA Infrared Telescope Facility
Mike Connelley, and John Rayner.

KBR
Randy Goebbert, Kurt Matillano, Dylan Schwarzmeier, James Cobb, and Laura Ulibarri.

Natural Energy Laboratory of Hawaii Authority (NELHA)
Keith Olson, and Dean Towle.

Pacific Disaster Center (PDC)
Brian Leeper, Cassie Stelow, and Marta Zaleski.

Privateer
Matthew Lugo, Shaantam Chawla, and Joel Walsh.

Subaru Telescope
Olivier Guyon, Kody Haleamau Rubio, Eric Jeschke, Russell Kackley, Michael Lemmen, Lucio Ramos, and Kiaina Schubert.

University of California Observatories (UCO)
Daren Dillon, Phil Hinz, Renate Kupke, Bruce Macintosh, Christopher Ratliff, Connie Rockosi, Maureen Savage, and Kyle Westfall.

W. M. Keck Observatory
Laurie Edmondson, Chien-Hsiu Lee, Craig Nance, Hilton Lewis, Rich Matsuda, Jeannette Mundon, Joel Payne, Shelly Pelfrey, Kevin Tsuboda, and Truman Wold.

University of Hawaiʻi Maui College
Jung Park.

University of Hawaiʻi at Hilo
Kathy Cooksey, Bonnie Irwin,Marianne Takamiya, and William Walters

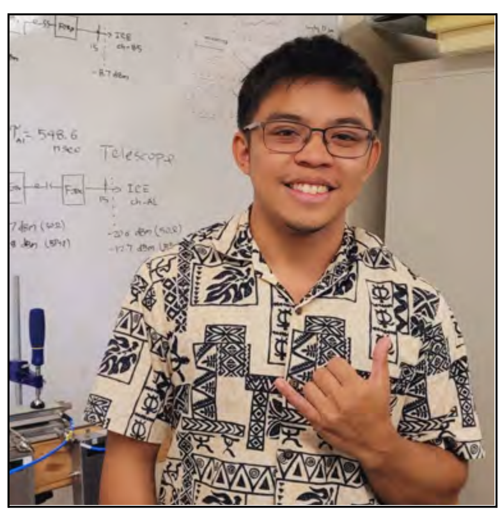
Anthony Angelo Apilado
University of Hawaiʻi at Mānoa

Site: Academia Sinica Institute of Astronomy & Astrophysics, Hilo, HI
Mentor: Derek Kubo, Momi Jeschke & Geoff Bower

Designing an Algorithm to Cancel LTE Interference Signals in Fast Radio Burst Data

The Academia Sinica Institute of Astronomy & Astrophysics (ASIAA) has been working on building a radio telescope array in Pahala. The Hawaii outrigger is a new addition to a joint international astronomical effort to collect data on Fast Radio Bursts (FRBs). FRBs are radio pulses ranging in length from a fraction of a millisecond to 3 seconds. FRBs are quite significant because they can produce the energy equivalent to the sun's annual output in a single short burst. It is still unknown what causes FRBs to occur; one common hypothesis is that FRBs are the result of neutron stars collapsing, while another is that the FRBs are caused by magnetars (neutron stars with extremely strong magnetic fields). Thus, the goals of the new Pahala array are to receive and collect astronomical radio data, identify FRBs, and ultimately attempt to localize the origin of the bursts. However, an obstacle at the Pahala site is significant LTE radio interference from cellular towers spanning approximately 730–770 MHz, which lies within the 400–800 MHz bandwidth used for capturing FRBs. The purpose of this project is to design an algorithm that will create a signal equal in amplitude to the interference signal but with opposite phase, so as to cancel out the LTE interference. This anti-signal will suppress the interference so that FRBs will become distinguishable within the telescope data. The algorithm was written in Matlab, utilizing a cross-correlation function to determine the delay between the telescope signal and the reference signal (replicating an antenna pointed directly at the LTE transmitter). The algorithm then scales the LTE signal and removes it from the telescope signal, leaving only the FRB signal. Testing the algorithm on Matlab Gaussian Noise generated data achieved 99.6% success, or 24 dB of suppression, which is sufficient but shy of the goal of 30-dB suppression.

Anthony is a senior at the University of Hawaii at Manoa, completing his bachelor's in Electrical Engineering with a focus on the electro-physics track. He was born in the Philippines, but grew up in Waipahu, Hawaii. He aims to become an electrical engineer where he can work on antennas and radio-frequency devices. In his free time he enjoys powerlifting.



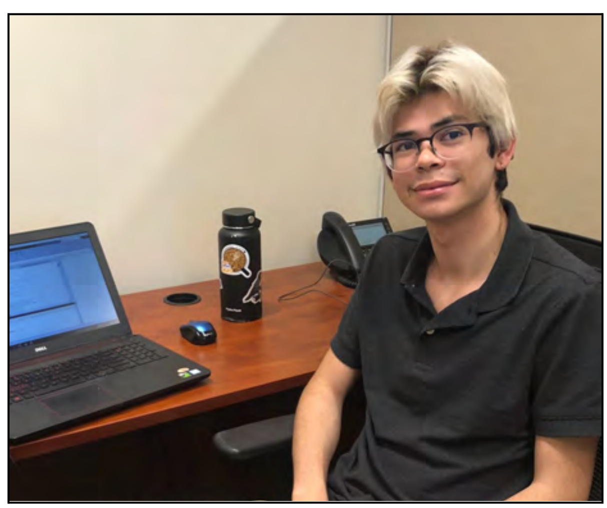
Liam Caldwell
Arizona State University

Site: Daniel K. Inouye Solar Telescope, Pukalani, HI
Mentors: Brialyn Onodera & Sebastien Poupar

Improving Vibration Data-Collection and Analysis Processes at DKIST

Telescopes are extremely sensitive instruments that require a high degree of positional precision in order to form high-resolution images. Thus, vibrations, both from internal and external sources, are often a major source of telescope image degradation and greatly affect the quality of outputted data. At the Daniel K. Inouye Solar Telescope (DKIST), the opto-mechanical group utilizes a rigorous tracking and analysis process to detect and minimize sources of vibration. However, within the current system, vibration is primarily measured at fixed accelerometer sites, and the general scripts lack a degree of intuitivity that prevents DKIST staff outside of the engineering group from accessing and digesting the accelerometer data. In order to support the scientists and engineers who use the data collected by the telescope, the current MATLAB routines have been improved for broader data collection and comparison, and the processes and results are standardized to create a more user-friendly and accessible database. Furthermore, a MATLAB routine to incorporate PicoScope acceleration readings into the current data analysis process has been developed, and the newly assimilated PicoScope will be used to troubleshoot various sources of vibration within the telescope, functioning as a mobile accelerometer. Overall, we accomplished our goals to streamline both the data collection and analysis process for sources of vibration and to integrate a portable method of data collection via the PicoScope, ultimately improving the opto-mechanical team's ability to diagnose and treat problematic sources of vibration.

Liam Caldwell was born and raised in Wailuku, Maui. Currently, he attends Arizona State University, where he is studying Mechanical Engineering with a concentration in Energy and the Environment. He is heavily involved with the Society of Engineers at school, serving in club leadership and participating in competitions and conferences at a national level. In his free time, Liam enjoys hiking and skateboarding.



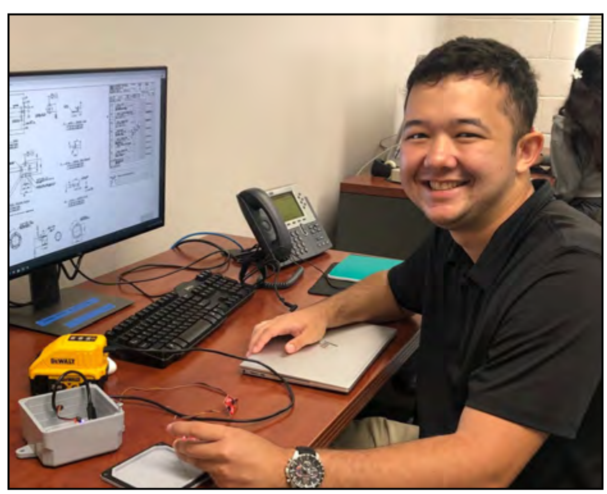
Micah Chang
University of Hawaiʻi at Mānoa

Site: Gemini Observatory, Hilo, HI
Mentor: Ross Megargel & Chas Cavedoni

Development and Prototyping of Gemini North's Lateral Guide Roller Monitoring System

The Gemini North telescope is currently testing their dome rotation system because of repeated failures in the Lateral Guide Roller (LGR) system. The LGR system utilizes bearings to guide the bogie system, which supports the weight of the dome along the dome track. The failure of the LGR has led to constant repairs of the dome rotation system as well as lost operation time. The dome rotation system is difficult to monitor as the majority of the system is enclosed by insulation materials, thus a sensor system was needed to reliably monitor both the LGR and the bogie system. A sensor package was developed and modeled using Autodesk Inventor to design housings and mounting points for the sensor package. A prototype sensor system was manufactured utilizing available equipment at Gemini North's facilities and locally sourced hardware excluding the sensor components. The sensor package included an accelerometer and a distance sensor to record displacement of the bogie as well as the LGR location in relation to the bogie. This process was redeveloped thoroughly, inevitably resulting in the conclusion that the available sensors were inadequate to collect accurate data due to unexpected noise. However, the accelerometer demonstrated the capability to determine unexpected vertical movement; this will be useful in the future to monitor the movement of the leaf springs, which will have a direct correlation to the LGR failure. Additionally, CAD models were created for the redesign of the LGR with the intent to make the LGR arms easier to repair and without the need to remove the entire LGR assembly. The redesign of the LGR also incorporated finite analysis and a cost analysis that were used together to determine which prototype would be the most effective. Overall, the bogie system will be better monitored and maintained in the future.

Micah Chang was born in Hilo, Hawaii, where he graduated from Waiakea High School and went on to begin college at the University of Hawaii at Hilo. Currently he is pursuing a bachelor's degree in Mechanical Engineering at the University of Hawaii at Manoa. During college, he has found a passion for design and has joined a robotics club competing in the University Rover Challenge. He is excited to gain more hands-on engineering experience and explore different career opportunities. In his free time, Micah enjoys camping, fishing, and BBQing with friends and family.



Noah Chung
Harvard College

Site: Canada-France-Hawai‘i Telescope, Waimea HI
Mentors: Marc Baril & Tom Vermeulen

Developing a Real-Time Status Webpage for the Maunakea Atmospheric Monitor

Operated by the Canada-France-Hawaii Telescope, the Maunakea Atmospheric Monitor (MKAM) is a robotic, tower-mounted telescope that is used to provide a best-case estimate of the atmospheric "seeing" on Maunakea. Previously, monitoring of the operational state of MKAM by remote observers and technical staff was complicated and time-consuming, and the available status data were refreshed on its webpage only once per minute. This project addresses these issues with the implementation of a webpage that pulls and displays formatted data from the status server at a frequency of 0.5 Hz. HTML, CSS, Javascript, and a company-internal language were used to build upon existing software and create the webpage. The webpage facilitates the access of real-time MKAM data by remote observers, allowing simpler atmospheric analysis and faster telescope adjustment.

Noah was born and raised in Honolulu, where he graduated from Punahou School in 2022. He is currently attending Harvard College as a freshman. He has not decided his major, but he is currently interested in Computer Science, Physics, and Math. He would like to work in a STEM field when he graduates. He enjoys food and traveling, and in his free time, he likes to read, play video games, and watch baseball.

Catherine Cornella
University of Hawaiʻi at Hilo

Site: UH Institute for Astronomy, Hilo, HI
Mentor: Mark Chun & Luke McKay

Decoding Ground-level Chaos: Exploring Meteorological, Environmental, and AIRFLOW Data to Identify Key Causes of Ground-level Optical Turbulence

Image quality of ground-based telescopes such as the University of Hawaiʻi 2.2-meter telescope (UH 2.2m) is hindered by optical turbulence, much like how heat haze on a road distorts one's view. This type of turbulence is caused by mechanical energy in conjunction with temperature variations. This project took the first step in quantifying the effects of environmental conditions on optical turbulence inside the dome of the UH 2.2m. We used AIRFLOW (Airborne Interferometric Recombiner - Fluctuations of Light at Optical Wavelengths) sensors to sample optical turbulence at various locations within the dome by projecting a light pattern across a distance of 100 mm. The aim of this project is to use this sensor data, along with meteorological data from the summit weather station, and dome environment data from the engineering databases to perform a preliminary analysis aimed at identifying key problems and significant contributors to the dome's optical turbulence. Since our AIRFLOW sensors record data every 5 minutes, while the meteorological data is recorded every minute, the first stage of this work involved the creation and synchronization of the datasets from each of the relevant sources. The second stage focused on analyzing the data for major factors within the resulting datasets. This data will help determine new locations for the sensors, which will be moved at some point to monitor areas of more interest as indicated by the initial analysis. The data from the new locations will also be incorporated into the analysis as additional datasets.

Catherine is from Hilo, born and raised, homeschooled until 16, then began attending HCC as a dual-credit enrollment student, transferred to UH at 17. She has been working on a Bachelors of Computer Science at University of Hawaii at Hilo since, aiming to graduate in Spring of 2024. If she's able to find a suitable job, she'd like to go for her master's in CS, but doesn't have much interest in anything further except for teaching purposes. She can usually be found in the computer lab working on homework or playing games, and a good book will hold her attention for hours.

Kaʻala Deitch
University of Hawaiʻi at Mānoa

Site: W. M. Keck Observatory, Waimea HI
Mentors: Truman Wold & Joel Payne

Project Kahua: Design and Analysis of a New Work Platform in the Keck-2 Azimuth Cable Wrap Area

In 2019, the Safety and Hazard Reduction project (SHR) at W.M. Keck Observatory was appointed and placed at high priority in order to identify and resolve any potential workplace hazards. During the SHR audit, one potentially insufficient area discovered was a walking platform located above the azimuth cable wrap under the Keck-2 secondary mirror. The purpose of this platform is to allow access to an instrument housing unit known as the "dog house" and the cables located beside it. However, when the area was inspected, the platform was observed to be oriented in an abnormal manner, sitting directly on the cables and cable tray, which posed some concerns for its continuous use. As a cautionary measure, the platform was removed and the area has remained inaccessible. In order to regain access to the work area, a new platform needed to be designed and installed. To assist with design and abide by OSHA regulations, a 3D model of the area was created and analyzed using SolidWorks and Finite Element Analysis (FEA). Output from the FEA showed that the platform did not meet the allowable stress requirement under worst foreseeable use case conditions. In reviewing these FEA results with the Mechanical Engineering team, we decided to explore two options: to add additional support to the areas experiencing the most stress, or to design something that shifts the required load off of the concerning areas. Due to the difficulty of installation, along with spatial and locational constraints, the latter was pursued. Finally, a report was compiled that documents the analyses, concept designs, and evaluation of three proposed design solutions for regaining access to the work area.

Kaʻala was born and raised on the Big Island of Hawaiʻi where he graduated from Ke Kula ʻO Nāwahīokalaniʻōpuʻu. He is currently pursuing a B.S. in Mechanical Engineering and a Minor in Hawaiian Language at the University of Hawaii at Manoa. Aspiring to a career in mechanical design and manufacturing, Kaʻala plans to engage in projects that can improve his understanding of the engineering design process. In his spare time, he enjoys playing volleyball and going to the gym. Ka'ala has also recently picked up welding to expand his knowledge of assembly in order to improve his designs.

Cassidy Denault
Seattle University

Site: Pacific Disaster Center, Kīhei, HI
Mentors: Brian Leeper & Cassie Stelow

Automating Regression Testing for Pacific Disaster Center Mobile Applications

Pacific Disaster Center's (PDC) mobile application, Disaster Alert, is a free public platform notifying and informing users of current natural disasters and other potential safety threats. Like most apps, Disaster Alert follows the Software Development Life Cycle (SDLC), a structured process designed to increase quality and improve functionality of applications and software. Before each release, rigorous regression testing is essential to ensure that changes to the software code do not adversely impact existing functionalities. Much of the process of manually testing each new app version on an array of individual physical devices can be automated using software that virtually simulates a range of mobile devices and OS versions. This regression testing can be automated by test scripts that interact with the app, mimicking human interactions. These emulators automatically test incremental changes to the code against a wide range of user platforms. Software development and test automation framework tools were used to develop a functional automation test suite for Disaster Alert. Research was done to select these tools and ensure reliability and scalability of the test suite. Android Studio along with Xcode were utilized to create emulators and simulators on which the tests were run. Popular test automation libraries Robot Framework and Appium Library were used to write the desired test cases. Documentation detailing test environment requirements and setup, test structure, maintenance, and possible future enhancements was also produced. The developed test suite interacts with primary functions and provides a straightforward path to adding more exhaustive cases. The automated regression test suite also consistently produced repeatable results, enabling efficient identification of defects. Automating repetitive tasks facilitates quicker feedback on code changes, enables faster iterations and provides a strong foundation for ongoing software maintenance and updates. As Disaster Alert continues to evolve, the test suite can be updated to accommodate new features and functionalities.

Cassidy was born and raised in Hilo, Hawai'i and graduated from Waiakea High School. She is currently pursuing a degree in Computer Science and a minor in Data Science from Seattle University in Seattle, Washington toward the goal of working in the fields of web development, human computer interaction, and data science. Cassidy also works as a grader for the Seattle University Computer Science department and as a social media manager for multiple campus organizations. Outside of school, Cassidy enjoys hiking, photography, drawing, and learning new sports.

Rielyn Domingo
Gonzaga University

Site: Daniel K. Inouye Solar Telescope, Pukalani, HI
Mentors: Stephanie Guzman & Heather Marshall

Comparative Analysis of Maintenance Management Systems

A Computerized Maintenance Management System (CMMS) helps to enhance maintenance strategy through increasing the incorporation of assets or equipment into a preventive maintenance plan, and gathering relevant data to identify the occurrence and duration of component failures, as well as the impact of failure-induced downtimes on observing cadence. This tool helps companies to achieve a more mature maintenance strategy that encompasses centralized access and linkage of maintenance information, including equipment history, work orders, scheduled maintenance, inventory, and inspections. The staff of the Daniel K. Inouye Solar Telescope (DKIST), situated on Haleakala, Maui, are in the process of deciding if their maintenance management system will run from Hippo or Eptura. Currently, the maintenance approach leans towards reactivity, with a reliance on demand work-orders, and a lack of centralized recording for repairs and inspections. DKIST endeavors to transition towards a proactive and integrated maintenance approach. To determine whether to continue using Hippo or switch to Eptura, I have constructed a trade study involving the management systems Hippo, Eptura Core, and Eptura Advanced. Metrics were created based on the needs of DKIST, added capabilities provided by Eptura Core and Eptura Advanced, and risks associated with migrating to a new tool. This study involved gathering the importance of criteria through a survey distributed to the staff of DKIST. By comparing the collected data and creating a scoring system, DKIST will be able to make an informed decision regarding whether to retain Hippo or migrate to Eptura as their maintenance management system.

Rielyn Domingo was born and raised on the island Maui of Hawaii. He graduated from King Kekaulike High School and currently pursuing a bachelor's degree in Mechanical Engineering at Gonzaga University. After completing his bachelor's, he may pursue a master's degree or go straight into the industry of mechanical engineering. His hobbies include pickleball and movies.

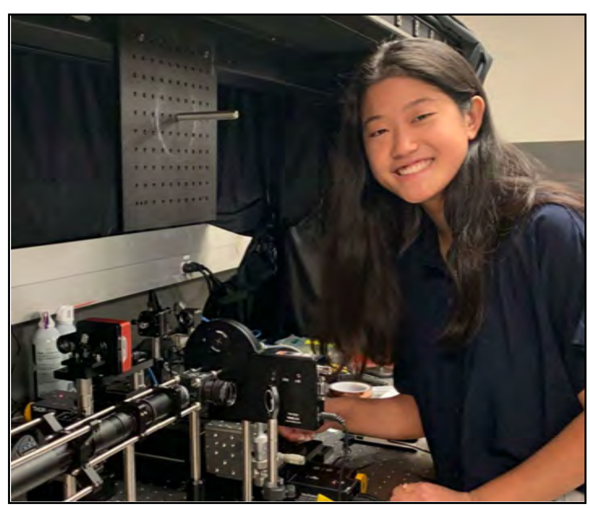
Kiana Ejercito
University of Hawaiʻi at Mānoa

Site: University of California Observatories, Santa Cruz, CA
Mentor: Kyle Westfall

Fiber-Optic Performance Requirements for Keck's FOBOS Instrument

The Fiber-Optic Broadband Optical Spectrograph (FOBOS) is a novel spectrograph in development for the Keck II Telescope at the W.M. Keck Observatory on Maunakea. FOBOS will deploy thousands of optical fibers to convey light collected at the telescope focal plane to a set of spectrographs. Currently, most astronomical instruments use fibers with a numerical aperture (NA) of 0.22 that outputs a fast beam, requiring the optical system to be larger and more expensive to capture the output light. FOBOS thus aims to use fibers with a smaller NA to produce a slower beam, reducing the cost of the spectrographs. However, low-NA fibers are expected to be more susceptible to throughput losses. In this project, we use a test bench to determine performance requirements needed for potential integration into the FOBOS design. First, we test our optical setup by measuring output focal ratio, throughput, and focal-ratio degradation (FRD) to measure the performance of standard fibers. These tests were performed using fibers similar to those used by the Dark Energy Spectroscopic Instrument (DESI), which are multi-mode mode fibers with 107-μm cores and NA = 0.22. Second, we analyze the output focal ratio, throughput, and FRD of fibers with 200-μm cores and NA = 0.12, then compare the throughput when stress is applied to determine throughput loss. This comparison allows us to determine if using fibers with a smaller NA will be feasible for FOBOS. Future work will focus on measuring fiber-to-fiber performance variations to develop acceptance testing protocols to meet FOBOS's strict calibration requirements.

Kiana Ejercito is from the island of Oahu. She graduated Kalani High School and currently attends the University of Hawaii at Manoa pursuing a Bachelor of Science in Astrophysics. Kiana is passionate about outreach and volunteers for events such as the Science Olympiad and events run by the Institute for Astronomy. In the future, she hopes to continue research and inspire others to become interested in science. In her free time, she enjoys reading and listening to music.



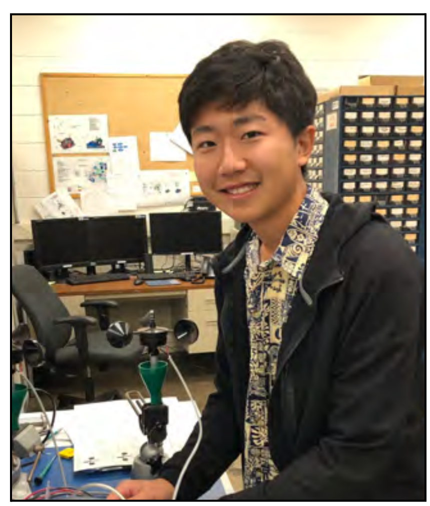
Matthew Fujioka
University of Hawaiʻi at Mānoa

Site: W. M. Keck Observatory, Waimea, HI
Mentors: Craig Nance & Kevin Tsubota

An Analysis of Energy Usage and Reduction Strategies for Selected Keck Observatory Facilities

The W. M. Keck Observatory (WMKO) aspires to be a leader in green energy initiatives in the astronomical community. WMKO's carbon emissions are divided into three categories: Scope 1 are direct carbon emissions, Scope 2 are indirect carbon emissions focused on electricity consumption, and Scope 3 are indirect carbon emissions focused on air travel. This project studied Scope 2, beginning with the summit facility's electricity usage, which equates to $1M and 1600 tons of carbon dioxide equivalent (tCO2e) annually. Through analysis of 3 years of Hawaii Electric Light Co. (HELCO) billing and other data, a report was compiled and provided to observatory leadership, concluding that recent cost increases are due to the escalating price per kilowatt-hour (kWh) rather than greater usage. The report modeled HELCO's plan to put all customers, including WMKO, on a Time of Use (ToU) schedule that would charge an increased rate at night when the facility consumes the greatest amount of electricity. The analysis concludes that electrical costs will only increase by 10%. This report led to a change in strategy to focus purely on energy reductions and not load shifting. We identified the observatory dome exhaust fans as an ideal candidate for energy reduction: the fans are the largest single loads at the observatory, rated at 100 hp. Our report recommends running the fans less often, as opposed to upgrading with more energy-efficient motors. To fully understand the use of the fans, anemometers were installed in the exhaust wind tunnels to measure the flow rate. In addition, the performance of the photovoltaic system was analyzed to determine the return-on-investment and percentage of savings.

Matthew Fujioka is from Oahu, where he graduated from President Theodore Roosevelt High School in 2022. He is in his first year at the University of Hawaii at Manoa, majoring in a Bachelor of Science in Mechanical Engineering. Matthew is currently the financial officer of the UH Drone Technologies Lab, a member of the Native Hawaiian Science Engineering Mentorship Program, and a member of the Manoa Scholar's Club. In his free time, Matthew enjoys playing tennis and participating in programs to help teach young students about engineering concepts. Matthew hopes to expand his knowledge and experience in mechanical engineering and its impactful applications.



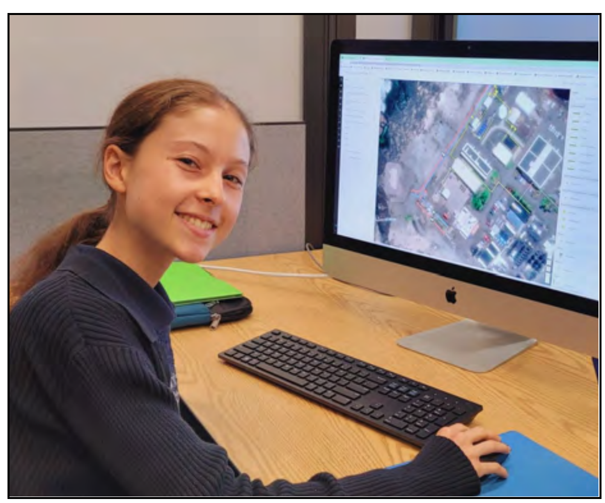
Camry Gach
Dartmouth College

Site: Natural Energy Laboratory of Hawaii Authority, Kona, HI
Mentors: Keith Olson & Dean Towle

Incorporating Geolocation and an Inventory Database into Seawater Distribution System Topology Maps

The Hawaii Ocean Science and Technology (HOST) Park supplies an extensive amount of seawater through its distribution system, serving customers such as aquaculture farms, Ocean Thermal Energy Conversion (OTEC) laboratories, and aquatic species habitats. A full-facility, geospatial distribution map of the pipeline was needed so that the Natural Energy Laboratory of Hawaii Authority (NELHA) can strategically plan scheduled maintenance shutdowns that minimize interruption to surrounding clients. Identifying pipeline features geospatially also enhances NELHA's organization of instrument inventory and improves communication between operations staff when performing repairs. This map was created using ArcGIS software, incorporating data from existing maps in addition to geographic coordinates and pipeline elevations collected by a previous NELHA intern, Daniel Gregg, using a Global Navigation Satellite Receiver. The selected data structure enables users to query the map's database related to instrument inventory in need of repairs, different water line systems, and main vs. lateral lines. Using ArcGIS's Experience Builder interface, various filtered maps appear on a single webpage to simplify user navigation. Balancing ease-of-use for operations field workers, the maintenance crew, and program developers was a key consideration in justifying data storage methods and map design. This map is expected to aid in the scheduled repair planning process and monitoring pipeline conditions throughout the HOST Park.

Camry Gach is from Maui, Hawaii. She attends Dartmouth College as a first-year undergraduate student and intends to earn a degree in environmental engineering. She is passionate about applying her knowledge in STEM and environmental studies to create designs that work towards sustainable development goals. Her high school engineering project involved tracking the sun with a mirror throughout the day to maximize its reflection onto a solar panel. At NELHA, Camry looks forward to gaining on-site experience in water resource management and learning to analyze hydraulic systems using engineering software tools. In her free time, Camry enjoys snorkeling, dancing, and exploring the outdoors.



Taryn Godfrey
University of Hawaiʻi at Hilo

Site: Blue Ocean Barns, Kona, HI
Mentor: Hannah Resetarits

Evaluating Mitigation Methods for Non-Target Species Growth in Methanogenesis-Inhibiting Algae Cultures

Methane is one of the main atmospheric greenhouse gasses known to drive global climate change. To help reduce the agricultural production of methane, Blue Ocean Barns in Kailua-Kona produces *Asparagopsis taxiformis,* a species of red algae, as a food additive for ruminant livestock, such as cattle. Although many red algae produce bromoform, *A. taxiformis* is special for its ability to store bromoform in a “gland cell,” giving *A. taxiformis* the ability to store high concentrations of bromoform within its tissue. The bromoform is released when the algae is dried, and when *A. taxiformis* is added as a supplement to livestock feed, methane emissions from ruminant livestock are reduced by up to 90%. However, a common problem that arises during the cultivation of seaweed cultures is the unwanted growth of *Ulva*, a genus of green macroalgae that live in intertidal areas with a freshwater intrusion. *Ulva* have the ability to adapt to multiple different environments, which makes them difficult species to control or remove. This project investigated multiple potential methods to mitigate the growth of *Ulva* while minimizing harm to the surrounding *A. taxiformis*: exposure to varying concentrations and durations of bleach or salinity, long periods of air exposure, mechanical break-up of material, and depriving algae of nutrients. Culture health was monitored by measuring before-and-after weights in flask experiments, surface-area growth in well-plate experiments, nutrient levels, daily pH-level readings, and daily qualitative observations. Experimental outcomes and recommendations for the most effective *Ulva* mitigation strategies will be presented.

Taryn Godfrey was raised in a small town in Idaho and graduated from Grangeville High School in 2022. She is currently studying marine science and going into her second year at University of Hawaii at Hilo. Taryn enjoys being in the ocean, traveling, and spending time with friends and family. After graduating, Taryn plans to pursue a career in research where she can continue to learn about her environment.

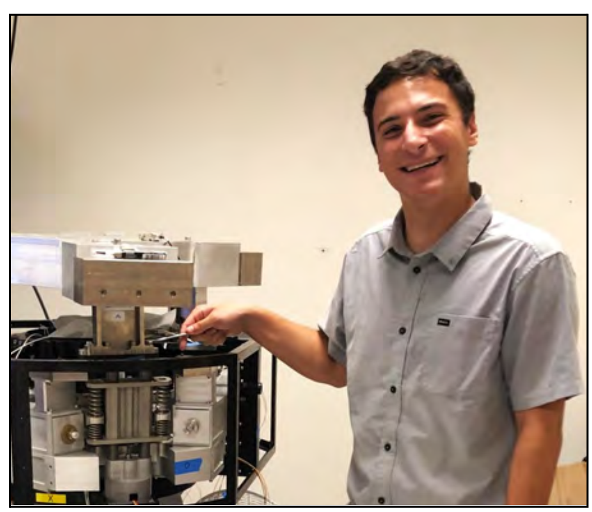
Ethan Goore
Rice University

Site: Gemini Observatory, Hilo, HI
Mentor: Logan Sato & Anthony Sylvester

Designing a New Shaker Assembly for Gemini North

With modern adaptive optics technology, even the smallest, micron-scale vibrations of sensitive telescope equipment can significantly impact image clarity. Many machines in the telescope generate vibrations, and vibrations affect image quality the most when they match the telescope's natural frequency and, in turn, excessively vibrate the mirrors and other sensitive equipment. Thus, it is useful to know the telescope's natural frequencies and other vibrational characteristics in order to avoid this resonance. This can be theoretically determined through finite element analysis, but a more accurate result requires physical testing using a process known as modal analysis. Modal analysis is the process of exciting a test specimen at different frequencies and measuring the magnitude of vibration of the test specimen at each frequency. A typical modal analysis setup consists of an exciter, usually an impactor or a shaker, that generates vibrations and accelerometers to measure the magnitude of vibration of the test specimen. The aim of this project is to design a shaker assembly in CAD to be used for conducting modal analysis at Gemini North. This shaker assembly will produce vibrations in a single axis and mount to the instrument support structure in multiple orientations to vibrate the primary mirror, where the accelerometers are mounted. Results from modal analysis conducted with this shaker can be used to make more informed decisions in the future regarding machines in the observatory and their potential impacts on vibrations.

Ethan Goore is from Kohala, Hawai'i Island and graduated from Hawai'i Preparatory Academy. He is currently a mechanical engineering student at Rice University and is interested in aeronautics and renewable energy. He is a member of the Rice University Wind Club, Rice Design Build Fly club, Rice Eclipse rocketry club, and he is executive producer of the Marching Owl Band. For fun, Ethan likes to play Hawaiian music on his steel guitar and ukulele.



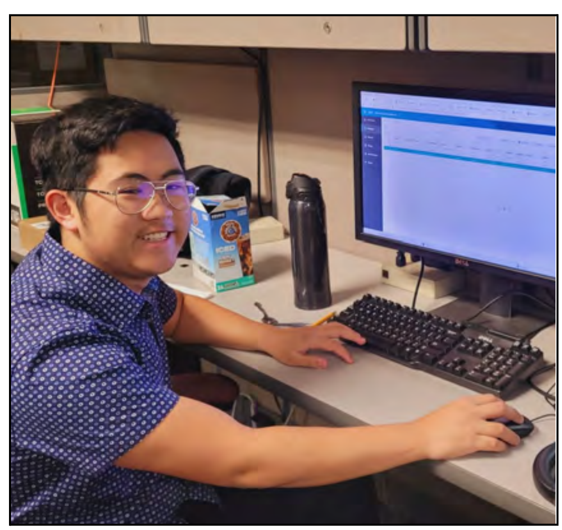
Jase Ishimi
University of Hawaiʻi at Mānoa

Site: Subaru Telescope, Hilo, HI
Mentor: Kody Haleamau Rubio & Kiaina Schubert

Development and Deployment of an Open-Source Hyper-Converged Infrastructure Environment

In a traditional computing infrastructure, servers are self-contained within their own environment and provide a role or service within the system. This self-contained nature has many drawbacks, including the underutilization of resources as well as potential catastrophic failures, since the data is self-contained. One solution to this problem is using a Hyper-Converged Infrastructure (HCI) environment as they have proven to be able to provide a great number of benefits, including redundancy and efficiency, as well as solve the shortcomings of a traditional computing infrastructure. At Subaru, we will be developing an in-house deployment of an HCI that will come from Ovirt, an open-source Red Hat-based resource that utilizes other open-source resources. We will be using three test machines in a sandbox environment to deploy and test the capabilities of the Ovirt HCI environment. We will be assessing the redundancy of the Ovirt deployment as well as its capabilities. This will be accomplished through deconstructing parts of the environment and observing how the system handles these errors. We will be looking for successful migrations of the virtual machines within the test machines as well as correct error reporting and handling within the system. After the initial testing phase, we will then move into implementing containers for storage as well as do further testing with live virtual machines. Documentation of the HCI system performance will be taken throughout the deployment and testing process, and will be compared with the current computing systems. Finally, a proposal that includes hardware and software specifications will be made toward an actual implementation of the HCI system within Subaru.

Jase Ishimi is from Oahu and is currently pursuing a Bachelor of Arts in Computer Science at the University of Hawaii at Manoa. His current goals are to gain as much experience as he can in the field of Computer Science so that he can decide on a career path before graduation. He enjoys swimming, gaming, and reading books in his free time. He is excited for the internship as he enjoys going to new places as well as meeting new people.



Del Jordan
Colorado School of Mines

Site: Canada-France-Hawai‘i Telescope, Waimea HI
Mentors: Greg Barrick & Raycen Wong

Designing and Implementing a Landing Alignment System for CFHT's MegaPrime Instrument

MegaPrime is a large astronomical instrument that operates at the prime focus of the Canada-France-Hawaii Telescope (CFHT). The 10-ton structure is switched out with other instruments once every few weeks, for which it must be "landed" on an access platform base for storage and maintenance. The rotational orientation of MegaPrime during landing is currently set using a small aluminum bar held by hand between the upper-end spider and the access platform stand. This procedure, which has been in place for many years, is not very precise, and it poses some pinch risk to the person holding the gauge block for the rotation. This project included the design and construction of a new mechanism for safely landing the MegaPrime upper end in its storage location, while ensuring that it is in the correct rotational position to allow the access platform to land properly on its receiving stand. The new landing guide still allows access to MegaPrime's platform without being removed, and it is designed to have a lifetime of 120 landing operations, or approximately 10 years of operation, without requiring replacement of any parts. In addition, the mechanism will operate without requiring personnel to place any part of their body between moving and stationary parts during the landing process.

Del was born in Berkeley, California and raised on the Big Island. He graduated from Parker School in 2022 and is now majoring in mechanical engineering at Colorado School of Mines. Del plans to minor in aerospace engineering and have a career in the aerospace industry. In his free time, Del enjoys mountain biking, going to the beach, and spending time with friends.

Kyla Lee
University of Hawaiʻi at Mānoa

Site: UH Institute for Astronomy, Hilo, HI
Mentors: James Ou & Christoph Baranec

Lighting the Way: Enhancing Laser Astronomy Insights through PAM Analysis

Robo-AO operational information presents an opportunity to assess the potential negative impacts of the growing population of satellites, especially the new mega-constellations, on laser astronomy and the ability to observe the sky. The Robo-AO systems are autonomous laser adaptive-optics instruments designed for high resolution astronomy with few-meter class telescopes. Robo-AO-2 is currently being commissioned at the University of Hawaii 2.2 meter telescope on Mauna Kea. These systems emit a laser into the sky as a reference to understand how to correct for atmospheric disturbance. Predictive Avoidance Messages (PAMs) from US Space Command provide guidance in the form of open/closure windows, and on when and where it is safe to utilize lasers to avoid damaging possible satellites. However, the plain text format of PAMs is difficult to directly comprehend, as it describes information in both spatial and temporal domains. For this project, we are developing a python program that will leverage historical and newly received PAM files to understand the impact of satellite patterns on observations. This visualization and analysis tool will analyze the percentage that each observing region is open, at a given point, how long until the next closure, and to assist with operational decision-making.

Kyla is a first year Computer Science student at University of Hawaii at Manoa. She plans to attain her masters degree in computer science, then pursue a career in the cybersecurity field. She is passionate about sharing her love for STEM. Kyla has a passion for STEM and competes in FIRST Tech Challenge (FTC) on Team Magma 9378, FIRST Robotics Competition (FRC) on Team Magma 3008, Oahu Mathematics League, CyberPatriots, GirlsGoCyberStart, and CompuGirls Hawaii. Anywhere she goes in life, she hopes to continue her passion in exciting the world about what she, herself has become so excited in. She looks forward to her future in continuing her journey through the wonders of the cyberworld.

Austin Lugo
Purdue University

Site: KBR, Kīhei, HI
Mentors: Randy Goebbert & Kurt Matillano

Creating a Camera Driver for a Space Domain Awareness Telescope

Due to the rapidly growing number of objects orbiting Earth, there is an increasing need to observe and track satellites to avoid collisions and ensure the ethical use of space assets. The Kihei, Maui, division of KBR is engaged in a large-scale project to develop a system of small autonomous telescopes that will perform automated surveys of the sky with the aim of identifying and tracking these satellites. These small telescopes require custom drivers to control various subsystems, including operation of the cameras. This new driver must be compliant with current standards in astronomy. This means complying with procedures set up by ASCOM (Astronomy Common Object Model) and ASCOM Alpaca, which is a RESTful API that uses network communication to communicate between applications and devices in all operating systems. A driver compliant with these rules was created by systematically interfacing with each of the camera's settings and ensuring that a single camera setting can be manipulated by running a simple Python script. Once the camera setting was reacting appropriately, it was made to respond to commands pre-specified by ASCOM by conjoining the aforementioned Python script with endpoints that the operating system can communicate with. Then, these steps were repeated with every setting KBR wanted to manipulate. As a result of this new driver, KBR has the groundwork to create other ASCOM compliant drivers for other pieces of hardware and can control their camera fully autonomously, without the need for human interaction.

Austin was born and raised on Maui, and he is currently pursuing a bachelor's degree in Computer Engineering at Purdue University. Austin is an Eagle Scout who plans on using leadership skills he learned in scouting and technical skills from college to start his own company. Austin enjoys the outdoors, the gym, video games, and quality time with friends.

Joselito Macabante
University of Hawaiʻi at Mānoa

Site: Daniel K. Inouye Solar Telescope, Pukalani, HI
Mentors: James Hoag, Gary Foster & Wade Bortz

Designing Encoder-Based Position & Velocity Feedback System Concepts for DKIST's Aperture Cover

The Daniel K. Inouye Solar Telescope (DKIST) is the most powerful solar observatory in the world and is designed to revolutionize our understanding of the Sun and its dynamic processes. Currently, the position feedback system of the DKIST's aperture cover relies solely on end-of-travel limit switches, so only three position states can be determined: closed, in-between (during motion), and open. This system provides no feedback on the aperture cover's position during the in-between stage, with the entire process taking about two minutes. Furthermore, variations in the load on the aperture cover at a shutter altitude greater than 20° can cause the cover to stick at the in-between position, failing to trigger the upper limit switch. This lack of confirmed open or closed position readings prevents the subsequent proper inflation of the cover seals. Although the drive assemblies on the aperture cover contain motor encoders that can be used to interpolate the cover's position from the rotation of the drive assembly, initial findings using the interpolated values have shown some inconsistencies. In order to address these issues, and to provide a more accurate positional measurement of the aperture cover during the open and close process, design concepts for a new position and velocity sensing encoder-based system were created and analyzed using SolidWorks. The proposed design concepts aim to address these issues by providing operators with an instantaneous readout of the aperture cover's precise position and velocity during the open and close process. Multiple encoder-based systems were analyzed, then narrowed down to two: a rack-and-pinion system and an optical/tape encoder system. The final designs integrate with the current shutter structure and central module, utilizing pre-existing designs and aspects of the assembly. The concepts presented here all demonstrate that implementing an encoder-based position and velocity sensing system is feasible and should serve as a basis for future designs.

Joselito (Jose) Macabante was born and raised on Oahu. He is currently a Senior at the University of Hawaiʻi at Mānoa, pursuing a Bachelor's of Science in Mechanical Engineering. Jose currently serves as the Secretary of the American Society of Mechanical Engineers (ASME) UH Mānoa collegiate chapter as well as being a Pledge in Pi Tau Sigma, the International Honor Society for Mechanical Engineering. Jose is also a Peer Mentor at Kapiʻolani Community College ʻImi Naʻauao Peer Mentor Program. He hopes to gain real-world problem solving and project experience from this opportunity. In his free time, he enjoys playing video games, listening to music, and working out.

Abigail Macalintal
University of Hawaiʻi at Manoa

Site: UH Institute for Astronomy, Hilo, HI
Mentor: Luke McKay & Mark Chun

Designing, Prototyping, and Fabricating an Advanced Enclosure for the UH88 Wide-Field Imager Off-Axis Guider System

The University of Hawaiʻi 2.2-meter Telescope, commonly referred to as the UH88, holds the distinction of being the first large telescope built on Mauna Kea in 1968. Since then, both imaging and spectroscopic instruments have been upgraded many times. Currently, we are working on designing and prototyping a permanent enclosure to enhance the Wide-Field Imager (WFI) off-axis guider system for the UH88 Cassegrain imager. The guider system enables users to achieve accurate tracking and dithering through a computer-controlled system, thus improving observations of celestial objects. The new enclosure will serve as a fully functional prototype that effectively blocks stray light from entering the guider system or science detectors. Furthermore, it ensures efficient routing of electrical cables, facilitates mounting/dismounting of electronics, and guarantees adequate dissipation of waste heat generated by the guide camera and stepper motors. To achieve these goals, we conducted a study of various materials suitable for augmenting the enclosure, in addition to inspections and measurements of the WFI off-axis guider system. The primary purpose of this study was to gather comprehensive information to facilitate the design and prototyping of a new enclosure. With this information, we were able to design a 3D-model of the enclosure using Autodesk Fusion 360. The result is an accurate rendering of the prototype which will be utilized in the fabrication process, where the most appropriate material for the guider system will be implemented to guarantee optimal performance and suitability.

Abigail Macalintal was born and raised in Kailua on the island of Oʻahu. After graduating from Kamehameha Schools Kapālama in 2021, she attended the University of Hawaiʻi at Mānoa. Abigail is currently an upcoming junior, pursuing a Bachelor of Science degree in Mechanical Engineering. She is the President of the Society of Automotive Engineers at UH Mānoa and a member of the Native Hawaiian Science & Engineering Mentorship Program (NHSEMP) at UH Mānoa. In her spare time, Abigail enjoys collecting shells, propagating plants, taking her dog Elijah on walks, and spending time with her family.

Abraham Marsh
Georgia Institute of Technology

Site: University of California Observatories, Santa Cruz, CA
Mentor: Phil Hinz

Characterizing a New Generation of Actuators for Use in Large Deformable Mirrors

The University of California Santa Cruz Laboratory for Adaptive Optics (LAO) works to develop large deformable mirrors that allow telescopes to compensate for wavefront distortion due to atmospheric turbulence. This technology requires hundreds of fast, high-precision actuators to deform the mirror; however, current deformable mirror technologies are small and require active cooling. The LAO has received hybrid variable reluctance actuators that require 75 times less power in a compact form, which could be implemented in higher densities without the need for active cooling. Before implementing these new actuators, the LAO must prove that the new design is capable of the speeds and accuracies required for adaptive-optics instruments. This project was to characterize these actuators by measuring their linearity, hysteresis, and response speed, as well as experiment with how to implement the actuators into a closed-loop system. Measurements of each actuator were gathered using a capacitive sensor. The actuator was driven manually with a power-supply current. Distance and voltage data were gathered and analyzed in Python to measure hysteresis and linearity. To create a feedback loop between the actuator and the capacitive sensor, I designed a Python program to read and interpret the capacitive sensor data. A software program that can drive the actuators was combined with the capacitive sensor readings to create a closed-loop system where the actuator adjusts its distance based on feedback from the capacitive sensor. A digital-to-analog circuit is needed to allow for software to control the actuator.

Abraham Marsh was born and raised in Honolulu, Hawaii and is currently attending Georgia Tech. He graduated from Kaiser High School and is now pursuing a B.S. in Electrical Engineering with the intent of completing a M.S. in Electrical Engineering. Abraham loves learning new skills and enjoys hands-on technical challenges. His career interests lie in avionics and control systems. In his free time, he plays piano, guitar, ice skates, and works on personal projects.

Kamea Mcmillan-Zilberman
University of Hawaiʻi Kapiolani Community College

Site: Subaru Telescope, Hilo, HI
Mentor: Michael Lemmen & Olivier Guyon

Finding an Effective Cooling Method to Optimize High-Altitude Video Streaming with Consumer-Grade Electronics

Video cameras mounted in high-altitude locations such as the ones on Maunakea are subject to harsher conditions than at sea level. Higher UV levels and prolonged exposure leads to the overheating and damage of the electronics, as well as increased noise distortion on the video itself. Researchers at Subaru Telescope are developing a camera that will be mounted on the outside railing of the Keck observatory building, allowing for high-quality images and 24-hour video streaming at high altitudes. The current camera enclosure mounted on the side of Subaru has been experiencing crashes during the day due to overheating and increases in image noise. The goal of this project is to redesign the enclosures for Subaru's sky-monitoring cameras with cooling in mind. Due to the lower air density, these cameras require additional cooling beyond those built into the device by the manufacturer, as their effectiveness is reduced at that altitude. In 2022, a new design was made using passive cooling fans to allow airflow to pass through the camera case while preventing water from entering the enclosure. However, this new design was implemented in autumn, not summer, and was only in use for one month before lava flows cut off power to it. Using Cinema Line FX3 4K Sony cameras, this project will compare this passive cooling system with active cooling techniques to determine which has the greatest effect on improved image quality. Using the best cooling method, we will build a camera enclosure implementing either passive or active cooling. The results of this research may allow for the advancement or development of new cooling techniques used for small enclosed spaces at these altitudes, and allow for both amateur and professional astronomers to take advantage of these designs.

Kamea Mcmillan-Zilberman was born on Oahu spending 6 years living in Waimanalo, then moved to the mainland spending 6 years in total in L.A. and Michigan before moving back home. He graduated from Henry J. Kaiser High School in 2021 during the pandemic, and has been pursuing a degree in Electrical Engineering at Kapiolani Community College before transferring to UH Manoa next spring. He likes to read or listen to audio books, practice Taekwondo, and doodle in his spare time.

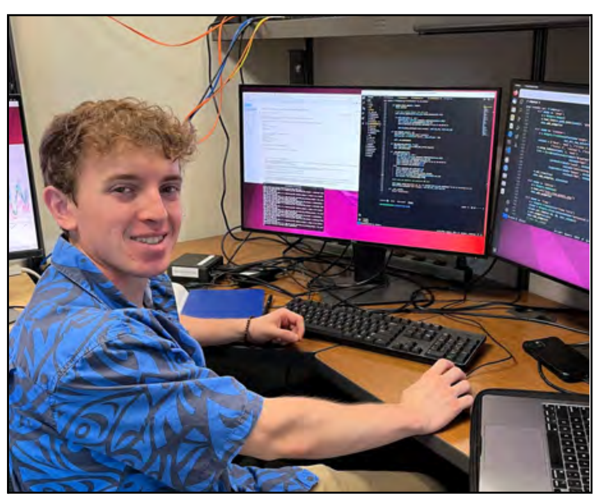
Jonathan Merchant
Carleton College

Site: Subaru Telescope, Hilo HI
Mentor: Russell Kackley & Eric Jeschke

Converting Subaru's C-Based hskymon application to a Python-Based SPOT application

As an integral part of the international astronomical community, the Subaru Telescope is critical for astronomers and researchers to observe the universe. To do so, these astronomers and researchers use many unique software applications to locate their targets, monitor current weather conditions, and predict the optimal time period for object observation. The hskymon application combines all three of these tools into a comprehensive user-interface. However, in recent years the maintenance of hskymon has been difficult and unable to keep up with recurring bugs and crashes. In order to remedy this problem, we are developing a new user interface, termed "Subaru Planning and Observation Tools" (SPOT), that will be written in Python and use Ginga plugins. The aim of this new application is to allow for easier continued maintenance and development by the Subaru Software Division team as compared to hskymon. This project continues the process of building the SPOT application by drawing comparisons to the older hskymon application. In particular, we use numerous Python modules along with the Ginga toolkit in order to display scientific data for the application's user, while also providing a simple and clean user-interface. Writing this new application will also allow for continued maintenance and development by the Subaru Software Division team in the future, making the SPOT application an integral part of astronomical research. Additionally, SPOT is being created in a way that allows it to be used with other observatories, allowing for increased usability among the scientific community.

Jonathan Kamehanaokalā Merchant was born in Seattle and raised in Maui, Hawai'i. He attended both Kamehameha Schools Maui and Seabury Hall before moving to Olympia, Washington halfway through his sophomore year of highschool and graduated from Olympia High School. He is currently pursuing a double major in computer science and history at Carleton College in Northfield, Minnesota. In his free time, Jonathan enjoys playing soccer, reading, listening to music, and spending time with friends and family.



Koji Miyakawa
University of Hawaiʻi at Hilo

Site: Daniel K. Inouye Solar Telescope, Pukalani, HI
Mentors: André Fehlmann & Tom Schad

Deriving a Sky-Brightness Model to Establish Good Coronal Observing Conditions

The Daniel K. Inouye Solar Telescope (DKIST) on Haleakala, Maui, is the world's largest solar telescope. With its capability to observe the solar disk and the much fainter solar corona, DKIST plays a crucial role in solar research. Accurate knowledge of the sky brightness near the sun is vital for determining the feasibility of coronal observations on a given day. The primary goal of this project is to utilize a Cimel Electronique CE318-T automated multispectral atmospheric photometer and develop a model to estimate the sky brightness as close to the solar limb as possible, which will provide near real-time data to assist telescope operators in decision-making. The CE318-T is able to measure and calculate atmospheric parameters such as aerosol optical depth (AOD) and water-vapor content. However, the CE318-T has limitations in measuring pure sky brightness close to the sun due to its large field of view. Therefore, we pursued two potential approaches to achieve this goal. One avenue involves using custom observing modes of the CE318-T to disentangle the sun's brightness from the surrounding sky brightness, necessitating data collection and subsequent analysis. Using a cross-sun arrangement of pointings, photometry of the sun, solar limb, and sky were collected to create a simple model of sky brightness. Another approach we explored is incorporating AErosol RObotic NETwork (AERONET) aerosol properties as inputs to a parametric model of the sky brightness. The available atmospheric modeling software, Simple Model of the Atmospheric Radiative Transfer of Sunshine (SMARTS), aided in this endeavor by computing clear-sky spectral irradiances, including direct-beam and circumsolar for specified atmospheric conditions. Successful implementation of the proposed model provided valuable insights into estimating sky brightness near the solar limb, further enhancing DKIST's capabilities for coronal observations.

Koji was born on the island of Oahu but grew up in Japan. He is currently a junior studying astronomy and physics at the University of Hawaii at Hilo. Koji's passion for space exploration led him to participate in the NASA Hawaii Space Grant Consortium Research Internship during the Spring 2023 semester. In his free time, Koji enjoys watching movies. Upon graduation, he hopes to pursue a Ph.D. and contribute to the field of astronomy. Koji's multicultural background and interest in space exploration make him a valuable asset to the scientific community.

Jennifer Nakano
University of Hawaiʻi at Mānoa

Site: Gemini Observatory, Hilo, HI
Mentor: Clara Martinez-Vazquez & Ricardo Salinas

Classifying Variable Stars in the Large Magellanic Cloud through Machine Learning

As the number of astronomical surveys increase with technological advancements, the data collected from these surveys grows exponentially. Recently, a research team at Gemini carried out a stellar variability survey in the Large Magellanic Clouds using the Dark Energy Camera associated with Gemini's parent organization, NOIRLab. This survey has collected time-series data of about 5.5 million objects, and scientists now face the daunting task of determining which of these objects are variable stars and classifying what type of variable stars (delta Scuti, RR Lyrae, Cepheids, eclipsing binaries) they are. These classifications are based on observed stellar light curves and derived periods, along with their positions in color-magnitude diagrams generated from the survey. In hopes of improving the efficiency in characterizing the variable stars in this survey, we use machine learning models to automate the task of processing all of the incoming data. The machine-learning models XGBoost and the Histogram-based Gradient Boosting Classification Tree look for patterns such as variability in stellar magnitudes, and are trained to optimize the detection of variable stars without introducing contamination from false positives (non-variable stars that are incorrectly classified as variable stars). K-Nearest Neighbors and template fitting utilizes the period, luminosity, magnitude relation as well as folded light curves to distinguish the different variable star types. After the two phases of classification, the machine learning models achieve < 80% accuracy.

Jennifer Nakano was born and raised on the Big Island of Hawaii and graduated from Waiakea High School. She is attending the University of Hawaii at Manoa, pursuing computer science with a minor in mathematics. Jennifer is interested in data science, machine learning, and AI because of its adaptability to various fields and capability to make a difference in the world. Her goals are to work in the field of data science and work somewhere in Hawaii so that she can stay close to her family. Jennifer enjoys baking, playing video games, and spending time with her friends and family.

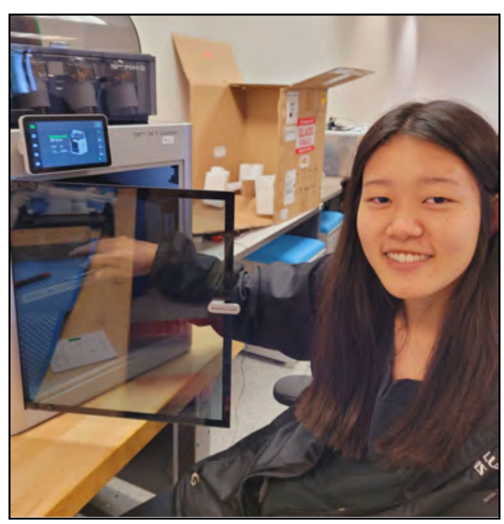
Claire Narimasu
University of Hawaiʻi at Mānoa

Site: KBR, Kīhei, HI
Mentors: Dylan Schwarzmeier & James Cobb

Designing and Installing a 3D-Printed Environmental Enclosure for a Ground Telescope Optical Train

The optical train, located on the back of a telescope, houses delicate equipment, cameras, filters, and focusers that are necessary to its operation. During inclement weather, this equipment is exposed to the elements for the time it takes the dome to close. In order to prevent damage to this expensive equipment, this project involved the design, fabrication, and installation of a protective environmental enclosure to surround the optical train of KBR's Apertura 12" f/8 Ritchey-Chretien Optical Tube telescope. This enclosure must not interfere with the movement of the telescope on the Paramount MX mount, nor with the existing cooling fans or wiring in place on the back of the telescope. Furthermore, it must allow for easy access to the equipment inside and appropriate temperature regulation. First, different types of technologies commonly utilized for virtualizing physical components/environments (LiDAR, photogrammetry) were evaluated and down-selected. Next, a photogrammetric model, schematics, and 3D-printing were utilized to complete this task. The model and schematics aided in formulation of the enclosure's computer-aided design using Fusion 360 software. The final design was 3D-printed, then assembled on the back-end of the telescope, along with a 120-mm air-handling system. The finished enclosure now protects against precipitation and corrosive environments. KBR will be immediately leveraging the results, technologies, software packages, and air-handling design with future different telescope optical-train assemblies, as well as with a second style of telescope mount that rotates on altitude-azimuth axes.

Claire is currently double majoring in Electrical Engineering and Geography at the University of Hawaiʻi at Mānoa and plans to graduate with her BS and BA in 2025. She was born and raised in Honolulu, Hawaiʻi and attended Moanalua High School, graduating in 2021. Her future plans involve a career in renewable energy and sustainability, with the overarching goal of helping the state of Hawaiʻi and the University achieve their respective 2045 and 2035 renewable energy goals. Aside from that, she hopes to once again pick up an instrument and sports after her project wraps up.



Angelu Ramos
University of Hawaiʻi at Hilo

Site: W. M. Keck Observatory, Waimea HI
Mentors: Max Brodheim & Tyler Tucker

Plotting Interface Requirements for the W. M. Keck Observatory Data-Reduction Pipeline Framework

Data reduction pipelines (DRPs) are sets of ordered steps implemented into software that allow raw instrument data to be turned into usable scientific products, which makes DRPs essential to astronomical research. In 2018, the W. M. Keck Observatory (WMKO) introduced the Keck DRP Framework, a software framework to allow developers to create their own DRP for any scientific instrument. Since then, users of the framework (primarily the WMKO Scientific Software Group) have found that the current plotting interface, bokeh, fails to provide the functionality needed for robust and reliable pipeline execution. As part of continued improvement of the framework, we investigated bokeh's limitations and how other industry standard plotting interfaces could be integrated into the framework instead. We have prepared a report detailing the requirements for a plotting interface to run within the Keck DRP framework. This report will be considered in further improvements to the framework to ensure that any newly implemented plotting interface delivers the functionality needed.

Angelu was born and raised on the Big Island of Hawai'i in North Kohala. She graduated from Kohala High School in 2018 and is a recent graduate of the University of Hawai'i at Hilo, where she completed her degree in Astronomy with minors in Physics and Math. She plans to pursue a career in astronomy research or operations.

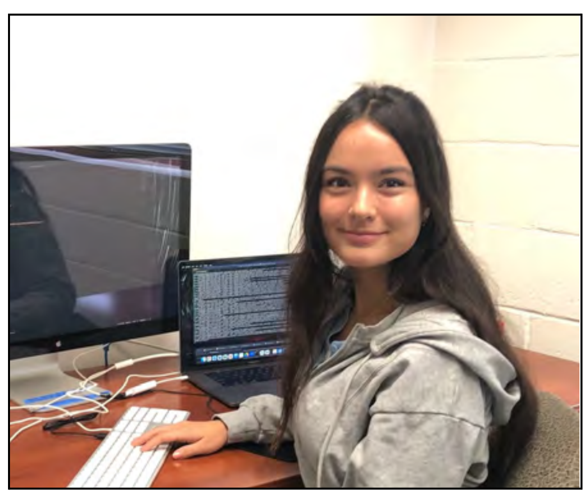
Samantha Reed
University of Hawai'i Kapiolani Community College

Site: Gemini Observatory, Hilo, HI
Mentor: Emma Kurz & Hawi Stecher

Building the Front-End and Creating a Logging System for the Next-Generation Gemini Engineering Archive

The Gemini Observatory consists of two twin telescopes: one located in La Serena, Chile, and one located on Maunakea, Hawai'i. A vital component within this observatory is the Gemini Engineering Archive (GEA), which serves as a repository for important telescope process data. The current GEA exhibits limited user-friendliness and lacks a mechanism for accessing and visualizing log data related to the different subsystems and instruments' operations. The aim of this project is to develop the Next Generation GEA, focusing on enhancing the front-end's visual interface and adding a feature to visualize log data. To achieve this goal, we utilize the visualization and analytics platform Grafana to create an enhanced front-end with easy-to-understand charts, graphs, and dashboards. Additionally, the Next Generation GEA will use the software tools Elasticsearch, Kibana, and Logstash (ELK stack) to build a logging system. Within this ELK stack, we developed code for the individual instruments and subsystems of the telescope, constructing pipelines to transfer log data to the database. To construct the new interface for GEA, we wrote a Python script to request telemetry data from the current GEA's server and transmit it to Grafana for visualization within a user-friendly interface. To deploy all of these operations, Docker containers were utilized to ensure the controlled execution environment of these systems. By implementing this Next Generation GEA, an improved understanding of the telescope's operations will be achieved, enabling scientists to easily gather data and better understand essential telescope processes.

Samantha is from the Big Island of Hawai'i and currently attends Kapiolani Community College. She plans on continuing her education at University of Hawai'i at Manoa to complete her BS in Computer Science. Samantha works as a peer mentor at the KCC STEM Center where she helps students in math. She enjoys the challenges and creative aspects of programming and wants to use what she learns to come up with innovative solutions to give back to her community. In her free time, she enjoys playing sudoku and spending time with her cats.



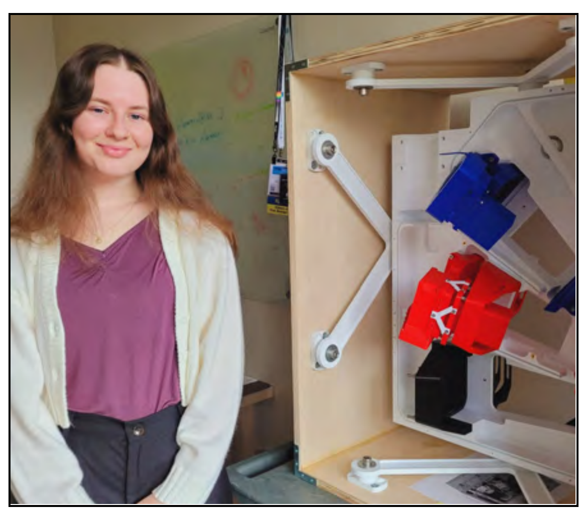
Amanda Schiff
University of Portland

Site: NASA Infrared Telescope Facility, Hilo, HI
Mentor: Mike Connelley

Verification of the Assembly Plan for NASA IRTF's SPECTRE Instrument

The 3.2-meter NASA Infrared Telescope Facility (IRTF) is currently developing SPECTRE, a three-channel integral field spectrograph covering the wavelength range 0.4–4.2 μm. SPECTRE will allow for the efficient characterization of small solar system bodies and astrophysical transient objects. The instrument would also aid in assessing the impact potential of near-Earth objects, a key goal of NASA. A preliminary design of SPECTRE has been created, and the assembly plan for the instrument needs to be tested to ensure viability. It is important to vet the assembly plan because the alignment of the instrument's internal optics will be an extensive and delicate process. Additionally, we need to test that key areas can be accessed since SPECTRE is more compact than previous facility instruments. To verify SPECTRE's assembly plan, a full-scale mockup of the instrument was created using primarily 3D-printed components. Significant attention was placed on the instrument's optics bench to address concerns regarding optical alignment. To ensure that real hardware could be used to practice the assembly procedure, we machined threaded inserts and installed heat-set inserts into clearance holes. Discrepancies such as part interferences, fastener accessibility issues, and optical alignment concerns were discovered and noted in a technical document to help inform the engineering team of potential mechanical design improvements and updates that need to be made to the assembly plan. The physical model aided in identifying logical inconsistencies in the assembly plan because prior to its existence, the plan was based on an intangible version of the design. This work was presented at the Preliminary Design Review (PDR) for SPECTRE, an important milestone in evaluating project readiness. The physical model was well-received by the review panel and instilled confidence in the maturity of SPECTRE's mechanical design.

Amanda was born in Santa Cruz, CA, and grew up in Kailua-Kona, HI, where she graduated from Kealakehe High School in 2020. She currently attends the University of Portland, where she is majoring in mechanical engineering and minoring in computer science. Alongside her studies, Amanda actively contributes to her school community by serving at the helm of UP's yearbook as Editor-in-Chief and as the Treasurer for her school's Society of Women Engineers chapter. Amanda's passions lie in the fields of aerospace and astronomical instrumentation, and she is particularly intrigued by topics that explore the intersection of visual arts, science, and engineering. In her free time, she enjoys running, finding cats in her neighborhood, and sipping on good coffee.



Kealia Sjostrand
University of Oregon

Site: Privateer Space, Kīhei, HI
Mentors: Joel Walsh & Shaantam Chawla

Casting Neural Nets on Satellite Waters: Training and Testing a Computer Vision Model

Privateer Space was founded to achieve a goal of making space more safe, sustainable, and accessible. The company was built on the belief that open access to space-related data would achieve this goal. As a potential use case, this project involved the training of a convolutional neural network (loosely based on You Only Look Once — a model capable of detecting objects in real-time) to identify and draw bounding boxes around any boats in satellite images. Nearly 200,000 images of the ocean were obtained from Kaggle's Airbus Ship Detection Challenge (2018) and used to train and validate the model. These images were converted to fit the required format for the model. For each image, an associated text file was created that contains the normalized coordinates (x-center, y-center, box width, and box height) of any bounding boxes in the image. The image and text file pairs were kept in cloud storage so that the model could be trained on cloud supercomputer clusters with specialized GPUs. During the training process, each of the images were cut into "patches," and the patch that contains the center of the boat then predicts the size of the bounding box and displays it on the image. A baseline model achieved a maximum precision of 0.8 and a maximum recall of 0.7 on the validation dataset of satellite images. While testing this model, it was discovered that the model struggled to identify boats in docks and residential areas. At this stage, there was only one object class (boat), but to address the domain adaptation issue, more classes and subclasses were necessary (such as types of boats). This problem was addressed by training a Contrastive Learning In Pretraining (CLIP) model, which encodes images and text files in such a way that paired files are close to each other in a vector space. By using CLIP, the similarity of and patterns in the existing data can be compared to discover more classes and subclasses. Continued training and testing of this model will continue to increase its complexity, which could transform it into an environmental and/or actuarial tool, such as a method of enforcing fishing legislation, measuring commerce, or sensing boats remotely.

Kealia Sjostrand was born and raised in Kahului, Maui. She is currently attending the University of Oregon, majoring in Data Science concentrated in Marketing Analytics, and minoring in Entrepreneurship, Math, and Sports Business. After college, she hopes to move back to Hawaiʻi and start her own business.

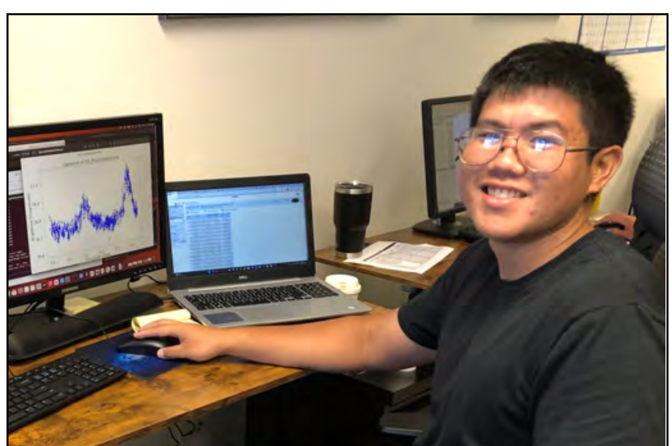
Xavier Tablit
University of Hawai‘i at Hilo

Site: W. M. Keck Observatory, Waimea, HI
Mentor: Chien-Hsiu Lee

Deriving Properties of Eclipsing Binaries from Zwicky Transient Facility Time-Series and Color Data

Eclipsing binaries are stellar systems in which two stars orbit one another. Possessing an orbital plane that is nearly edge-on to our line-of-sight from Earth, the stars appear to periodically eclipse each other, causing variability in brightness. With estimates placing the majority of stars as being components of binary systems, the study of such stellar interactions is paramount to the testing and improving of stellar models that can serve as a basis for estimating distances as well as understanding stellar dynamical systems. In our present age of all-sky surveys, many eclipsing-binary systems have been identified, but much of their time-brightness data (light curves) have yet to be analyzed. Equipped with a 47-deg^2 field-of-view camera, the Zwicky Transient Facility (ZTF) scans the entire northern sky with a two-day observation cadence in *g*, *r*, and *i*-bands, surveying for objects that vary in brightness, and making it ideal for identifying eclipsing binaries. We analyze the largest time-domain survey data taken by ZTF, which contains 49,943 detached binary systems identified by Chen et al. (2020). Employing procedures by Devor et al. (2008), we first utilized the Detached Eclipsing Binary Light curve fitter (DEBiL) to isolate the detached binaries, as well as determine the relative sizes of the binary components for each system. We then used the Method for Eclipsing Component Identification (MECI) to acquire pairs of stars that best fit the light-curve shapes from the stellar evolutionary model. With MECI, we derived basic parameters such as individual stellar masses and estimated distances to each system. This approach to analyzing binary systems allows for the probing of the large-scale structure of the Milky Way, serving as a valuable tool for assessing distances and mapping out our galaxy.

Xavier was born and raised on the Big Island of Hawaii. He graduated from Pahoa High School and is currently enrolled at the University of Hawaii at Hilo, pursuing degrees in Astronomy and Physics. Xavier intends to be an astrophysicist, study the cosmos, and inspire others to do the same by contributing to the Hawaii's scientific community and the world.



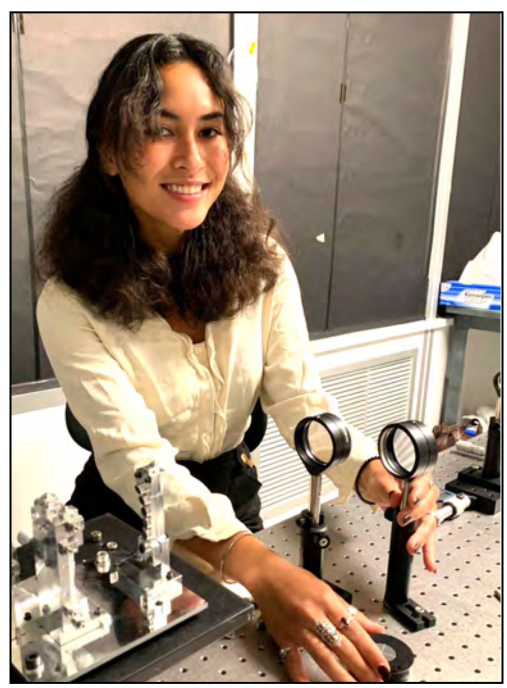
Grace Todd
Case Western Reserve University

Site: University of California Observatories, Santa Cruz, CA
Mentor: Renate Kupke

Quantifying the Precision of SCALES' Slenslit Unit through Optical Tests

The goal of the SCALES (Slicer Combined with Array of Lenslets for Exoplanet Spectroscopy) instrument is to detect faint exoplanets via atmosphere composition by producing hyperspectral imaging. From these spatially resolved spectra, we will be able to distinguish, compositionally, exoplanets from surrounding objects, such as gas and dust surrounding a protostar. The Slenslit is an optical component of SCALES that combines the precise sampling capabilities of a lenslet array, allowing for minimal light aberrations, and the high-resolution spectroscopy of an optical slicer. The unit realigns light through a series of tilted and curved mirrors in order to arrange the array of light produced by the lenslet into a pseudo-slit: a distribution of light from which spectra may be produced from each point with optimal spacing and precision. The objective of this project is to conduct a series of optical tests at the University of California Observatories (UCO) to determine the distribution between points of the pseudo-slit generated by the Slenslit prototype, as well as the quality of the image produced, to ensure that required spatial and spectral resolution are achieved.

Grace was born and raised in Kohala on the Big Island of Hawaii, and currently resides in Cleveland, Ohio, where she studies Astronomy at Case Western Reserve University. Though the stars do not shine as bright in the city of Cleveland, she utilizes CWRU's rooftop telescope as often as she can, so that she may revisit her oldest, closest friends whom she sees regularly back home. She hopes to share this love and knowledge of the universe with like-minded academics as a professor of Astronomy one day. When she isn't stargazing, Grace is most likely finding seashells on the ocean floor, hiking to hidden waterfalls, or residing on cliff sides.



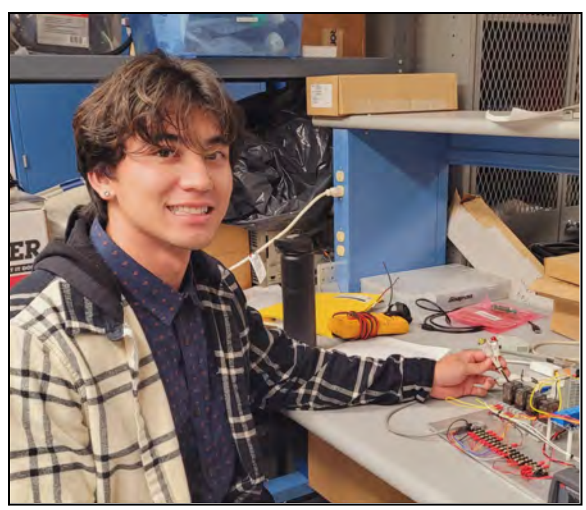
Logan Waltjen
Grand Canyon University

Site: Subaru Telescope, Hilo, HI
Mentor: Lucio Ramos

Improving the Cooling Switch System for the Prime Focus Spectrograph

The Subaru Telescope, located on the summit of Maunakea, currently uses an instrument called the Prime Focus Spectrograph (PFS). There are two PFS modules installed, with plans of installing two more in the near future. These modules are situated in the Spectrograph Clean Room located on the fourth floor of Subaru Telescope's corotating enclosure. The primary cooling system for the spectrograph modules consists of a recirculating thermo-chiller, SMC, and a liquid-to-liquid heat exchanger, Lytron LCS20. If the primary cooling system fails, the backup liquid-to-air heat exchanger, Lytron 6340, will be used and continue to cool the spectrograph cryocoolers by exhausting resulting heat directly inside the telescope enclosure. Currently, switching from primary to backup cooling must be done manually. To reduce downtime and potential damage to the spectrograph modules, we are developing and testing an automated switch system in the lab. The automated switch system relies on analog signals, and uses a time-delay relay that is activated upon an alarm output to give enough time for scientists to ensure that the back-up system is precooled and can supply the modules with the temperature that is needed. Analysis of the cooling system shows that the primary route of the coolant can be switched to the back-up route through two electric 3-way valves. Designating a threshold for certain flow and temperature monitors in the system allows for alarms to be outputted from data acquisition devices, which will then autonomously trigger the electric 3-way valves to switch to the backup route. Design and testing of a switch system using relays, proprietary software, and data acquisition systems was performed to test the feasibility of switching from facility to backup cooling autonomously.

Logan Waltjen was born and raised on the Big Island of Hawaiʻi. He graduated high school from Kamehameha Schools Hawaiʻi, and now attends Grand Canyon University in Arizona. He is pursuing a major in Electrical Engineering and plans to contribute to his community by using the knowledge he has learned in school and the workforce. In his spare time, Logan enjoys hanging with friends and exercising.



Akamai Internship Program

Akamai advances students into the Hawai‘i technical and scientific workforce. The program partners with industry, observatories, government, educational institutions, and the community to meet workforce needs in astronomy, remote sensing, and other science and technology industries in Hawai‘i. Akamai is led by the Institute for Scientist & Engineer Educators (ISEE) at University of California, Santa Cruz, in partnership with University of California Observatories, the University of Hawai‘i Institute for Astronomy and University of Hawai‘i at Hilo.

The 2023 Akamai Internship Program placed 32 college students from Hawai‘i at the following organizations to complete a seven-week project:

- Academia Sinica Institute of Astronomy and Astrophysics
- Blue Ocean Barns
- Canada-France-Hawai‘i Telescope
- Daniel K. Inouye Solar Telescope
- Gemini Observatory
- KBR
- NASA Infrared Telescope Facility
- Natural Energy Laboratory of Hawai‘i Authority
- Pacific Disaster Center
- Privateer
- Subaru Telescope
- University of California Observatories
- University of Hawai‘i Institute for Astronomy
- W.M. Keck Observatory

In 2023, Akamai interns were funded by:

- Gordon and Betty Moore Foundation
- Daniel K. Inouye Solar Telescope (National Science Foundation)
- Gemini Observatory (National Science Foundation)
- University of California Observatories
- Maunakea Observatories
- Slicer Combined with Array of Lenslets for Exoplanet Spectroscopy (SCALES) (NSF AST#2216481)
- Canada-France-Hawai‘i Telescope

For more information please contact:
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http://akamaihawaii.org