AKAMAI WORKFORCE INITIATIVE

Akamai Internship Symposium
Project Abstracts

Waimea July 30, 2021
W.M. Keck Observatory Headquarters

Hilo August 3, 2021
University of Hawaii, Hilo

Please RSVP Here

UNIVERSITY OF CALIFORNIA SANTA CRUZ

ISEE Institute for Scientist & Engineer Educators

Advancing Hawaiʻi college students into science and technology careers

2021 Akamai Internship Program

Akamai = smart, clever

The Akamai Internship Program is a unique program that supports Hawaiʻi 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, the students complete a communication course that begins in the short course and continues through weekly meetings and intensive coaching sessions. The Akamai program uses an internship 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 Akamai program are to address the technical workforce needs in Hawaiʻi and advance students from diverse backgrounds into science, technology, engineering and mathematics (STEM) careers. Interns receive college credit from UH Hilo.

2021 Host Organizations

Hilo, Hawaiʻi Island

- Smithsonian Astrophysical Observatory
- Academia Sinica Institute of Astronomy and Astrophysics
- Subaru Telescope
- University of Hawaii Institute for Astronomy

Waimea, Hawaiʻi Island

- W.M. Keck Observatory
- Canada-France-Hawaii Telescope

Kihei, Maui

- Air Force Research Laboratory
- Boeing
- KBR
- Maui High Performance Computing Center

Santa Cruz, CA

- University of California Observatories

AKAMAI WORKFORCE INITIATIVE

ISEE Institute for Scientist & Engineer Educators

Akamai Workforce Initiative 2021

Staff

Institute for Scientist & Engineer Educators at University of California, Santa Cruz (ISEE/UCSC)

Lisa Hunter	**Director, ISEE**
Jerome Shaw	**Associate Director, Akamai**
Cynthia Carrion	**Program Manager**
Mike Nassir	**Akamai Communication Course Instructor**
Nicole Mattacola	**Program & Event Coordinator**

Akamai PREP Course Instructors

Austin Barnes	ISEE/UCSC
David Harrington	Daniel K. Inouye Solar Telescope
Jerome Shaw	ISEE/UCSC
Stacey Sueoka	Daniel K. Inouye Solar Telescope

Communication Instructors

Cynthia Carrion	**Co-lead Instructor**	ISEE/UCSC
Mike Nassir	**Lead Instructor**	Univ. of Hawai‘i at Manoa
Lisa Hunter		ISEE/UCSC
Austin Barnes		ISEE/UCSC
Jerome Shaw		ISEE/UCSC
Stacey Sueoka		Daniel K. Inouye Solar Telescope

Special Thanks . . .

There are many people and organizations that have contributed to making Akamai a success and played a role in the 2021 Internship Program. We apologize if we have left your name off; thank you all for your contributions!

2021 Akamai Selection Committee
Paul Barnes (Institute for Astronomy, Hilo), Geoff Bower, (ASIAA), Chas Cavedoni (Gemini), Wesley Emeneker (AFRL), Dave Harrington (DKIST), Phil Hinz (UCO), Russell Kackley (Subaru Telescope), Mary Beth Laychak (CFHT), Nick MacDonald (UCO), Heather Marshall (DKIST), Luke McKay (IfA Hilo), Sam Ragland (Keck), Lucio Ramos (Subaru), Maureen Savage (UCO), Kiaina Schubert (Subaru), Ryan Swindle (AFRL), Laura Ulibarri (KBR), Truman Wold (Keck), Raycen Wong (CFHT)

2021 Akamai Mentor Council
Peter Konohia (Akimeka), Renate Kupke (UCO), Mary Beth Laychak (CFHT), Heather Marshall (DKIST), Keith Olson (NELHA), Lucio Ramos (Subaru), Chris Stark (Gemini), Ranjani Srinivasan (SMA/ASIAA), Marianne Takamiya (UH Hilo), Truman Wold (W.M. Keck),

Air Force Research Laboratory
Ryan Swindle, Scott Hunt, John Schmidt and Scott Pierce. *Mahalo for mentoring and program advocacy!*

Canada-France-Hawaii Telescope
Mary Beth Laychak, Ivan Look, Grant Matsushige, Greg Barrick, Heather Flewelling, Nadine Manset, Doug Simons, and Raycen Scott Wong. *Mahalo for mentoring and program advocacy!*

Daniel K. Inouye Solar Telescope (DKIST)
David Harrington, Stacey Sueoka, Andre Fehlmann, Heather Marshall, Brialyn Onodera, Thomas Rimmele, Tom Schad, and Lucas Tarr. *Mahalo for being a sponsoring partner, mentoring, and providing PREP instructors!*

University of Hawaii Institute for Astronomy
Kathy Cooksey, Luke McKay, Mark Chun, Paul Barnes, Christoph Baranec, Andre Fehlmann, Dave Harrington, Lucas Tarr, Garry Nitta and Haosheng Lin. *Mahalo for mentoring and providing us with a presentation venue!*

Maui High Performance Computing Center
Jeremy Young, Wesley Emeneker and Christopher Coury. *Mahalo for mentoring!*

KBR
Jeremy Case, Randy Goebbert, Oliver Grillmeyer, and Laura Ulibarri. *Mahalo for mentoring!*

Smithsonian Astrophysical Observatory
Geoffrey Bower, Ramprasad Rao, and Simon Radford. *Mahalo for mentoring!*

Subaru Telescope
Russell Kackley, Lucio Ramos, Eric Jeschke. *Mahalo for mentoring!*

University of California Observatories
Renate Kupke, Claire Max, Kyle Westfall, Nick MacDonald, Phillip Hinz, and Maureen Savage. *Mahalo for being a program sponsor, program advocacy and mentoring*!

W. M. Keck Observatory
Jeannette Mundon, Truman Wold, Shelly Pelfrey, Hilton Lewis, Leslie Kissner, Jim Thorne and Rich Matsuda. *Mahalo for mentoring, sponsoring an intern, hosting the symposium and providing housing!*

Terric Abella
Columbia University

Site: Maui High Performance Computing Center: MHPCC - Kihei, Maui
Mentor: Jeremy Young

Refining the Workflow of Network Traffic Data for PEcoC's Autoencoder

The Pacific Ecosystem for Cyber (PEcoC) is an AI/ML-enabled architecture that detects anomalous network traffic to advance full-spectrum cyberspace operations. Currently, PEcoC collects network packet capture (PCAP) data, processes each packet into session-level logs with Zeek (a network monitoring tool), and then scores sessions using shallow unsupervised anomaly detection models. Additionally, a deep learning algorithm, an autoencoder for DNS traffic, has been developed to run on raw PCAP. However, it is not operational since it scores individual DNS packets (rather than sessions), producing too much data for analysts to process. The objective was to create a refined workflow by aggregating the autoencoder frame scores into session scores to make the results tangible. We used a custom Zeek script to log frame numbers to sessions on the default DNS log. Then we used python scripts to match the scored frames with their corresponding sessions. Finally, we investigated different potential aggregations to output as the autoencoder's session score, such as the average or maximum frame scores per session. Once deployed, this refined autoencoder workflow will give digestible results into the hands of analysts who can then begin giving feedback for us to optimize and tailor the algorithm (e.g. scoring aggregation, score scaling, preprocessing steps, neural network layers, etc.).

Biography:
Tojo was born and raised in Makakilo on the island of Oahu. He graduated from Kamehameha Schools Kapalama and is currently studying computer science at Columbia University. In his free time, he enjoys programming algorithms while surfing and eating ocean-salted broccoli. He has always loved the sciences and especially computer science and can't wait to expand his knowledge in the field further. He hopes to one day pursue a career in STEM to make positive impacts on society while satisfying his passion for learning.

Dason Albano
University of Hawaii at Hilo

Site: Institute for Astronomy, Hilo - Hilo, HI
Mentor: Paul Barnes

Developing Software Interfaces for the Robo-AO-2 Adaptive Optics System

Robo-AO-2 is an in development laser adaptive optics system for the University of Hawaiʻi 88-inch telescope. In order to remotely operate Robo-AO-2's flip mirrors, shutter systems, etc., software must be created that will interface with its hardware components. The programs will compile in a Linux environment, in which they can be compiled remotely over a secure shell protocol (ssh). The two main devices that will be controlled are a remote input/output (IO) device and a motion controller. Both devices were programmed in C++, and both contain a text-based interface that controls Robo-AO-2's hardware components. Since these devices are controlled remotely by Ethernet, configuring their IP addresses and port numbers was necessary to have the new software communicate with those devices. The first device programmed, the remote IO device, had its own communication library, so functions that were critical for interfacing were available to be used. The second device programmed, the motion controller, did not have any proprietary communication library similar to the prior; instead, the Boost C++ libraries were utilized. In particular, the Asio library was used to handle socket programming, which was essential for our new software to communicate with the motion controller over its designated IP address. These new programs now successfully provide remote control of their respective mechanical components in Robo-AO-2, and will become a permanent addition to the suite of software for the adaptive optics system.

Biography:
Dason was born on the island of Hawaiʻi and grew up in Keaʻau. He is pursuing a bachelor's degree in computer science—with a minor in mathematics—at the University of Hawaiʻi at Hilo and he will begin his junior year this fall. His career plans upon graduation include working as a software engineer or teaching in secondary education. In his free time, he enjoys exploring minimalism, roaming around places, and working with computers.

Hannah Blue
University of Hawaii at Hilo

Site: Smithsonian Astrophysical Observatory - Hilo, HI
Mentor: Geoffrey Bower

Time Series Analysis Of Active Galactic Nuclei

A defining characteristic of AGN is their unpredictable and aperiodic variations in flux, and it is widely accepted that they are powered by accretion onto a supermassive black hole. To better understand how gas flows into black holes and the physics underlying variability, black hole light curves (flux vs. time) can be analyzed to determine a characteristic timescale at which the variability amplitude of flux measurements saturates. Following previous studies that described variability of radio AGN light curves using a damped random walk (DRW) model, light curves of M87 were fit as a stochastic DRW using existing observations from the Submillimeter Array, and the Combined Array for Research in Millimeter-wave Astronomy. A Monte Carlo Markov chain statistical analysis was applied to the data sets to estimate parameters (transition time, mean, and standard deviation of long timescales) used for the DRW. The best fit model for M87 resulted in a characteristic timescale of about 150 days with upper and lower limits of 278 and 62 days, respectively. Characteristic timescales have been shown to correlate with black hole mass. The shortest timescale expected for Sgr A*, with a mass of 4 million solar masses, is about 30 minutes, thus it is expected that the timescale for M87, with a mass of 6 billion solar masses, will be about 30 days. When comparing scales of this kind, the resulting and predicted timescales are largely in agreement. The resulting timescale being slightly longer than expected could be due to material orbiting at a slightly larger radius than the innermost orbit.

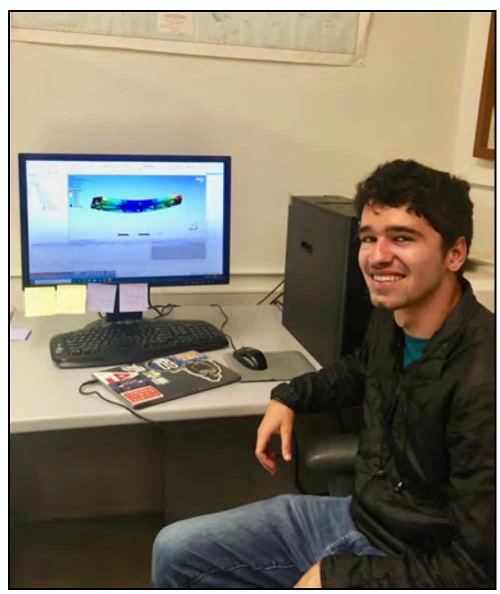
Biography:
Blue grew up in Hilo on the Big Island of Hawai'i. She graduated from Waiakea High School and is currently pursuing degrees in Physics and Astronomy with a minor in Mathematics at the University of Hawai'i at Hilo. Her special interests include adaptive optics, ground-based observation and space exploration tech, pedagogical practices, and physics education. She plans on going to grad school for optical sciences with a long-term goal of becoming a professor.

Nikolas Conmy
Fort Lewis College

Site: University of California Observatories - University of Santa Cruz, CA
Mentors: Nick MacDonald, Chris Ratliff, Deno Stelter

Deformation and Modal Analysis of the SCALES Optical Bench

Santa Cruz array of lenslets for exoplanet spectroscopy (SCALES) is a high-contrast lenslets integrated field spectrograph capable of imaging low light spectral exoplanets, that will be installed in the W. M. Keck observatory. The SCALES optical equipment will be attached to an aluminum 6061 optical bench. Mass needs to be removed from the bench in a way that the bench doesn't lose too much stiffness. Three light weighting methods being considered are to drill holes through the neutral axis of the optical bench, a custom grid cut out of the bottom of the bench to support the areas loaded, or an iso grid. These designs were compared to determine the optimal bench design. These designs were applied to finite element analysis (FEA) models of the optical bench to determine the deformation under gravity, the deformation under optical equipment load. This was used to find the relative angle of tilt of the optics. The natural frequencies were also found for each model. The optimal design suggested by the data is the bench with holes through the neutral axis. This design had the smallest deformation in the vertical direction and the smallest mass. The approximation of the angle of the optics will be used to determine mirror mount adjustments.



Biography:
Nikolas Conmy was born and raised in Maui, Hawaii. In 2018 he enrolled at Fort Lewis College in Durango Colorado to study engineering. Nikolas's passion for engineering came from analyzing mechanical systems as a child and a desire to learn the science behind their construction and material properties. In 10 years from graduation, his goal is to obtain a masters degree and a job working in the automotive or aeronautical industries to create more efficient and sustainable modes of transportation. This interest came from participating in Fort Lewis College's inaugural rocket club which competed in the 2021 NASA Student Launch. Nikolas enjoys mountain biking, surfing, and landscape photography in his free time around
Maui and Durango, Colorado.

Kevin Diep
University of Hawaii at Manoa

Site: W. M. Keck Observatory - Waimea, HI
Mentor: Sam Ragland

Automating Fried's Parameter Storage

Ground-based astronomical observations are distorted by turbulence in Earth's atmosphere. Large telescopes use adaptive optics (AO) systems to apply corrections to wavefront errors, thereby reducing distortion and improving telescope resolution. Our project is an essential part of the W.M Keck Obervatory's ongoing effort to upgrade their AO system by replacing its current licensed commercial software with an open-source alternative. The goal is to write a Python script to estimate and archive turbulence parameters for the Keck All-sky Precision Adaptive Optics (KAPA) project. Utilizing a collection of scripts called P3, we use existing images from actual observation and compute an estimation of seeing parameter for every image. We validate our estimations by comparing the results with Maunakea weather station's MASS/DIMM data and existing on-sky turbulence parameter data. We plot the Fried parameter r_0 of our P3 estimation vs MASS/DIMM values and vs. classic estimation for each image, then create a line of best fit for the observation night. From the fitting, we extract an error term and correlation coefficient to perform a statistic test for agreement. In addition, we included a functionality to plot of the MASS profile as a brief check for data irregularities. Our algorithm can automate calculation and storage of the estimation for multiple observation nights within a single run.

Biography:
Kevin Diep was born and raised on Oahu. He graduated from McKinley High School in 2017. He recently graduated from University of Hawaii, Manoa in 2021 with a Bachelors of Science in Astrophysics and Mathematics. He is currently interested in learning some computer science skills. In his free time he enjoys playing video games, reading manga, watching anime, and hanging out with his friends.

Aidan Griffin
Washington State University

Site: Boeing - Maui Space Surveillance Site - Kihei, Maui
Mentors: Trent Kyono, Jacob Lucas

Using Machine Learning to Achieve Semantic Segmentation of Video

The task of semantic segmentation is to identify and classify every pixel in an image. Using deep convolutional neural networks, we can achieve semantic segmentation over both individual and concurrent frames. We seek to determine the preferred method between the two. Through the training of these multi-channeled networks, we will model linear regression plots to determine and compare loss over the two models. We will utilize an IOU (Intersection Over Union) evaluation metric to grade this accuracy loss. In doing this, we will be able to determine the effectiveness of each of our models.

Biography:
Aidan is a third year student at Washington State University, pursuing a B.S. in computer science. He grew up on Maui, spending time playing pickup basketball and looking for compelling new books. Aidan constantly strives to grow in his knowledge of machine learning and it's wider fields. He is an intent collaborator, eager to lead and contribute in team activities such as Hackathon and Mentor Collective.

Lynzee Hoegger
University of Hawaii at Manoa

Site: Daniel K. Inouye Solar Telescope - Makawao, Maui
Mentors: David Harrington, Andre Fehlmann, Tom Schad, Lucas Tarr

Modelling Atmospheric Transmission for DKIST

DKIST's (Daniel K. Inouye Solar Telescope) scientific goals include making observations of the Sun at wavelengths in which the Earth's atmosphere is highly variable. Because the resolution of DKIST's instruments is so high, these variations in sunlight caused by the atmosphere can be problematic for data collection. MODTRAN (MODerate resolution atmospheric TRANsmission) was used to simulate the changes in atmospheric transmittance and scattering depending on different variables, such as humidity, aerosols, and air mass. Using these simulations, a database was built and interpolated onto the wavelengths most commonly used for DKIST instrumentation. These data were used to analyze the 60 m optical path between the calibration optics box near the top of the DKIST facility and the instrumentation. The database was additionally used to analyze the variations and atmospheric effects on the transmittance and scattering at the 1430 nm wavelength. This wavelength is highly variable, the central wavelength for one of the CryoNIRSP (Cryogenic Near Infra-Red Spectro-Polarimeter) filters, and a critical wavelength for solar coronal measurements. The MODTRAN simulations and further analyses found that the transmittance of light to DKIST at the 1430 nm wavelength is highly dependent on these variables. It was also found that MODTRAN was able to resolve variations even in an optical path length of 60 meters. This database will be useful to future DKIST scientists as it saves time and provides a detailed breakdown of the atmospheric effects on the transmittances for many of the scenarios they may encounter.

Biography:
Lynzee Hoegger is from a small town near Seattle, Washington. She is an Astrophysics major and is currently a rising senior at the University of Hawai'i at Manoa. She is also completing her certificate in Earth and Planetary Exploration Technology and has interests in both space exploration and exoplanet research. Over the last year she has done research relating to black holes and dark energy. After graduating from UH Manoa, she plans to continue her education in Astrophysics. In her spare time, Lynzee likes to play piano, as well as do photography, snorkeling, and hiking.

Zayden Pono Hora
Colorado School of Mines

Site: Institute for Astronomy, Hilo - Hilo, HI
Mentor: Luke McKay

Modeling the UH 2.2m Observatory with Photogrammetry Techniques

The University of Hawaii's 2.2 meter telescope requires maintenance and repairs to maintain functionality and maximum observation time. On-site engineering crews and experts work closely with remote personnel or other observatories to maintain the telescope efficiently, however, various complications make communicating a situation to remote members difficult. There are limited present-day plans/drawings of the telescope components and facility, mainly original drawings that date from the 1960s. To remedy this problem and further streamline this collaboration process at the summit, we first investigated various cost-effective methods of modeling the facility, with the objective of creating a virtual, up-to-date reference of the telescope. One method utilized a ZED stereoscopic camera and its AI-based depth sensor module to mimic laser-scanning techniques to generate a 3D model of the facility in real time. Another method we explored utilizes photogrammetric techniques of collecting large data sets of images of the building (with the ZED and possibly with rigged Canon cameras), thus allowing third-party programs to render an offline (and highly customizable) model of the building from a derived point cloud. I selected and implemented the latter method to collect hundreds of images of the facility per site visit to later render, accounting for lighting, possible points of interest, and other previously overlooked factors. Through this iterative process, we resulted with documented data/instructions of this technique, as well as several models of increasing quality. The result allows for future iterations of this method with better equipment or for possible uses at other sites

Biography:
Born and raised in Hilo on Hawaii Island, Zayden graduated from Kamehameha Schools Hawaii in 2020 and is currently studying Mechanical Engineering at the Colorado School of Mines. During his time in high school, he dedicated much of his time as a steersman in both summer and fall outrigger canoe paddling seasons. He was also a member of the Kamehameha Schools Bowling team, Math League team, National Honor Society, and Japanese Club. Zayden enjoys anything pertaining to the ocean as well as tinkering with Lego and Transformers toys. He aspires to one day become an engineer and apply his skills to solve problems affecting the ocean and his community.

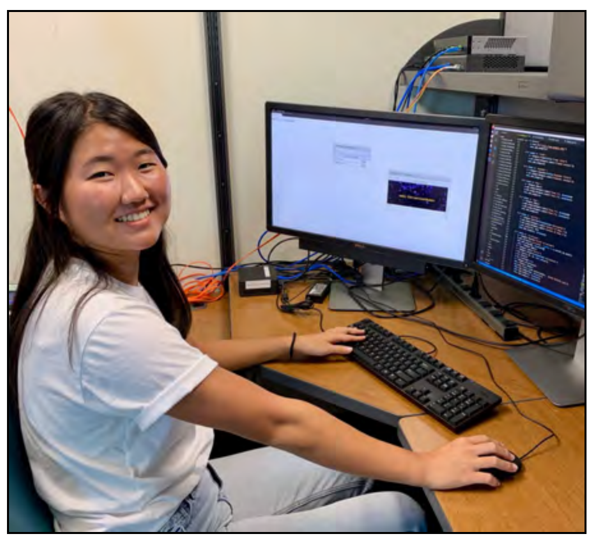
Kyra Ikeda
University of Hawaii at Manoa

Site: Subaru Telescope - Hilo, HI
Mentors: Russell Kackley, Eric Jeschke

Enhancing the Ginga Toolkit for Astronomical Image Viewers to Operate on the Web

The Subaru Telescope Software Division developed Ginga, a Python-based toolkit of GUI (Graphical User Interface) widgets, used to build image viewers for scientific data files taken by the telescope instruments. Currently, Ginga exists solely as a desktop application based on the Qt and Gtk toolkits; however, it would be convenient to allow the Ginga widgets to run on the web as well. This enhancement would provide ease of access for users worldwide and be beneficial for other applications that are based on the Ginga toolkit. The goal of this work is to have the Ginga web widgets closely imitate the functionality and appearance of the desktop version. To build Ginga on the web, encapsulation and abstraction will be employed by creating a wrapper class where the web widgets will be coded. Ginga will use the jQWidgets JavaScript library, JQuery UI, and basic HTML to form the GUI widgets when run on the web. Additionally, a client/server model will be employed including a web socket that provides two-way communication between the client and server. The server side is written in Python, and the client side is written in JavaScript, HTML, and CSS. A spreadsheet listing various Python methods that the widget wrappers have was created to methodically track which ones required implementation or improvements. The progress made during the course of this project will advance Ginga and applications based on it towards the ultimate goal of being fully operable in a web browser.

Biography:
Kyra Ikeda grew up on Oahu and graduated from Pearl City High School in 2017 as a valedictorian. She is currently pursuing a Bachelor of Science in Computer Science at the University of Hawaiʻi at Mānoa. Kyra is a member of her university's Supporting Women in Information and Technology & Computing in Hawaii (SWITCH) club and had the opportunity to serve as vice president. After graduation, she hopes to apply her knowledge of computer science to oceanographic research and be able to benefit the community. Outside of work and school, Kyra enjoys surfing, drawing, and painting.



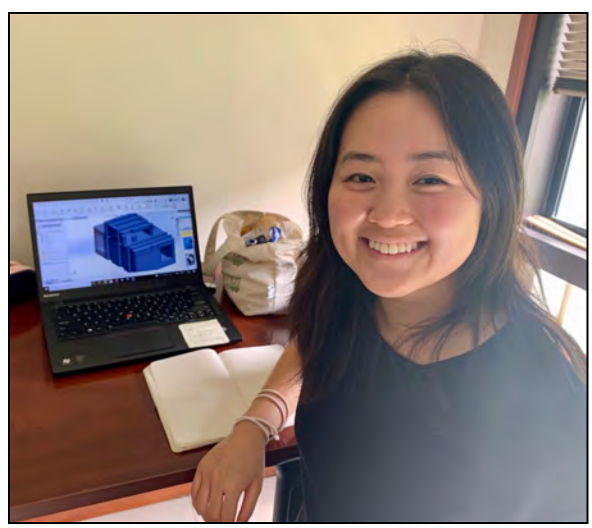
Sydney Kim
University of Hawaii at Manoa

Site: Canada–France–Hawaii Telescope - Waimea, HI
Mentor: Greg Barrick

Designing and constructing mounting system for particle counter deployment at CFHT dome

Dust can impair a telescope by scattering incoming light and reducing the lifetime of the mirror coating. To identify the atmospheric conditions that bring dust into the telescope, Canada-France-Hawaii Telescope (CFHT) will utilize particle counters to monitor air particle levels. However CFHT currently lacks a mounting system that will allow these counters to perform on and around the telescope. A case was designed and constructed to allow the particle counters and their corresponding Raspberry Pi computers to be mounted at various locations within the observatory without impeding their sensing function. The cases are 3D-printed using polylactic acid (PLA) plastic, providing complete access to the necessary power and wire ports, as well as allowing the particle counter and Raspberry Pi computer to be removable for maintenance. The particle sensing abilities of a cased counter and a naked counter were compared to find negligible variation, indicating no interference from the case. These cases will assist CFHT with their observations of dust presence within the dome.

Biography:
Sydney was born in California and raised in Hilo on the Big Island. She graduated from Waiakea High School and is currently attending the University of Hawaii at Manoa pursuing a degree in mechanical engineering. She values collaboration and cooperation in engineering, and aims to advance technology in a way that inspires and unifies people.



Chase Lee
University of Hawaii at Manoa

Site: KBR - Kihei, Maui
Mentor: Jeremy Case

Simulating Drone Flight, Camera Aperture, and Environment for Machine Learning Using Unity

Drone detecting devices are inadequate to where they lose track of drones that go below the horizon. To improve drone detection, images of flying drones need to be supplied. To do this, Unity, a platform for creating real-time 3D content, can be used. Unity can simulate physics and high-definition graphics of drones that can be utilized to improve machine learning (ML) models. Drones can be observed under realistic standards by simulating cameras using Unity. These simulations will fulfill the niche of drone image data needed to improve drone ML models. By using Unity, Proportional Integral Derivative (PID) controllers were added to virtual drone models which imitated realistic flight. These drones were put under different environmental conditions such as day or night. Cameras were also simulated to further improve this technology so that both ideal conditions and non-ideal conditions can be recorded. The simulation output shows drones affected by wind, and under different appearances, whether it be under different lighting or different colors and textures. A large quantity of drone imagery will be produced and will go on to improve ML technology so that the program can not only detect drones beneath the horizon but also detect drones under different circumstances.

Biography:
Chase Lee was born and raised in Honolulu, HI, currently attending the University of Hawai'i at Manoa. Growing up, he particularly enjoyed technology and video games so he is now working towards a Bachelor's degree in Computer Science. In his spare time, he likes to take part in many clubs such as the International Student Association, Game Dev at UHM, and UH Esports. One day Chase hopes to create his own indie game or be a part of a well-respected company, but for now, he is enjoying his educational journey in computer science.

Kyle Lingat
University of Hawaii Leeward Community College

Site: Maui High Performance Computing Center - Kihei, Maui
Mentor: Jeremy Young

Improving the Online Documentation Interface for the PEcoC Cybersecurity System

The Pacific Ecosystem for Cyber (PEcoC) can be described as a real-time, scalable, artificial intelligence and machine learning enabled architecture that continuously advances full-spectrum cyberspace operations in the Pacific. PEcoC carries out a multitude of tasks such as high performance computing, networking and storage, and detecting suspicious traffic. Due to the software complexity, having an interactive online documentation interface to display information on how to use and navigate PEcoC's software, and to educate new users that may not be familiar with the architecture, will benefit users. The current web-based documentation interface uses Sphinx (a Python library that automatically generates a documentation website). However, it lacks modern web design features, user interactivity, and website control. For those reasons, we have decided to investigate a switch of the documentation platform to Docusaurus, a static-site generator built with React. Docusaurus, when compared to Sphinx, is similar in terms of adding content as Docusaurus uses Markdown and Sphinx uses reStructuredText, both being lightweight markup languages and easy to read in their raw form. Docusaurus does offer increased user interactivity with buttons, dropdowns, and more control over the layout and features of the website. However, there are some potential drawbacks to switching over, such as security, deployment, and transition concerns. As far as deployment goes, Docusaurus does build static HTML files from source code but is unable to run without an online or self-hosting server. In regards to the potential transition, it should be smooth as the website does follow a similar layout so most of the content is in the same place and as mentioned earlier editing or adding content is a similar process. Nevertheless, Docusaurus actually does provide secure code as it's widely used by many popular applications.

Biography:
Kyle Lingat was born on the island of Oahu and grew up in the entirety of his life in Waipahu. He graduated from Waipahu High School in 2019. During his time at Waipahu High, Kyle attended classes that taught him programming fundamentals. Kyle now attends Leeward Community College with plans to transfer to UH Manoa to strengthen his programming skills. After graduating, Kyle hopes to become an accomplished app developer. In his free time, Kyle enjoys playing games and going to the gym.

Zachary Mader
University of Portland

Site: Canada–France–Hawaii Telescope - Waimea BI
Mentors: Heather Flewelling, Nadine Manset

Development of a Web Tool to Determine Celestial Visibility

The Canada-France-Hawaii Telescope astronomers and observers presently need a method of determining when observations of certain celestial objects can be made, in order to assist with scheduling of the telescope. The purpose of this project was to develop such a tool, so that when an object's celestial coordinates and a range of time is provided, a user will be provided with information about the visibility of the object at the specified coordinates. Relevant information includes the length and range of time in which the object is visible, as well as an indication of the object's position in the sky. A python script was developed using the library Astroplan, which allows for easy access to object visibility times under restricted conditions. A Graphical User Interface (GUI) was created in HTML, and PHP was integrated to allow for interaction with the python script. The tool also uses the python library matplotlib to display a graph on the GUI, which displays the air mass of the object over the night, specifically for the first night of the indicated time range. As users might plan to observe a single object for extended periods of time, accuracy of the tool was a priority, so in order to verify the accuracy, results were compared to previously known values and existing tools, where the values were found to be within the allotted range of error. Considering these factors, the tool provides relevant information for observers to accurately plan observations during times of visibility for their desired object.

Biography:
Zachary Mader was raised on the island of Hawaii. He is currently pursuing a degree in Computer Science and a minor in Computer Engineering at the University of Portland. Once he graduates, Zachary hopes to work in game design or virtual reality. During his free time, he enjoys playing video games and tennis.

Russ Masuda
University of Hawaii at Hilo

Site: KBE - Kihei, Maui
Mentor: Randy Goebbert

Unified Software Control of an Image Sensing System

The KBR company provides tracking systems for Space Domain Awareness and High Energy Lasers. KBR has acquired a BlackFly USB3 Camera and a motorized C-Mount Zoom/Focus Lens and is interested in integrating this technology into their future tracking systems. Currently, there is no centralized software that controls the functions of both BlackFly USB3 Camera and the C-Mount Zoom Lens. Additionally, KBR has requested an ergonomic graphical user interface (GUI) be developed in order to aid the operator. To resolve this issue a GUI was created using PySimpleGUI allowing the user to control the camera's zoom, focus, exposure, gain, scaling, frame rate fps, and binning functions. This was done by controlling the camera using the Spinnaker API (provided by manufacturer) with the lens controlled by using commands over network connections. To allow for concurrency between the GUI and camera the Python threading library were used. After developing the program, an installation guide and user manual was created to assist with end-user integration. In the future, the program will be used to assist with camera control for a variety of tracking systems.

Biography:
Russ is from Hilo, Hawaii and had recently graduated from the University of Hawaii at Hilo with a degree in Computer Science. In the future he plans to pursue a masters in Artificial Intelligence and enjoys working with neural networks in his spare time. His hobbies include snorkeling, drawing, and playing the ukulele.

Ryan Michaud
California State University, Chico

Site: Institute for Astronomy, Hilo - Hilo, HI
Mentor: Mark Chun

Characterizing a Low-Cost Commercial Camera for use with an Adaptive Optics Wavefront Sensor

The Institute for Astronomy in Hilo is upgrading their adaptive optics system for the UH 88" telescope, and will need a high-speed camera to help detect and correct for continuously changing atmospheric distortions. Specialized cameras made for low-noise and low-latency applications like this can be very expensive, at around $250,000. This project consists of testing certain performance characteristics of a $2,000 commercially-available camera to verify that it meets the needs of the telescope's adaptive optics system. Experiments were designed and implemented using a Raspberry Pi, an oscilloscope, and programs written in C and Python to quantify the frame rate, latency, and noise characteristics of the camera. Latency and frame rate tests have proven that the selected camera is likely to be of sufficient quality to use with the wavefront sensor, however data on other essential characteristics including linearity and certain noise measurements still need to be collected. If the camera satisfies these criteria and is found to be acceptable for use with the adaptive optics system, the telescope will be able to save money on a costly component in the adaptive optics system.

Biography:
Ryan was born and raised in Hilo, Hawaii, graduating from Waiakea High School in 2019 where he was actively involved in the FIRST robotics and CyberPatriot teams. He is currently working towards a Bachelor's degree in Computer Engineering at California State University, Chico. At Chico, he has helped mentor students in a summer engineering program and is also working with the Micromouse team to make a maze-solving robot. After graduating, he plans to get a job in the field of computer hardware design or computer security.

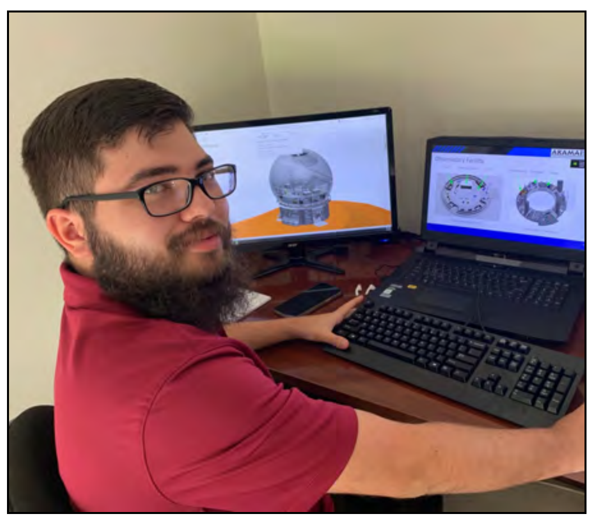
Evan Miyahara
University of Hawaii at Manoa

Site: Canada–France–Hawaii Telescope - Waimea, HI
Mentors: Ivan Look and Raycen Wong

CFHT/MSE Observatory Building and Facility Spatial Analysis and Review of Emergency Exit/Handling and Lifting Equipment

In the coming decade, Canada-France-Hawaii Telescope (CFHT) will evolve into the Maunakea Spectroscopic Explorer (MSE), a wide-field optical and near-infrared facility dedicated to multi-object spectroscopy of millions of astrophysical objects. The design of the MSE telescope will require reuse and modification of the existing CFHT observatory structure. CFHT is assembling a "Full-Up" working model to demonstrate the intentions for the new observatory. To achieve this, its designers must identify necessary changes to the facility such as emergency exits, hardware storage, labs, shops, and the handling and lifting equipment that will support the new telescope design. All of these items were evaluated for safety and efficiency within the planned operational parameters of the MSE. Using SolidWorks CAD modeling software, a spatial analysis of the basement level, first floor, and observing floor was performed, along with a review of lifting and handling equipment. The spatial analysis resulted in the redesign of several walls and rooms to facilitate emergency egress from the basement level. A full review of lifting and handling equipment throughout the observatory was performed to ensure all equipment will be capable of supporting day-to-day MSE operations, and new telescope enclosure cranes were recommended. The spatial analysis, together with the performed review, support the continued design work on the MSE Observatory Building Facility (OBF) document.

Biography:
Evan Miyahara was born and raised in Waipahu, Hawaii. He's always been interested in designing and building things. This led him to pursue a Bachelor of Science in Mechanical Engineering. Evan graduated from the University of Hawaii at Manoa this past Spring. His passions are rockets, cars, planes, and engineering for the future. As a result, he wishes to pursue a career in the Aerospace engineering industry. For most of his life, he has been a part of the scouting program achieving the rank of Eagle in 2017. Through these experiences, Evan realized that he enjoys the opportunity to work with energized peers to achieve a common goal.



Ka'ulu Ng
University of Portland

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

SCALES Diffraction Grating Design for Efficient Exoplanet Spectroscopy

The Santa Cruz Array of Lenslets for Exoplanet Spectroscopy (SCALES) project uses a chronograph to block out light from stars close to exoplanets of interest and uses a spectrograph to determine the molecular composition of the atmosphere. One portion of the spectrograph, a grating, breaks up the light and spreads the central wavelength out to allow accurate spectroscopy to occur. The grating design in this project targets medium and high spectral resolution values for accurate spectroscopy and will utilize a blaze angle to optimize the grating for K-Band, L-Band, and M-Band bandpasses. Starting with the targeted spectral resolution values, we used C++ code to calculate the optimal parameters for each grating by solving for angle of diffraction and spectral resolution by iterating through ranges for order, incident angle, and groove density. GSolver, a software used to do Rigorous Coupled Wave Analysis, was used to calculate the efficiency of the gratings by determining the intensity of light in each reflected order. GSolver enabled us to use the outputs of the C++ code to test the efficiencies of the theoretical grating with various blaze angles. Graphical analysis of efficiency versus blaze angle and efficiency versus wavelength was used to determine the final parameters. These grating parameters will be sent to a vendor for manufacturing the gratings to be used in the SCALES spectrograph for efficient medium and high resolution spectroscopy.

Biography:
Ka’ulu Ng was born and raised in Honolulu on the island of Oahu, Hawai’i. He is a 2017 graduate of the Kamehameha Schools Kapalama campus, who is now a 2021 graduate of the University of Portland with a major in Electrical Engineering with a minor in Computer Science. He hopes to enter the consumer electronics industry by working for Intel, Garmin, Apple, Sony, or Microsoft. When he’s not studying or working, he enjoys going to the beach, cardistry, ukulele, and playing sports.

Dennis Palad
Rochester Institute of Technology

Site: W. M. Keck Observatory - Waimea, HI
Mentor: Sam Ragland

Developing Graphical User Interfaces for Keck All Sky Precision Adaptive Optics

The Keck All Sky Precision Adaptive Optics (KAPA) project is centered around a monumental upgrade to the Keck I adaptive optics (AO) system. This upgrade focuses on enabling a four laser guide star system called Laser Tomography AO (LTAO) at Keck. To facilitate this upgrade, new graphical user interfaces (GUIs) needed to be developed. Relevant tools include the Wavefront Sensor (WFS) Display, AOoper, Geevum Hand Paddle, Laser Tip/Tilt Graph, and Laser User Interface. This update in GUI tools was accomplished using the kPyQt GUI module in Python and Keck EPICS channels and keywords for input and output streams. New functionalities added allow observers using the GUIs to display images and graphs for LTAO, read and parse catalogs, and communicate with a new Python Sequencer for the telescope and AO states. These GUIs were designed to maximize screen space, feel intuitive to navigate, function similarly to old designs, remain consistent in design, and implement new capabilities without straying from older GUI design. GUI designs were presented to the observing team at Keck and adjusted accordingly. Once the KAPA project is ready, it is recommended that these GUIs be used all together as the main observing tools for the LTAO configuration.

Biography:
Dennis Palad graduated from Hilo High School in the Class of 2018. He is currently a Junior at Rochester Institute of Technology currently pursuing a Bachelor's of Science degree in Computing Security with a minor in Economics. His goal is to pursue a career in Software Security.

Dane Payba
University of California, Los Angeles

Site: KBR - Kihei, Maui
Mentor: Oliver Grillmeyer

Visualizing Natural Language Processing Results on Performance Work Statements

Performance Work Statements (PWS) provide information for the work that is to be accomplished for specific contracts in the DoD. There exists a large corpora of historical textual data containing PWS that are ingested into digital format for advanced analytics. There is currently an HPC-backed machine learning solutions project deployed, utilizing Natural Language Processing (NLP) and BERT transformers to develop a big data analytics pipeline geared towards text analysis. At this state, this analysis is displayed solely in numerical form. The output is complex to digest for the user and would greatly benefit from a visual presentation of information. Visual results are much easier to process in contrast to the previously mentioned quantitative data and provide much greater insights into the structure of data. Word frequencies, combinations, and patterns are all examples of the current output. Utilizing the visualization software of Tableau and MatPlotLib, numerical results were processed to create charts, word clouds, distributions, graphs, and histograms based on the resulting text analysis after undergoing NLP. By obtaining visualizations of this data, meaningful analysis of the NLP model and PWS will be achieved. Examples include the ability to see most common words in the corpora of text, provide insights into the structure of textual data, obtain quick information without searching through numerical output, and the transformation of data through heatmaps, precision-recall curves, and confusion matrices. Through visual analysis, feedback about the machine learning model analysis can be enhanced, allowing the opportunity to better see the results of NLP processing.

Biography:
Dane Payba was born and raised in Maui and graduated from Maui High School as Valedictorian in 2020. He is currently going into his second year at the University of California, Los Angeles, majoring in Computer Science. Over the years, Dane has developed a deep passion for the Machine Learning and Artificial Intelligence field, developing numerous related projects, joining multiple competitions, and even an active part of the Association of Computing Machinery, Advanced AI pathway at his school. In his free time, he enjoys helping others, going to the beach, exploring the island, and playing tennis, even being a part of the club team at UCLA.

Brittany Ann Ramos
University of Hawaii at Manoa

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

Evaluating the Efficiency of Fiber Optic Observations within FOBOS

Fiber Optic Broadband Optical Spectrograph (FOBOS) is an instrument concept for Keck Observatory that utilizes fiber optics to observe targets within its field of view. FOBOS uses more than 2000 Starbug fiber positioners to move two different fiber modes at the focal plane, single-fiber apertures and 37-fiber Integral Field Units (IFU's), enabling both integrated and spatially resolved observations. By providing thousands of apertures with multiple formats, FOBOS aims to quickly and efficiently observe large, statistical samples. Here, we explore how efficient FOBOS observations will be in an effort to understand how best to optimize FOBOS operations. We have developed Python code that assigns FOBOS apertures to targets using linear sum assignment, and we evaluated the results by calculating the observing efficiency (the fraction of all apertures assigned to targets in each observation) and sample completeness (the fraction of targets observed over all observations) as a function of the target density. In combination, these values produce a figure-of-merit that allows us to identify when the cost of continuing an observing program worsens. We find this transition generally occurs once an observing program can only allocate ~80% of FOBOS apertures to targets. Depending on whether the program requires single-fiber apertures or IFU's, individual observing programs can expect to observe 75-85% of their targets before observational cost increases. In the future, we aim to show that this can be improved by observing multiple observing programs simultaneously.

Biography:

Brittany Ann Ramos was born and raised on Oahu, Hawaii. After graduating from Kapolei High School in 2016, she attended University of Hawaii - West Oahu and Leeward Community College and is now currently a senior pursuing her Electrical Engineering degree at University of Hawaii - Manoa with a concentration of Electro-Physics and a minor in Business. After graduating, Brittany plans to give back to her community by obtaining a STEM-related profession in Hawaii.

Sebastian Rodriguez
Oregon State University

Site: Daniel K. Inouye Solar Telescope - Makawao, Maui
Mentors: David Harrington, Andre Fehlmann, Tom Schad, Lucas Tarr

DKIST Interpolation Database

Daniel K.Inouye Solar Telescope (DKIST) is the world's largest solar telescope. DKIST passes 300 watts of optical power through a complex optical path including the earth's atmosphere at various zenith angles as well as an additional 60 meters of travel within the facility. The telescope is subject to a wide range of atmospheric factors which obscure solar radiation. Optical components are subjected to fluctuating thermal stresses, which vary with these atmospheric conditions. MODTRAN, an atmospheric simulator, had been used to design a database that interpolates wavelength and transmission data to better understand the effect thermal loads have on optics. A wide range of modeled atmospheric conditions were fed into a python program designed to calculate their impacts on the telescope's main components. This data was packaged in a way that could easily be accessed or appended by researchers on the summit. The resulting array of atmospheric factors were analyzed and cataloged for DKIST's calibration. Thermal calculations were derived and compared to actual telescope data. Some of the database's outputs include: total heating flux absorbed by the optic, approximate temperature ranges at specific wavelengths, and plotted absorption curves over all of DKIST's functional wavelength ranges. The database will help researchers evaluate the thermal strain on optical components. DKIST researchers can retrieve data from our archives to assess heating under a range of conditions.

Biography:
Sebastian Rodriguez grew up on the island of Oahu. He graduated from Kapolei High in 2017 and is currently pursuing his bachelor's degree in mechanical engineering with a minor in aerospace engineering at Oregon State University. Sebastian is a resilient worker who excels at thermal management and prototype development. He hopes to apply these skills in the aerospace sector- optimizing thermal management systems for efficient/green passenger transport. When he is not busy with school, Sebastian enjoys going to the beach, playing the guitar, and camping.

Leinani Cathryn Roylo
Brown University

Site: W. M. Keck Observatory - Waimea, HI
Mentors: Truman Wold, Jim Thorne, and Joel Payne

Creating a Safer Work Environment during Segment Exchanges

The primary mirrors of the W. M. Keck Telescopes are each composed of 36 segments. Six segments are changed out every month for cleaning, recoating, and repairing. During segment exchanges, a technician is required to stand under a 1000lb suspended mirror segment to manually clean the transportation cart attachment points and also manually guide the segment onto the cart. The safety of the technician under the load is not guaranteed, so a solution is needed to protect them. The first step was to understand the process of segment exchanges to define the requirements of the solution, then conceptualize and compare solutions. During the requirement process, the segment exchange procedure was divided into two parts resulting in the need of two different solutions. The first solution required a safety structure, while the second solution required an alignment tool. From our analysis of the safety structure, it is recommended to implement a cage system that will prevent the fall of a suspended load by supporting the segment on three posts and protect the technician. It is also recommended to utilize a temporary bumper alignment tool to guide the radial post in the middle of the mirror segment during the second part of the segment exchange process. Both solutions are preliminary conceptual designs. The safety structure progressed more through the design process, in which initial finite element analysis was conducted to ensure proper dimensions and initial off-the-shelf parts were identified.

Biography:
Leinani is from Mililani, O'ahu and graduated from Kamehameha Schools Kapālama in 2017. She recently earned her Bachelor of Science degree in Mechanical Engineering from Brown University. At Brown, she founded and led Brown's Hawai'i club, Hawai'i at Brown, and was heavily involved in the design curriculum for her school's introductory engineering course. Leinani will continue her education by pursuing a master's degree in Brown's 5th-Year Master's Engineering Program, focusing on Solid Mechanics. She hopes to pursue a career that involves improving the safety and efficiency of engineered objects.

Jacob Simons
Seattle University

Site: Smithsonian Astrophysical Observatory - Hilo, HI
Mentor: Ramprasad Rao

Development of a Visualization Front End for an Updated Database

The current Submillimeter Array (SMA) PostgreSQL database visualization tool is outdated with limited graphing options, non-interactive graphs, and cannot easily make permanent graphs. A new visualization tool is required to replace the current one with updated features that solves the current one's limitations. The new visualizer will generate graphs using a graphing program called Grafana. The new tool will act as an interface for Grafana in order to streamline the creation of modernized interactive graphs. To collect the user's input, a web-based front end is used to build a JSON query to represent a Grafana graph. The query is then sent to Grafana through it's API to build the customized graph. The web based interface was built with Flask in order to make it simpler so that focus could be shifted towards mimicking Grafana's capabilities. The current iteration of the tool is capable of creating new dashboards with graphs, deleting dashboards, and creating temporary graphs. The new tool will need continued work later on to implement the update dashboard feature, add more graphing options, and improve the layout of every page.

Biography:
Jacob was born, raised in Hilo and graduated from Waiakea High School. During his senior year in high school he took a computer science class which sparked his interest in coding. He is now attending University of Seattle pursuing a degree in Computer Science. Computer science has become a passion for him as he enjoys coding small projects in his free time. He hopes to get more experience in the field of programming and earn a job as a software engineer.

George Emil Villanuevas
Oregon State University

Site: Air Force Research Laboratory - Kihei, Maui
Mentor: Ryan Swindle

Creating an As-built Mechanical Model for HiVIS to Identify Upgrade Locations

The Air Force Research Laboratory plans to upgrade their High Resolution Visible and Infrared Spectrograph (HiVIS) on its AEOS telescope in order to improve its performance. These consist of an infrared polarimeter and a dichroic mirror between visible and infrared channels. However, in order for these upgrades to be added the space and space limitations that the upgrades will be placed in must be determined. The focus of the project is to easily determine the design limitations and placement of the upgrades as the only current methods to determine them are from part drawings or by physically dismantling the instrument. To determine the space and space limitations, a mechanical computer aided design or CAD model of HiVIS was constructed using a 3D CAD software called SolidWorks. Using data from existing part drawings, the parts were modeled in 3D. Each portion of the spectrograph was modeled separately beginning with the parts in the infrared channel then the visible channel. After the parts were modeled, they were then assembled into their components and then arranged based on the light ray pattern from an optical design software known as Zemax. As a result, by completing the mechanical CAD model of HiVIS the location and space constraints for these optical upgrades could be accurately determined within the CAD model. Furthermore, mount designs for the optics within these upgrades are to be designed utilizing the discovered limits and tolerances. In the future, this CAD model could be utilized for determining future upgrade placements and designs.

Biography:
George Villanueva was born and raised in Kahului, Maui and graduated from Maui High School in 2019. He is an upcoming third year at Oregon State University majoring in Mechanical Engineering and pursuing a minor in Aerospace Engineering. He has interest in CAD design, robotics, 3D printing and aerospace technology. George is the upcoming Event Coordinator for OSU's Society of Asian Scientist and Engineers Chapter and looks forward to becoming an active member in OSU's AIAA Club. After graduation, George eventually plans to work for companies such as NASA, SpaceX, or Boeing or return home to work in Hawai'i. In his free time, he enjoys spending time with friends, playing video games, watching anime, and graphic design.

Akamai Internship Program

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

The 2021 Akamai Internship Program placed 24 college students from Hawaiʻi at the following organizations to complete a seven-week project:

- Air Force Research Laboratory
- Canada-France-Hawaii Telescope
- Daniel K. Inouye Solar Telescope
- KBR
- Maui High Performance Computing Center
- Smithsonian Astrophysical Observatory
- Subaru Telescope
- University of California Observatories
- University of Hawaiʻi Institute for Astronomy
- W.M. Keck Observatory

AWI currently receives funding and other support from:

- U.S. Air Force
- Hawaii Community Foundation Career Connected Learning Program
- Daniel K. Inouye Solar Telescope
- University of California Observatories
- W.M. Keck Observatory (some via NSF AST-1836015)
- Maunakea Observatories
- Univ. of Hawaii Institute for Astronomy (via NSF AST-712014)

For more information please contact:

Lisa Hunter, Director, Akamai Workforce Initiative
UCSC Institute for Scientist & Engineer Educators
(831) 459-2416, lhunter@ucsc.edu

http://akamaihawaii.org