AKAMAI WORKFORCE INITIATIVE

Summer Internship Symposium
Project Abstracts

Maui August 6, 2018
University of Hawaiʻi, Maui College

Hilo August 8, 2018
Grand Naniloa Hotel

Waimea August 10, 2018
W.M. Keck Observatory Headquarters

Pasadena August 14, 2018
TMT Project Office

UNIVERSITY OF CALIFORNIA SANTA CRUZ

ISEE Institute for Scientist & Engineer Educators

Advancing Hawaiʻi college students into science and technology careers

2018 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.

2018 Host Organizations

Hilo, Hawaiʻi Island

- Gemini Observatory
- Hawaiʻi Electric Light Company (HELCO)
- Pacific International Space Center for Exploration Systems (PISCES)
- Smithsonian Submillimeter Array (SMA) / Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
- Subaru Telescope
- University Of Hawaiʻi at Hilo
- UH Institute for Astronomy

Kawaihae, Hawaiʻi Island

- Liquid Robotics

Kona, Hawaiʻi Island

- Akabotics LLC
- Natural Energy Laboratory of Hawaiʻi Authority (NELHA)

Waimea, Hawaiʻi Island

- W.M. Keck Observatory
- Canada-France-Hawaii Telescope (CFHT)

Kahului, Maui

- HNu Photonics

Kihei, Maui

- Air Force Research Laboratory (AFRL)
- Akimeka LLC
- Integrity Applications Inc/Pacific Defense Solutions (IAI/PDS)

Pukalani, Maui

- Daniel K. Inouye Solar Telescope (DKIST)
- UH Institute for Astronomy

Pasadena, CA

- Thirty Meter Telescope International Observatory (TIO)

Santa Cruz, CA

- TMT/UC Observatories (WFOS)

AKAMAI WORKFORCE INITIATIVE

ISEE Institute for Scientist & Engineer Educators

Akamai Workforce Initiative 2018

Staff

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

Lisa Hunter, Director
Austin Barnes, Akamai Program Manager
Nicole Mattacola, Program & Event Coordinator
Jerome Shaw, Associate Director, Akamai R&D
Rafael Palomino, ISEE Program Manager
Nicholas McConnell, ISEE Program Manager

2018 Akamai PREP Course Instructors

Austin Barnes, Lead Instructor	ISEE/UCSC
David Harrington, Co-lead Instructor	Daniel K. Inouye Solar Telescope
Jerome Shaw	ISEE/UCSC
Nicholas McConnell	ISEE/UCSC
Rafael Palomino	ISEE/UCSC
Lauren Anderson	Flatiron Inst., Ctr. for Comp. Astrophysics
Devin Chu	UCLA, Physics & Astronomy
Elizabeth Koeman-Shields	UH Manoa, HIGP
Grace Lin, Team Leader	Data Scientist at StoryFit
Geetanjali Rakshit	UCSC, Computer Science
Stacey Sueoka, Team Leader	Daniel K. Inouye Solar Telescope

2018 Communication Instructors

Austin Barnes, Co-lead Instructor	ISEE/UCSC
Rafael Palomino, Co-lead Instructor	ISEE/UCSC
Lisa Hunter	ISEE/UCSC
Michael Nassir	Univ. of Hawai‘i at Manoa
Jerome Shaw	ISEE/UCSC
Nicholas McConnell	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 2018 Internship Program. We apologize if we have left your name off; thank you all for your contributions!

2018 Akamai Selection Committee
Joey Andrews (Akimeka), Dennis Douglas (IAI), Angelic Ebbers (Gemini), Justin Fletcher (Air Force), Cindy Giebink (IfA Maui), David Harrington (DKIST), Joseph Janni (Air Force), Peter Konohia (Akimeka), Mary Beth Laychak (CFHT), Pamela Madden (NELHA), Heather Marshall (DKIST), Luke McKay (IfA Hilo), Mike Nassir (UH Manoa), Lucio Ramos (Subaru), Ramprasad Rao (ASIAA/SMA), Devin Ridgley (HNu Photonics), Ranjani Srinivasan (ASIAA/SMA), Chris Stark (Gemini), Ryan Swindle (AFRL), Truman Wold (Keck)

2018 Akamai Mentor Council
Dennis Douglas (IAI), Angelic Ebbers (Gemini), Cindy Giebink (IfA Maui), David Harrington (DKIST), Mary Beth Laychak (CFHT), Keith Olson (NELHA), Kiaina Schubert (Subaru), Ranjani Srinivasan (SMA/ASIAA), Ryan Swindle (AFRL), Warren Skimore (TMT), Truman Wold (W.M. Keck)

Air Force Research Laboratory
Capt Justin Fletcher. *Mahalo for mentoring!*

Akabotics LLC
Monica Parks and Newton Parks. *Mahalo for mentoring!*

Akimeka LLC
Peter Konohia, Rob Nelson, Desislava Iorgova, and Joey Andrews. *Mahalo for mentoring and hosting our Maui selection committee meeting!*

Canada-France-Hawaii Telescope
Doug Simons, Mary Beth Laychak, Windell Jones, Nadine Manset, Callie Crowder, Steven Bauman, Steve Hughe. *Mahalo for mentoring and providing housing for our interns!*

Daniel K. Inouye Solar Telescope (DKIST)
David Harrington, Stacey Sueoka, Bill McBride, Paul Jeffers, Chriselle Galapon, Brialyn Onodera. *Mahalo for being a sponsoring partner, mentoring, and providing PREP instructors!*

Gemini Observatory
Chas Cavedoni, Angelic Ebbers, Chris Stark Tom Cunning, Steve Hardash and Stacy King. *Mahalo for mentoring and hosting our Hawai'i Island selection committee meeting!*

Hawaii Electric Light Company (HELCO)
Riley Ceria, Kandice Kubojiri, Kim Tabac, Jashar Day, Mel Higa, Jessica Vargas, Nelson Nishimoto. *Mahalo for mentoring.*

HNu-Photonics
Devin Ridgley, Riley Aumiller. *Mahalo for mentoring.*

Institute for Astronomy, Hilo & Maui
Marc Cotter, Luke McKay, Mark Chun, Dan O'Cara, Cindy Giebink. *Mahalo for mentoring.*

Integrity Applications Incorporated/ Pacific Defense Solutions
Dennis Douglas. *Mahalo for mentoring and hosting our intern meetings!*

Liquid Robotics
Billy Middleton, Pono Thronas, Stacey Sueoka. *Mahalo for mentoring!*

Natural Energy Laboratory of Hawaii Authority NELHA
Pamela Madden, Keith Olson. *Mahalo for mentoring and hosting our weekly intern meetings!*

PISCES
Kyla Defore, Christian Anderson. *Mahalo for mentoring!*

Smithsonian Submillimeter Array SMA/ Academia Sinica Institute of Astronomy and Astrophysics ASIAA
Simon Radford, Ranjani Srinivasan, Derek Kubo, Ramprasad Rao, Matt Cooper Peter Oshiro, Geoffrey Bower. *Mahalo for mentoring!*

Subaru Telescope
Tom Winegar, Yuko Kakazu, Russell Kackley, Lucio Ramos. *Mahalo for mentoring, participating in our PREP course.*

Thirty Meter Telescope International Observatory
Sandra Dawson, Gary Sanders, Warren Skidmore, Lianqi Wang, Kyle Kinoshita, Gelys Trancho, Amir Sadjadpour, Holly Novak, Magnolia Ycasas, John Miles, Kayla Hardie, Brady Espeland, Eric Wilde. *Mahalo for mentoring and being a sponsoring partner!*

TMT/UC Observatories (WFOS)
Renate Kupke, Daren Dillon, Nicholas Macdonald. *Mahalo for mentoring*.

University of Hawai'i at Hilo
Donald Straney, Dr. Heather Kaluna, Dr. Joseph Masiero. *Mahalo for mentoring and continuing to provide housing for the Hilo interns!*

University of Hawai'i Maui College
Mark Hoffman, Elisabeth Dubuit, Jung Park, Lui Hokoana, Lani LeBron. *Mahalo for your partnership since the inception of Akamai, all of your help this year.*

W. M. Keck Observatory
Hilton Lewis, Rich Matsuda, Jeannette Mundon, Truman Wold, Sam Park, Matthew Brown, Sam Ragland, Peggi Kamisato. *Mahalo for mentoring and more!*

Jaren Ashcraft
University of Rochester

Site: Lick Observatories - University of California, Santa Cruz
Mentors: Renate Kupke, Daren Dillon, Nicholas Macdonald

Characterization of Near-Field and Far-Field Illumination Patterns from Multimode Optical Fibers for Fiber-Fed Spectrographs

The Thirty Meter Telescope (TMT) is considering the implementation of fiber-fed spectrographs (i.e. WFOS, PSI) due to the advantages of stability achieved by optical fibers. Before incorporating these fiber feeds into the constructed instrument the fibers must be characterized for certain quantities that will inevitably affect the performance of the instrument. The purpose of this project is to assemble a test bench that will characterize the mode scrambling efficiency (MSE) and focal ratio degradation (FRD) of multimode optical fibers. The test bench couples broadband visible light into a fiber and then images the near-field and far-field illumination patterns onto cameras at the input and output of the fiber. The recorded near-field illumination profiles will inform users of the MSE, and determine the spatial homogeneity of the light out of the fiber face. The far-field profiles will assist users in examining FRD, which could result in throughput variations to the telescope instruments. This test bench is constructed to accommodate a variety of optical fibers so that it can be used to characterize the fibers for multiple instruments. Initial results for the square and circular core fibers being considered for the Automated Planet Finder's spectrograph are presented to demonstrate the capabilities of the test bench.

Jaren was born and raised in Waikoloa Village on the Big Island of Hawaii, where he cultivated his love of sciences in the presence of the telescopes on Mauna Kea. Currently, he is enrolled in the University of Rochester's Institute of Optics pursuing a major in Optics and hopes to pursue a graduate program in Optics or Astronomy after graduation. His primary interests include the development of optical systems for telescopes and spacecraft, and novel laser systems. STEM education and outreach is of incredible importance to him, and he wishes to one day return to Hawaii to work on STEM enrichment programs within the public school system. Presently, Jaren involves himself in his community by acting as President of the OSA: Student Chapter and spearheading educational development initiatives for the Institute of Optics. Outside of his schooling, Jaren relaxes by enjoying the outdoors, rock-climbing, and amateur astronomy.

Alec Bayer
University of Hawai'i Maui College

Site: University of Hawai'i Institute for Astronomy, Maui
Mentors*:* Daniel O'Gara, Cindy Giebink

Designing and Building a Virtual Air Traffic Radar with a Graphical Interface

The University of Hawai'i Institute for Astronomy (IFA) participates in Satellite Laser Ranging, which is the process of obtaining satellite position data from the roundtrip time of an ultrashort laser pulse. A powerful laser located at the Transportable Laser Ranging System-4 site is used for this process, and it must avoid adjacent air traffic. To protect air traffic, staff, called spotters, observe the sky and stop the laser when needed. In order to assist spotters, plane position data that is broadcast at 1090MHz, known as Automatic Dependent Surveillance-Broadcast(ADS-B) data, has been used by consumer and commercial grade equipment to plot air traffic. However, both consumer and commercial ADS-B tracking systems have drawbacks such as not plotting in real-time, or lacking customization capability due to the required use of proprietary software. This project solved these limitations by designing and building a custom system using consumer hardware and open-source software to meet the IFA's needs and serve as a flexible, cost-efficient alternative. The receiver system was made from an antenna that connected to a software-tunable radio receiver dongle tuned to 1090Mhz, and a Raspberry Pi running the open source program, dump1090. ADS-B data was then processed by an existing calculation software, which was translated from Fortran into C, and had its output stage reconfigured for use with a modified Graphical User Interface (GUI). The final system plots plane data to a Linux application in real-time using a sky plot view, and also lists the data of each plane in a table. The program provides spotters with a nearby plane's azimuth, elevation, latitude, longitude, and distance, as well as auditory notifications. This virtual radar system is planned to be implemented as a form of assistance for spotters on the summit of Haleakala after final tests have been conducted by IFA staff. In the future, updates could be made such as, including flight numbers for commercial airlines, plotting the laser's current pointing angle, or even reworking the GUI into a web-based program.

Alec Bayer first became a Maui resident at a young age when his parents brought their family business to the island. Although they had to move back to the mainland a few years later, Alec returned to become a University of Hawai'i Maui student after completing initial schooling in Houston, TX. Alec has since completed an AS in Electronic & Computer Engineering Technology, and is pursuing a BAS in Electrical Engineering through Arizona State University's online division. In his free time Alec utilizes his technical skills by repairing music equipment for music studios and venues, in addition to volunteering at Mana'O Radio.

Romilly Benedict
George Mason University

Site: Natural Energy Laboratory of Hawaii Authority
Mentors: Pamela Madden, Keith Olson, Jan War, Dean Towle

Microplastics in NELHA Pipelines

Natural Energy Laboratory of Hawaii Authority (NELHA) pumps deep and surface seawater through a series of pipelines and supplies it to clients. Recently, these clients have become curious about the possible concentration of microplastic particles in the pipelines. Microplastics are plastic particles under 5 mm that are a pervasive and potentially harmful pollutant in ocean water. Since NELHA has not previously characterized this pollutant, the purpose of this project was to determine the concentration of microplastics in the pipeline system and in the nearshore waters fronting NELHA. Four pipelines were sampled: two surface pipelines at 80 feet deep and two deepsea pipelines at 2,000 and 3,000 feet deep. Samples were also collected from the surface waters around the facility. Samples were collected in 0.333 mm nets and then sieved to isolate particles between 5 mm and 0.333 mm in diameter. Next, natural organic matter was oxidized using concentrated hydrogen peroxide with iron sulfate as the catalyst in a process called wet peroxide oxidation. Plastic particles were then separated using a dense sodium chloride solution. Finally, particles were examined under a microscope for verification and then weighed to determine the total mass of plastic in the known volume of water. Results indicate that microplastic is present in both the deepsea and surface seawater pipelines. Surface net trawls revealed higher concentrations of microplastic in the nearshore ocean waters fronting NELHA. This aligns with other research which has found that microplastic particles are present throughout the world's waters, and tend to exhibit greater concentrations at the surface compared to the water column.

Romilly was born in Austin, Texas and moved to Waimea, Hawaii when she was three-years-old. She graduated from Honoka'a High School in 2017 and is currently a freshman at George Mason University in Virginia. She is majoring in Chemistry with a concentration in Environmental Chemistry and intends to work in the field of forest restoration. In her free time she reads, creates art, and plays underwater hockey.

James Boyd
University of Hawai'i at Hilo

Site: Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
Mentors: Ranjani Srinivasan, Geoff Bower

Improving YTLee Array Data Storage and Visualization

The Yuan-Tseh Lee Array (YTLA) is a radio interferometer, located on Mauna Loa, Hawai'i. YTLA's current project involves observations of carbon monoxide from the early universe. To ensure smooth operations, key parameters have to be recorded and archived. At the present, that data is stored in text files and a Redis datastore that resides in primary storage. Primary storage is less abundant than secondary storage, and there is a risk that the YTLA will collect more data than it has primary storage. Right now, there is no interactive user interface for visualizing this data. Visualizing data returned from user generated queries with graphs will expedite analysis and diagnostics. I created a decoupled Python application featuring MongoDB, another data storage solution that writes data directly to secondary storage and is easier to maintain than other databases. I also created a user-friendly interface to Plotly, a Python data visualization library. The future of this project is to use these newly created tools to monitor additional telescope metadata to further augment YTLA's research capacity.

James Boyd is from southeastern Louisiana and moved to the Big Island in March, 2017. Currently, he is enrolled at the University of Hawaii at Hilo, pursuing a major in Computer Science and hopes to develop software after graduation. He has a particular interest in Python. Presently, James serves his community by picking up rubbish. Outside of his studies, James relaxes by visiting tide pools and playing fetch with his dog, Kyna.

Malcolm Chun
Electronics Technology - Hawai'i Community College

Site: Institute for Astronomy, Hilo
Mentors: Marc Cotter, Luke McKay

UH88 Telescope Dome Shutter Motor Test Cell

The UH 2.2m Telescope ("UH88") was constructed in 1968 and saw first light in 1970. One of the main mechanisms of the telescope are the two dome shutter doors. Each door weighs 22,000 pounds, together they weigh 44,000 pounds. These doors are controlled by four synchronous AC motors which open and close them remotely during telescope operations at night. The operator has no knowledge of the velocity or position of the shutter doors except for end-of-travel, when the doors make contact with the limit switch. The limit switches are mounted in eight locations on the shutter opening (one on each corner of each door). When a door contacts a limit it disconnects signal to a contactor, which shuts power to both motors on that door. The shutter door motors are 50- plus years old and Institute for Astronomy (IFA) needs to upgrade the motor drive system to newer technology. The main upgrade is to replace all four of the current synchronous AC motors with variable frequency drive (VFD) motors. My project is to design and fabricate a test cell to run one of the new VFD motors which will be controlled by a variable frequency controller (VFC). I designed and fabricated a test cell that is both portable and flexible. Since a VFD motor weighs 38 pounds, I had fabricate the test cell in two pieces. One is the plate to mount the motor, and the other unit is a stand to mount the controller. With the new controller, the operator can monitor the parameters of the new motors, such as amperage, power, frequency, and torque values via computer networking. This is an invaluable method of testing and programming the new motors utilizing the portable test cell that I designed and fabricated during my internship with IFA. IFA will utilize the data collected for analysis of replacing the four motors and also for training.

Malcolm Chun is from the island of Oahu and moved to Hilo, Hawaii in 2014 after retiring from the Hawaii Air National Guard. He is pursuing his degree in Electronics Technology from Hawaii Community College, where he will earn his Associate in Applied Science. After graduation, he wants to pursue a career in telescope instrumentation. He volunteers as a mentor for the FIRST (For Inspiration and Recognition in Science and Technology) Robotics team (Hilo Viking Robotics 1378) at Hilo High School, where he teaches theories and application of machining and welding to high school students. His team placed 2nd at the Hawaii Regional Competition this March 2018 and qualified by earning the Engineering Inspiration Award. In his free time, he enjoys archery, astronomy, and free diving.

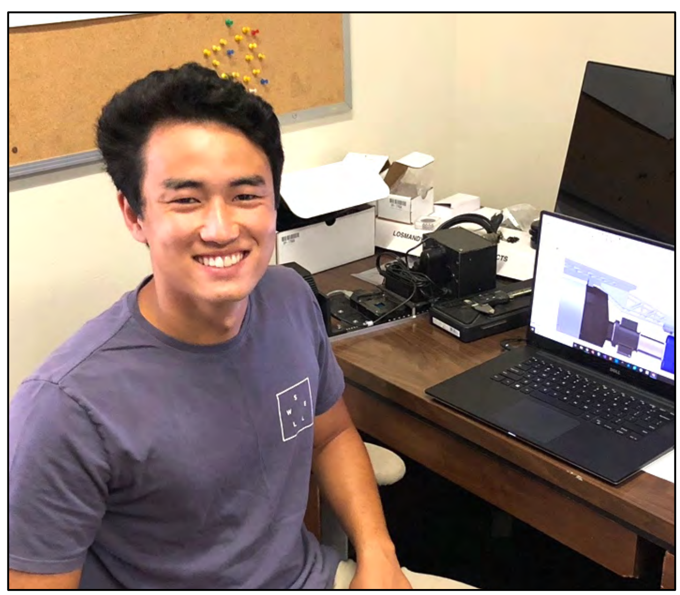
Ian Denzer
Yale University

Site: The Canada France Hawaii Telescope (CFHT)
Mentor: Windell Jones

Astrometric Camera Mount Design and Implementation

The Canada France Hawaii Telescope (CFHT) wishes to implement a new astrometric camera on their telescope to assist in the automation of their alignment process. The astrometric camera performs this operation by taking an extremely accurate picture of the sky and then measuring the offset of the target object with respect to the telescope. Due to the precise nature of the process, the astrometric camera needs to stay perfectly fixed relative to the telescope. This project sought to design and implement a mount to support the astrometric camera and minimize the deflection of the assembly as the telescope moves across the sky. Properly supporting the astrometric camera required dividing the mount into two parts: a local mount, that stiffens optical elements of the camera, and a global mount, that attaches the entire camera assembly to the telescope. Using SolidWorks, several mount options were produced, and simulations were performed to ensure total camera deflection was kept within the required 10 arc seconds. After a review process, a final design was chosen that attaches to one of the trusses supporting the secondary mirror of the telescope. In addition, a micro-adjustment system was added to the global mount to help align the camera and telescope optical axes during the installation of the astrometric camera on the telescope. All parts of the camera mount were built and assembled in-house at CFHT, and basic function testing was executed in Waimea. With the mechanical aspects of the camera finished, CFHT will look to finalize the astrometric camera's software and complete the final, on-telescope testing of the system in the near future.

Ian Denzer was born and raised on the Big Island of Hawaii. Ian graduated from Kealakehe High School and is currently attending Yale University planning on majoring in Mechanical Engineering. Ian particularly enjoys working on robotics and other mechatronic systems. In his free time at Yale, Ian is involved with Ultimate Frisbee, Yale Aerospace, Yale Intelligent Vehicles, and Y Pop-Up, a student group that creates pop-up restaurants for students.



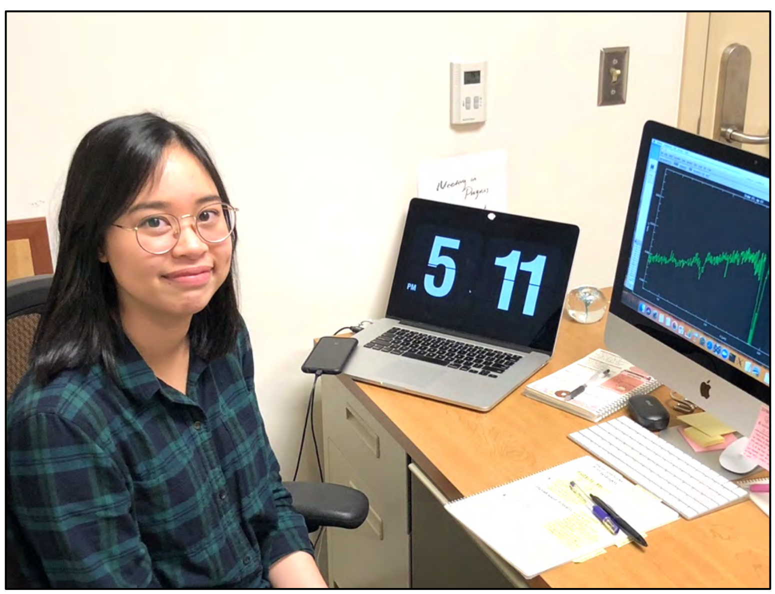
Maria Daniella Douglas
University of Hawai'i at Manoa

Site: University of Hawai'i at Hilo
Mentors: Dr. Heather Kaluna & Dr. Joseph Masiero
Collaborators: Dr. Vishnu Reddy, Dr. James Bauer, & Patrice Smith

Comparison of near-Earth asteroids and the main belt family, Euphrosyne

An asteroid family is created by an impact event that results in the partial or complete break-up of a single parent asteroid, and each piece that breaks off that parent asteroid is considered a member of the family. Family members are identified by comparing the orbital elements of asteroids around the parent body to orbital evolution models of members following the break-up event that created the family. Members of the outer main belt family, Euphrosyne, are one of the few main belt objects affected by gravitational interactions with Saturn. Models of these interactions by Masiero, et. al (2015) suggest that several objects of Euphrosyne family were modified into near-Earth orbits. Using their model in conjunction with albedo constraints, Masiero et. al identified a sub-population of NEOs that may have originated from the Euphrosyne family. To confirm the compositional relationship between this sub-population of NEOs and the Euphrosyne family, we conducted a visible and near-IR spectroscopic study of both main belt members as well as candidate NEOs. In particular, we used SpexTool to reduce spectra of two main belt members and three candidate near-Earth objects (NEOs). We compared the slope as well as any absorption features of the candidate near-Earth objects' spectra to members of the Euphrosyne family's spectra in order to determine if the NEOs are related to the main belt family. Of the three candidate NEOs, two objects, asteroids 475967 and 507366, had spectra consistent with the shape of both main belt Euphrosyne members. The similarly flat and featureless spectra indicate that these NEOs are related to the Euphrosyne family. These results not only give validity to Masiero's model, but help to further constrain possible candidates for NEOs from the Euphrosyne family. To further prove the model and categorize more NEOs, more spectroscopic studies of family candidates using the same reduction and comparison process will be done.

Maria Daniella is a rising senior at University of Hawai'i at Mānoa pursuing a B.A. in Astronomy. After graduation, her goal is to continue work in the astronomy field in both education and research. In her free time, she works as an interchanger for UH Mānoa's Outreach College, volunteers at the Hawaiian Humane Society, and is an avid baseball fan.



Meili Ellis-Tingle
University of Hawaii at Hilo

Site: W.M. Keck Observatory
Mentors: Matthew Brown, Peggi Kamisato

Automating Astrophysics Data System (ADS) Author Affiliation Curation

W.M. Keck Observatory's twin optical and infrared telescopes are considered two of the most scientifically productive telescopes in the world. The data collected by these telescopes are used by astronomers all over the world to advance their research. In order to examine how far Keck data reaches in the astrophysics community we wanted to determine who is using Keck data to write publications, and what institution they are affiliated with. To solve this problem we designed a web application to pull author and author affiliation data from the astrophysics data system (ADS), based on a growing list of BibCodes of articles which have used Keck data. The new system will replace the old system of using a script to communicate with the ADS website and extract the required information to a text file, which is not the desired format. The base functionality of our new application was developed using Python to communicate with the ADS application programming interface (API). The user interface consisted of a webpage developed with HTML, CSS, and JavaScript. We linked these two components of the application using a pre-built Python web server which we modified for our purposes. The data collected by the web application will then be exported into a csv file which will be added to the Keck librarian's records. This data will show the authors of publications using Keck data, and their affiliations. Knowing who exactly is publishing articles based off of Keck data can have implications when it comes to funding. Public and private funders want to see that Keck data is being used by the general scientific community, and our application makes that information readily available.

Meili is a Waiakea high graduate from the Big Island. She is currently pursuing a BS in computer science. She gained an interest in computer science while taking a logic class in high school. She is particularly interested in video game development. During her free time she enjoys running, swimming, writing, reading, and playing video games.

Kenji Emerson
University of Hawaii at Hilo

Site: Smithsonian Submillimeter Array (SMA)
Mentor: Dr. Ramprasad Rao

Modeling Polarization Morphologies in Young Star-Forming Regions

We present an algorithmic method of simulating the intensity and polarization results of protoplanetary star-forming regions for the backwards comparisons to observational results. The orientation of oblong shaped dust grains in protoplanetary regions is heavily influenced by the prevailing magnetic field. Dust grains influence observed polarization angles by reflecting with a vector aligned with the grain's longest axis. The magnetic field vectors are therefore aligned perpendicular to the polarization vectors. We generate models of protoplanetary regions. By toggling functions that describe the geometries, density profile, polarization models, and magnetic fields of these regions, we attempt to generate similar conditions in our simulations to observational data. Matching correlations between the simulations, and the constraints and data from observational studies, inform us of the possible arrangements that a protoplanetary region might have.

Kenji Emerson is a sophomore at the University of Hawaii at Hilo currently majoring in Physics and Astronomy. Although currently pursuing a bachelor's degree in both of these fields, he aims for the completion PhD degree and to conduct research in astronomy (of interest, among others, is cosmology).
Born and raised in Hilo on the island of Hawaii, leisure activities include video games, tennis, and a modest bit of socialization.

Kylie Higaki
Oregon State University

Site: Pacific International Space Center for Exploration Systems (PISCES)
Mentor: Kyla Defore
Co-Mentors: Christian Anderson, Rodrigo Romo

MARTIAN Characterization of Hawaiian Regolith In-Situ for Thermal & Material Analysis and Sintering

Over the last few years, the Pacific International Space Center for Exploration Systems (PISCES) has been collecting samples of basaltic regolith found on the Big Island of Hawaii for in-situ resource utilization (ISRU) production of structural construction elements. Hawaiian basalt is the most similar in composition to be found on both Mars and the Moon. Martian analog sites are then analyzed to determine if they are viable for construction. Three samples, Pu'u Nene, HI-SEAS, and Haiwahine were analyzed for further contribution to the Small Business Technology Transfer (STTR) report. These samples were then tested to determine the best thermal parameters of the materials that would be used for launch test requirements. Satellite imagery was performed to map out and characterize field locations. A lab analysis included the Energy Dispersive X-Ray Fluorescence (EDXRF) to determine the chemical makeup of the samples, sample imagery to view the sediments further than the naked eye and a particle size distribution analysis to determine the ratio of each regolith sample. The samples were then sintered into structural bricks and characterized for their specific heat capacity and density. All three of the bricks resulted in a glassy finish, this is undesirable due to its fragile nature. All three bricks included significant stress fracturing and shrinkage. It is recommended that the samples are baked again, using a lower thermal profile with a slower cooking time, it is also recommended that an X-Ray Diffraction (XRD) crystallography analysis be performed to better understand mineralogy of the samples.

Kylie Higaki is a Class of 2016 graduate from Pearl City High School and will be a Junior at Oregon State University in the Fall of 2017. She is currently pursuing a bachelor's degree in Environmental Engineering . She grew up on the island of Oahu in Pearl City.
On her free time, she enjoys exploring and going on adventures with friends. She hopes to pursue a career in Environmental Engineering and return to Hawaii to work.

Mickie Hirata
Washington University, St. Louis

Site: HELCO (Hawaii Electric Light Company)
Mentors: Riley Ceria, Kandice Kubojiri, Kim Tabac.
Collaborators: Jordan Li, Jashar Day, Mel Higa, Jessica Vargas, Nelson Nishimoto.

Updating Distribution Models to Determine new Hosting Capacity to support Clean Energy

In order to support Hawaii State's clean energy goals, distribution models need to be more robust and include Distributed Energy Resources (DER). A DER model allows consumers with renewable energies, such as solar panels and inverters, to be a power source and be able to share that power back through the utility grid. Having multiple sources of power flow complicates circuit characteristics since traditional distribution planning was only required to look at one directional power flow. Two way power flow introduces the new concept of hosting capacity, which is the amount of DER that can be installed on a circuit until there is a circuit violation such as high voltages. The Engineering distribution team at HELCO would like to implement a new DER model that includes phase distribution, types of conductors, and customer nodes that would provide a more accurate analysis of hosting capacity for the Hawi 11 and Hawi 12 circuits. This project re-evaluated the Hawi circuits by inputting circuit and circuit information into eGIS(Geographical Information System), MicroStationV8i, and Synergi Electric software packages. The Hawi circuits have features of over saturation, lower nominal voltages at the distribution level, and more dispersed customers leading to a long feeder length. The completed re-evaluation of these circuits allowed for a more accurate analysis which lead to better solutions to increase the circuit hosting capacity. Further analysis will be done such as circuit balancing, conversion of distribution voltages, adding voltage regulating devices, and reconductoring of lines, to optimize hosting capacity.

Mickie Hirata is from Waimea on the Big Island. She is currently studying Electrical Engineering at Washington University in St. Louis after studying Physics at the University of Redlands for three years through the dual-degree program. Hirata is also pursuing an MS in Electrical Engineering. When Hirata is not studying, you will often find her napping, sketching, eating and looking at dog videos. Hirata's main career goal is to work in HI in an environment where she is constantly learning new things with interesting electronic systems. Her current interests include learning about/working with digital electronics, hardware descriptive language, and very large scale integrated systems

Austin Jennings
University of Hawaii at Hilo

Site: Canada France Hawaii Telescope
Mentors: Dr. Nadine Manset and Callie Crowder

Science Feasibility Study for Simultaneous Observations with SPIRou and ESPaDOnS

The Canada France Hawaii Telescope (CFHT) currently offers two spectrographs for astronomers, ESPaDOns and SPIRou, but only one instrument can be presently used at any given time. From an engineering standpoint, it would be possible to use both instruments at the same time using a new opto-mechanical device. However, the purpose of this project is to conduct a preliminary astronomical study in order to determine if it is reasonable to use both spectrographs simultaneously or quasi-simultaneously. To determine this, the V (wavelength for ESPaDOnS) and H (wavelength for SPIRou) magnitudes was found for all the main spectral classes as well as 3 stellar luminosity classes – pre-main sequence, main sequence, and giants. Using each instrument's exposure time calculator, a range of magnitudes that would be observable for both spectrographs was found, considering parameters such as a maximum exposure time and saturation limits. From this, a wide range of spectral types that would be feasible for both instruments was established. A range of realistic exposures times was set; the minimum exposure time limits were given by the shortest possible exposure time on SPIRou: 6 seconds. The maximum exposure time was set to a one hour limit as it is a typical maximum exposure time for faint stars. These limits reduced certain spectral types because the stars were either too bright or too dim on one or both of the instruments. These calculations were done for multiple different signal-to-noise ratios (SNR), 100, 300, and 500. It was determined that the magnitude range of stars that could be used by both instruments simultaneously was about 1.28 - 13 in the V magnitude and 5.06 - 5.13 and 11.09 - 12 in the H magnitude. Our final results indicate that astronomers would save a lot of time on the sky using both instruments simultaneously as well as receive more information on any given observed star (as data from two different wavelength domains are acquired). One of many science cases that would benefit from this change includes researching quickly varying phenomena such as variable stars and binary star systems.

Austin Jennings was born and raised on the island of O'ahu where he graduated from Kamehameha Schools in 2015. He is currently a junior majoring in Astronomy with a minor in Physics at the University of Hawai'i at Hilo. His current career interests include topics such as galaxy evolution, star formation, and supernovae. On his spare time, Austin enjoys playing video games, exercising, and watching Netflix.

Alexandra Kaohi
University of Hawai'i at West Oahu

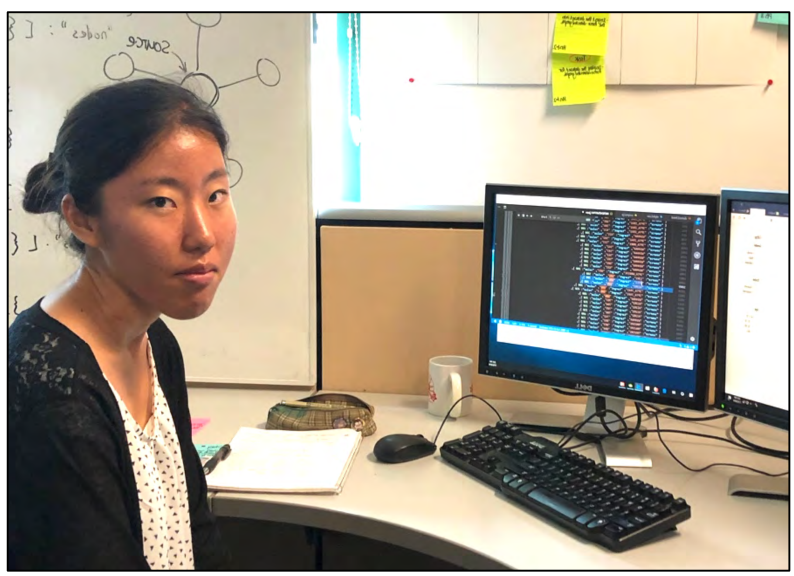
Site: Akimeka LLC
Mentor: Peter Konohia

Development of D3 Visualizations for TMDS/MSAT Medical Datasets

Data Visualization has become a popular trend to visualize complex data in a simple manner. It allows people to gain better insight and to identify unknown trends/patterns about the data. Currently, Akimeka is evaluating the potential usage of a JavaScript library called "D3" (Data-Driven Documents) for electronic military health records from the TMDS (Theater Medical Data Store) and MSAT (Medical Situational in the Theater) applications. A user can utilize D3 to create personalized and dynamic visualizations with minimal effort in coding. For this project, D3 is used to explore its capabilities to visualize a patient dataset from the TMDS and MSAT applications into multidimensional charts/graphs such as line charts, area charts, and heatmaps. We chose a minimum of three charts/graphs: a force-directed graph, a donut chart, and a stacked bar chart that are able to represent the patient dataset as simple but concise visuals. Using Toad for Oracle, a database management program, the patient dataset is exported and converted into a file format that can be used to input into the charts and graphs. The charts and graphs are then built by using Microsoft Visual Code, an open source editor. Additional features such as filters by demographics were added to make the charts and graphs interactive. It may be possible that D3 could replace Akimeka's current data visualization tool called "Chart FX" to create data visualizations instead.

Alexandra is currently a 3rd year undergraduate student attending at University of Hawaii West Oahu majoring in Information Security and Assurance. In 2015, she graduated from President William McKinley High School. Afterwards, she immediately pursued her Associate in Science degree of IT at Kapi'olani Community College.

One of Alexandra's goals is to become an Information Security Analyst at a IT company. During her spare time, Alexandra's hobbies are drawing with her sketchbook, browsing on the Internet, and listening to music.



Tyler LaBonte
University of Southern California

Site: Air Force Research Laboratory (AFRL)
Mentor: Capt. Justin Fletcher

TensorFlow Distributed Image Serving: A lightweight, RESTful remote inference library for decoupling deep learning model development and application

Deep learning techniques routinely deliver state of the art results across myriad application domains. These techniques automatically produce useful parameterized algorithms, or models, by selecting model parameters to minimize a differentiable function measuring task (e.g., object detection, language translation, etc.) effectiveness; this parameter selection process is known as training. Deep learning algorithms can be trained to exploit complex and subtle patterns in data that are inscrutable to humans, and are therefore impracticable in hand-designed algorithms. This combination of autonomy and expressive capacity enables useful information processing in many practical problem domains (e.g., self-driving cars). However, adoption and transition of trained models often presents a technical barrier, as deep learning models are inherently complex, computationally demanding, and are generally tightly coupled to the software framework in which they were developed.
In this work, we describe a library, TensorFlow Distributed Image Serving (TenDIS), that enables flexible, automatic decoupling of deep learning model development and application. TenDIS enables the embedding of any image processing model into production systems with minimal effort by standardizing model input and output through a RESTful API, thereby encapsulating the model server into an easily-integrable black box architecture. TenDIS also encapsulates the model in a TensorFlow-Serving environment that does not require cloud infrastructure for remote inference. This capability is critical for application development using classified data and networks. Finally, TenDIS enables the low-friction deployment of deep learning models to the Internet of Things (IoT) by decoupling the device (e.g., a drone or sensor) and its computational backend; thus, remote inference can be completed on a more powerful machine and the results transmitted to the IoT device. We demonstrate TenDIS' operability on two image-based models: a CycleGAN and a Faster R-CNN utilizing the TensorFlow Object Detection API. Future work will use TenDIS to decouple deep learning model development and application in production systems.

Tyler graduated from Mililani High School in 2017 and will be a sophomore at the University of Southern California in the fall of 2018. He is majoring in Computer Science with a minor in Statistics, and is passionate about combining ethical data science and leadership to solve problems in the community. At USC, Tyler participates in research at the Data Science Institute, where he works on a team developing a modern machine learning platform for liver transplantations. He is also involved in K-12 STEM outreach, and volunteers teaching robotics at a local Los Angeles middle school. Outside of academics, Tyler enjoys playing intramural sports with Hawaii Club and going on hikes.

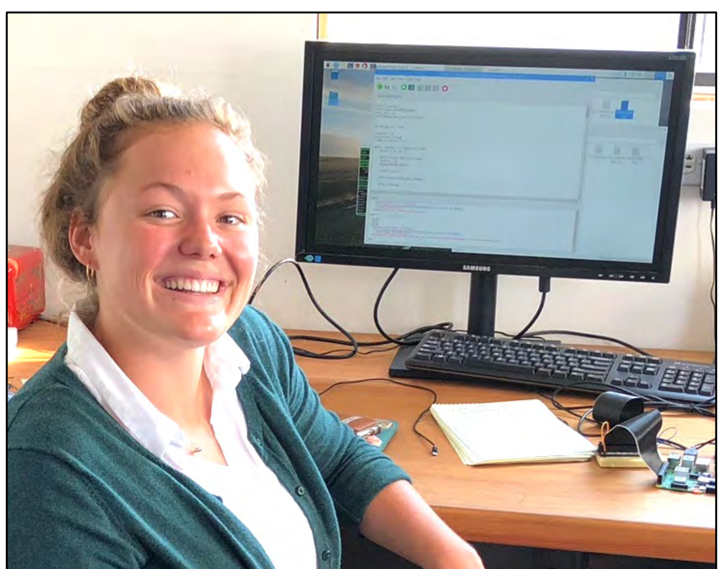
Janelle Laros
Lehigh University

Site: Akabotics LLC
Mentors: Monica Parks, Dr. Newt Parks

Data Visualization of Water Quality Data Abstract

Waterway contamination is a major public health safety issue that affects millions of people worldwide. In America, some of the most polluted waterways are closely inhabited by thousands of communities. Focussing on recent waterway contamination in Hawaii, Akabotics LLC works to remedy this problem with amphibious, autonomous robots that collect water quality data and restore waterways. Akabotics LLC required a way to view their collected water quality data in realtime, on site, and in remote locations for better water quality assessments and in-the-field action. This summer at Akabotics LLC, I established a live streaming, Internet of Things connection between the water quality data, a data visualization platform, and a scalable database. Internet of Things (IoT) is a network of physical devices embedded with a connectivity software that enables them to connect and exchange data with each other. The data visualization and database platform is built to display and store sensor data ranging from dissolved oxygen, electric conductivity, oxygen reduction potential, temperature, pH, and turbidity. These sensors transmit their data wirelessly through IoT and into the data visualization and database platform, which is designed through Microsoft Azure. To establish this connection, I used a Wi-Fi microchip connected to an embedded controller, or a single board computer. Once the IoT connection is made, the water quality sensor data is continuously live streamed into a web-based, cloud computing platform which sends the data simultaneously to a scalable database, and data visualization component. With this data live streaming, it offers Akabotics LLC the power to assess the water quality data on-site and establish an accurate and realtime approach to solving waterway contamination.

Born and raised in Kailua Kona on the west side of the Big Island, Janelle graduated from Hawaii Preparatory Academy in 2017. She is currently going into her sophomore year at Lehigh University in Bethlehem, Pennsylvania where she is pursuing an integrated degree in mechanical engineering and product design. While at Lehigh, Janelle is apart of her school's Formula One SAE team where she is a member of the Aerodynamic Design team. She is also the Vice President of the Co-Ed Club Water Polo team and a member of the Pi Beta Phi sorority. She is very interested in the Aerospace field as well as environmental science, and renewable energy. In her free time, she likes to snorkel and go hiking with her friends.



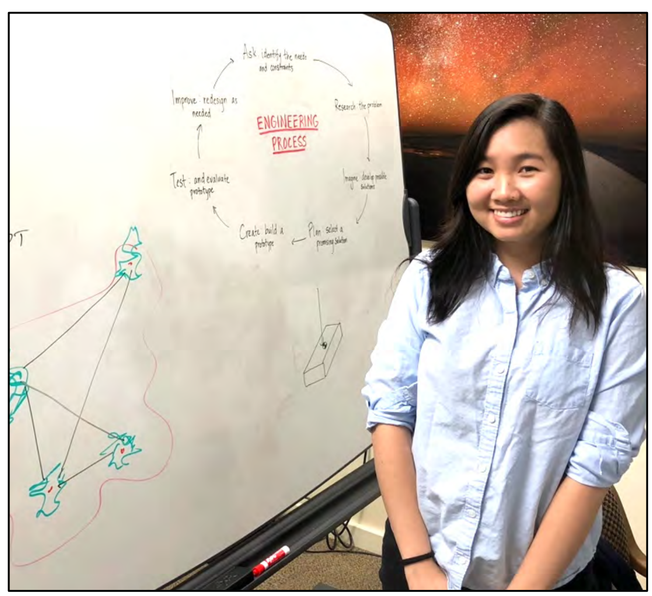
Alicia Lau
University of Rochester

Site: W.M. Keck Observatory
Mentors: Truman Wold, Sam Park
Collaborators: Adam Vandenberg, Ean James

Designing a Ground Transport Device for the Keck Cosmic Web Imager

The W.M. Keck Observatory (WMKO) is home to twin telescopes, known as some of the world's most scientifically productive optical and infrared telescopes. Within the observatory sits the Keck Cosmic Web Imager (KCWI), a spectrograph of high efficiency and of flexible image and spectral resolutions. The Keck Cosmic Reionization Mapper (KCRM), a feature that could expand the instrument's capabilities, will be installed in the near future. The addition of the KCRM will enable new discoveries at high redshift. The primary goal of the project is to design a ground transport device that can mobilize KCWI and ensure safe transportation into the clean room for servicing. Currently the KCWI sits on the Nasmyth deck, which is about 30 feet above the dome floor. The KCWI must be transported from the Nasmyth deck into the clean room that will be on the dome floor. A list of requirements was compiled based on gathering specific constraints for the design and coming to a consensus with the engineering team on design requirements. This involved scheduling meetings with different engineers and management leaders to determine which requirements were prioritized. Multiple conceptual designs were drafted to meet the requirements and project constraints. After refining the requirements with the engineering team, we chose the optimal design and created a solid model on SolidWorks to show the effects of the external forces applied on the transport device in motion. A stress analysis of the final model will show that it will hold under the specific conditions set prior, deeming it safe for implementation. The findings of this project will assist the engineers who will implement the transport device for the KCWI in the near future.

Alicia Lau was born and raised on the island of Oahu. After graduating from James Campbell High School in 2015, she enrolled at the University of Rochester. Currently, she is majoring in Mechanical Engineering and minoring in Japanese Language and will become a senior in the upcoming fall. Some of her educational and career interests include renewable energy, biomedical instrumentation design engineering, and prosthetics. She is involved in her university as a member of the Society of Asian Scientists & Engineers chapter to promote professional skills amongst Asian scientists and engineers, a teaching assistant for the introductory physics courses, as well as the co-captain of the school's pop and hip-hop dance team. In her free time, she enjoys playing tennis, dancing, trying new foods, and playing video games.



Julina Lee
Hawaii Community College

Site: Subaru Telescope
Mentor: Tom Winegar

Updating FITS Files for Transfer to Astronomers

The Subaru archive stores images taken during the night at the summit in FITS format, which is an ASCII text header followed by a binary image. Currently, the astronomers can only download FITS files as they were written during observation. Subaru supports a new instrument called Hyper-Suprime Cam (HSC) that creates 300GB of data and 15,000 FITS images a night. HSC processes the quality of each picture after observation and this assessment is not included within the original FITS file. The quality assessment includes the seeing size of the target and transparency of the atmosphere. HSC team would like to include these quality assessments as corrections to the FITS file. Therefore, the archive has conflicting requirements: storing the original FITS for the archive and correcting the FITS file for the observer. The purpose of this project is to update the FITS files with the statistical assessments. To achieve this, corrections are written as a small ASCII text file that can be read and transferred quickly. I helped implement Python programs to copy the original FITS file and insert the ASCII text corrections to create a new FITS file at the observers location or during transfer. When the observer has the original FITS files, they can receive corrections and update the FITS headers without transferring again and doubling their transfer time. I also provided file validation for the updated FITS using MD5 values when the observer applies the correction. This adds a new function for the archive to make corrections to FITS after observation without increasing transfer time.

Julina Lee is from Hilo, Hawaii. She is a mother of two daughters. She graduated from Waiakea High School in 2008. She currently attends Hawaii Community College and will graduate in Spring 2018 with her Associates in Science degree in Information Technology. She will also receive a Certificate of Competence in Information Security in Fall 2019. She plans to further her education at Western Governors University to pursue her Bachelors Degree in Information Technology. She enjoys powerlifting and spending time with her family.

Noah Levine
University of Hawaii Community College

Site: Canada-France-Hawaii Telescope Corporation (CFHT)
Mentors: Steven Bauman, Steve Hughes, Greg Green
Co-Mentor: Tom Vermeulen

Installing a comprehensive autonomous observatory power monitoring system

Over the past decade, CFHT has paid an average of $338,159 in electrical costs annually. There is presently no real-time system in place to measure and analyze the electrical power being consumed from general operations at the CFHT observatory on the summit of Maunakea. Without a comprehensive system to track the electrical usage, there is no feedback mechanism to verify that CFHT is being charged accurately or data needed to investigate ways to mitigate electrical inefficiencies and overall electrical costs. The new system, comprised of energy monitors and current transformers, is installed to monitor the instantaneous electrical power that is being supplied to the numerous pieces of heavy equipment situated at the observatory. The heart of the system consists of two eGauge Pros, along with 54 current transformers to monitor eighteen three-phase breakers that power equipment such as elevators, compressors, chillers, hydraulic pumps, and uninterrupted power supplies (UPS). I used the C programming language to pull the electrical data from the current transformers using an API provided by the eGauge manufacturer. This data is then published onto Status Server, an in-house software program used for plotting data from sensors and sending out alerts. The end product is a group of webpages grouped by equipment on Status Server that displays current, voltage, and power factor information, both real-time and over a past interval, pulled from the energy monitors in table and graph form. I have also implemented alerts depending on thresholds, to notify the appropriate staff of problems such as drastic electrical dips or energy spikes in the electrical system. Because of the inherent value of the power monitoring system, it will most likely be implemented into CFHT's base facility and headquarters in the near future.

Noah Levine is currently an Information Technology student at Hawaii Community College. He will be pursuing a Bachelor's Degree in IT after he graduates, specializing in software development and database management. Noah is primarily interested in programming and web development, as well as working on Internet of Things(IoT) applications.

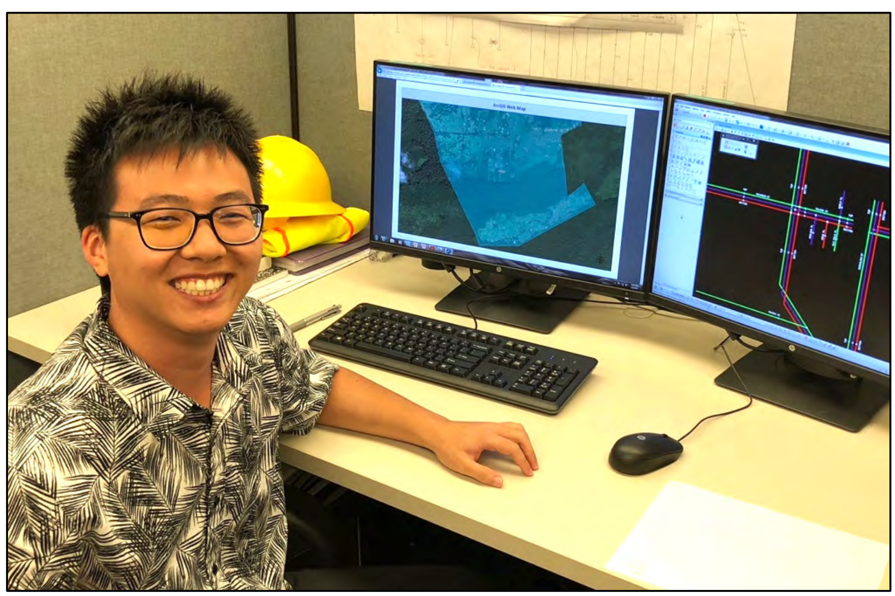
Jordan Li
University of Hawaii at Manoa

Site: Hawai'i Electric Light (HELCO)
Mentors: Riley Ceria, Kim Tabac, Kandice Kubojiri
Collaborators: Mickie Hirata, Mel Higa, Jashar Day, Nelson Nishimoto

Determining Hosting Capacities through the Optimization of Distribution Models to Support Clean Energy

HELCO (Hawaii Electric Light Company) is the utility company on Big Island that provides power generation, transmission and distribution. The Engineering team at HELCO would like to improve in their distribution model to support clean energy. With increasing levels of Distributed Energy Resources (DER), it is important to have an accurate distribution system models. In addition, with the added complication of renewable energies added into the circuit, the hosting capacity of each circuit needs to be carefully detailed. Each substation is unique with its own characteristics that can affect hosting capacity, such as circuit length, load distribution, nominal voltages, balance, installed devices and types of conductors. In order to calculate the true hosting capacity in this project, we determined phases (A, B, C) of each transformer in the field and tracked the number of customers off each transformer to provide a more accurate model from the existing model. Circuits and circuit information was inputted into eGIS (Geographical Information System), MicroStationV8i, and Synergi Electric software packages. After gathering and analyzing the data a new circuit hosting capacity can be determined. This could be compared against the old hosting capacity numbers and the differences can be analyzed. The circuits can also be further studied to determine what we need to do to further improve a circuit hosting capacity, such as circuit balancing, var controllers, voltage regulators, and reconductoring of lines.

Jordan is a rising Junior at the University of Hawaiʻi at Manoa studying Electrical Engineering. He was born in Oahu but grew up primarily in China. He came back to Hawaiʻi at a later age and attend middle, and then later graduated from President William McKinley High School. He enjoys outdoor activities such as hiking and jogging. But he also enjoys watching anime, hero action movies and sci-fi films. Currently, Jordan is interested in renewable energy with the hopes of aiding Hawaiʻi's strive to being fully self-sustaining in the near future.



Matthew Lugo
Gonzaga University

Site: Gemini North Observatory
Mentor: Tom Cumming

Updating the Vibration Monitoring System (VMS)

For most observatories, internal vibration is one of the largest causes of image distortion. As such, Gemini has put in place a vibration monitoring system (VMS) to test and locate any sources of vibration. However, the current VMS was created as a temporary solution for a more permanent problem. The previous VMS was just a prototype, and is being upgraded to a newer and more reliable system. It was also found that the old VMS referenced the wrong accelerometers when testing for vibration. We were tasked with streamlining the system in three areas: hardware, software, and mechanical. Printed circuit boards (PCBs) were custom designed and installed to eliminate wire tangle leading out of the VMS. Chunks of code in Python were simplified, allowing for a better Arduino trigger to activate both VMS systems. Also, a new sheet metal box was designed to permanently house the VMS and its side components. The entire system was tested to ensure that it would be able to successfully monitor vibration through a network of accelerometers. In the end, three separate PCBs were designed and manufactured; they were also soldered and installed into the system and tested for correctness. The sheet metal box was approved for manufacturing and many issues with the system, such as output voltages being too low, were looked into and resolved. This system will likely be duplicated and implemented in the Gemini South observatory to maintain cohesion with Gemini North. The new VMS will be kept around for many years to be able to, on the fly, trace for any unwanted sources of vibration.

Matthew grew up in Wailuku, Maui and graduated from Seabury Hall in 2015. He is a Senior at Gonzaga University and is pursuing a Bachelor's of Science in Mechanical Engineering. Matthew is also currently helping a professor research combustion. After college he plans to head into the aerospace industry, and possibly pursue a Masters Degree. In his free time, Matthew enjoys reading, video and board games, and learning more about the technology of the future.

Keoki Massad
University of Portland

Site: Thirty Meter Telescope (TMT), Pasadena
Mentors: Kyle Kinoshita, Dr. Gelys Trancho,
Co-Mentors: Jamie Nakawatase, Dr. Amir Sadjadpour, Dr. Hiroshi Terada

Challenges of Weight Loss: Determining the Mass of the TMT Utilities on the Telescope

While designing a complex structure such as the Thirty Meter Telescope (TMT), it is important to consider the attributes of the individual components to understand the performance of the system as a whole. Mass is one such attribute that is managed to ensure structural integrity of the telescope. Various utilities are distributed on the telescope, including their pipes, cables, manifolds, power distribution boxes, and cable trays. The purpose of this project is to develop and use a systematic process to determine mass estimates for these distribution items for each floor of the telescope in order to ensure that each floor adheres its mass allocation. An Excel database was prepared to allow the user to input the specific parameters of each distribution item of the preliminary TMT utilities CAD model in Navisworks to calculate and display its estimated mass. With these results, we will present and compare them with the mass allocation budgets. Since the estimated mass for each floor is for the preliminary design, these estimates can be used as a baseline for comparison with the ongoing design. These mass estimates allow TMT systems engineers to manage the comprehensive TMT mass budget and determine if additional components can be added to the structure while still adhering to the mass allocations per floor. Without a baseline weight estimate, it is very challenging to determine if you have to lose weight or not.

Keoki Massad is a current student at the University of Portland, finishing his degrees in Mechanical Engineering and Computer Science. He is from Honolulu, Hawaii and is a 2014 graduate from the Kamehameha Schools, Kapalama Campus. When he is not in school or running meetings for his schools Tau Beta Pi chapter, he enjoys playing sports and surfing with family and friends.

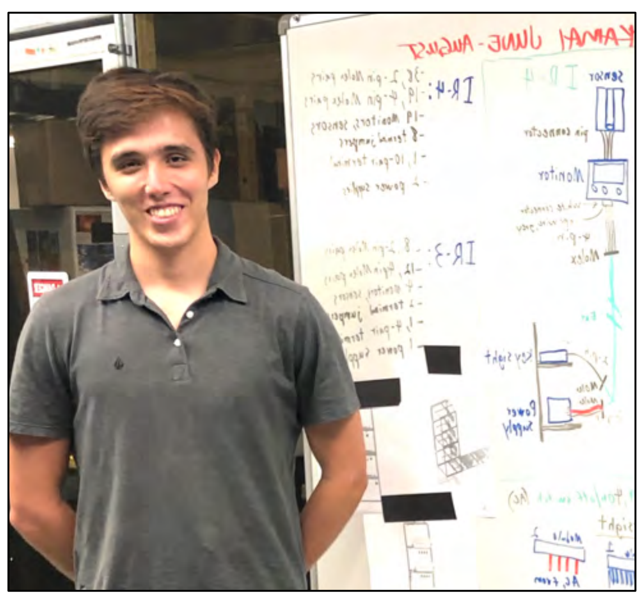
Paul McCabe
Case Western Reserve University

Site: Subaru Telescope
Mentors*:* Lucio Ramos, Matthew Wung

Coolant Monitoring System Installation

The Prime Focus Spectrograph (PFS), soon to be installed at Subaru Telescope on Mauna Kea, requires many controlled variables to operate at the highest level of precision and accuracy. Temperature control is one of the most important, as any fluctuations can disrupt and even damage these delicate spectrographs. Therefore, a liquid glycol cooling system has been installed for the instruments and the air in the room they are housed in. The purpose of my project is to install a sensor network to monitor the liquid coolant constantly and remotely, ensuring the flow rate, temperature, and pressure of the coolant remains at acceptable levels. Installation of the coolant sensors starts with determining a wiring schematic, ensuring a design that is flexible and easy to manage in the future. Information must pass from a sensor to a monitor, and then to a computer port, allowing for immediate remote access to the coolant's status. The prototype was then assembled. By taking voltage measurements of the analog outputs, I confirmed that the sensor recorded data accurately. Detailed documentation was made of the wiring, part inventory, and software setup of the coolant monitoring system for future maintenance. Once the modules were assembled and tested and all details were finalized, I documented a systematic method for assembly and installation and installed all 23 sensors and monitors at the Subaru Telescope on Mauna Kea. Anyone who maintains or duplicates this fluid monitoring system in the future can follow the assembly documentation to ensure working instruments for many years to come.

Paul was raised on Oahu in Aiea and graduated from Punahou High School in 2017. He currently attends Case Western Reserve University in Cleveland Ohio and is pursuing a B.S. in Electrical Engineering with a concentration in Solid State as well as a secondary major in Philosophy. During his spare time in college, he likes to explore new things like photography and graphic design, weightlifting, and the Cleveland Museum of Art. In the future, he hopes to discover solutions to renewable energy and nature conservation as well as travel the world.



Alexander Meyer
University of Hawaii at Maui College

Mentors*:* Bill McBride and Mackenzie Stratton
Site: Daniel K. Inouye Solar Telescope (DKIST)

Determining the vibration budget for the CRYO-NIRSP Compressor

No other solar telescope in the world even comes close to the resolving power of DKIST, which will be capable of less than 14 milli-arcseconds of image resolution. Because of the sensitivity of the optics, even subterranean magma flow will affect image quality. Cryo-NIRSP is a piece of optical equipment that has a 7 ft compressor rack, which will undoubtedly introduce an immense amount of vibration into the structure. I have developed a vibration model that correlates the rigid body motion of the compressor directly into image degradation. This model was used to understand the vibrating nature of the compressor rack and transform it into image motion. Accelerometers and force sensors detected vibration displacements at a dozen different locations on the instrumentation lab. Through the use of computational software, data was collected in the time domain and heavily filtered. It was transformed into the frequency domain and plotted against the image degradation. The projection has successfully shown a predictable correlation between vibrations at a given force and the image degradation. This report analyzed a single location on the telescope, but over 30 high risk areas around the site will be examined. The data obtained from these measurements will help mitigate vibration and improve overall image resolution.

Alex Meyer was born and raised on Maui. After ending his military service, he attended University of Hawaii at Manoa for three years. Currently at UH: Maui College, Alex is pursuing a bachelor's degree in Engineering Technology. After completing his degree Alex intends to seek out a masters degree program in his field of study. Outside of academia he enjoys robotics, classic role playing games, fantasy novels, and collecting polyhedral dice.

Olivia Murray
University of Hawai'i at Manoa

Site: Thirty Meter Telescope
Mentors*:* Dr. Warren Skidmore, Jake Llamas

Construction of a Science Case Web Tool for TMT Science Cases

Scientists from all over the world who would like to conduct observations using the Thirty Meter Telescope (TMT) have to submit a proposal including requirement information regarding their science program. Each proposed observation is referred to as a science case. There are two components to a science case: a high level description of the program (i.e. the scientific justification) and technical requirements and astronomical target information relating to the observations. These science case proposals provide the motivation for building the TMT observatory and the needs of those who would use it, thus help to determine the design for the entire observatory. The purpose of this project was to replace the old method of collecting this information by creating a web application where scientists can submit proposals. This application will create all future collections of science cases and compile the technical information so that it can be used by TMT design teams. This application was developed using the Ruby on Rails application framework, which utilizes Haml and Javascript. It needed to be integrated into the current TMT website and be accessible only by permitted users. Users can work with other scientists to create a new science case and add as many instrument configurations as necessary for each science case. This application has dynamic fields, which filter based on previous selections and acts as a form control. Using this new tool, applicants can fill out all necessary information, which will be stored in an exportable database and available for TMT design teams to manage. It is recommended that Thirty Meter Telescope implement a method within this application to import all previous science cases and create a public webpage that displays all approved science cases.

Olivia was born and raised in Hilo on Hawaii Island. She graduated from Waiakea High School in 2016 as a valedictorian. She is a Regents Scholarship recipient at the University of Hawaii at Manoa where she is an Honors student majoring in Computer Science and currently enrolled in the Security Science track. She currently works with the Center on Disability Studies on the Ka Pilina grant, writing math and science lesson plans for grades K-8. She is also a college consultant with NexTech where she helps plan and run STEM workshops. After graduating, she hopes to stay in the field of Cyber Security. In her very limited free time, Olivia is an active team member of Pacific Roller Derby.

Jonathan Musgrave
University of Rochester

Site: Institute for Astronomy Hilo
Mentor: Mark Chun

`Imaka Atmosphere Telescope Simulator

The 'Imaka wide-field instrument has an areal field of view close to a magnitude larger than any other adaptive optics system currently in use for astronomy. The challenge for this ground layer adaptive optics (GLAO) system is to correct for the wavefront aberrations that arise from the atmosphere and from the instrument's optical system. In order to characterize the performance of such a system we need to develop in the lab a way to replicate the aberrations and conditions the system will see "on-sky". To do this we propose to use two commercial DSLR Canon lenses to generate on-axis and off-axis point sources (e.g. stars) for the system. The Challenge in doing this is that with `imaka's wide field of view the optical design can become complex and expensive. Commercial lenses are a good choice due to the industry's standard for high-quality imaging over wide fields of view. In this project such a system was prototyped on an optical breadboard with an aperture stop to simulate the correct telescope pupil. Data was collected to measure the image quality across the field to quantify the basic performance of the system. Later phase retardation screens will be placed into the system to simulate atmospheric conditions.The point spread function (PSF) across the field was measured and compared to a diffraction limited computer generated PSF to define image quality values such as Strehl ratio, full width half max (FWHM) and the modulus transfer function (MTF). The `imaka team will use this data to design a dedicated telescope and atmosphere simulator for the instrument.

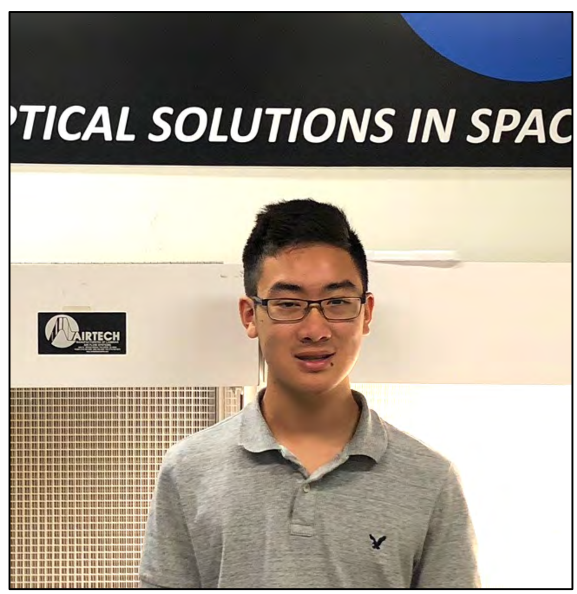
Jonathan Musgrave is currently a freshman in the Institute of Optics at the University of Rochester pursuing my degree in Optical Engineering. His goal is to use his degree to develop new and more efficient computational devices and to better understand the world around us. Jonathan was born and raised in Honolulu, HI and graduated from Punahou High School. He has always loved the sciences and especially physics and can't wait to expand his knowledge in the field further.

Corin Nishimoto
California Polytechnic State University, San Luis Obispo

Site: HNu-Photonics - Scorpio V Division
Mentors: Devin Ridgley, Sylvia Loh, Brittany Willbrand

Design & Prototyping of a Sanitizing & Cell-Seeding Device

The BioChip SpaceLab (BCSL) is an automated cell culturing platform designed to perform microgravity biology interrogations onboard the International Space Station (ISS). BCSL consists of up to 12 BioChips for a given microgravity experiment on-orbit. Due to the unique nature of experimentation on ISS it is important to design equipment that is safe, time efficient and easy to use for the crew. While BCSL is an autonomous platform during experimentation, the experiment preparation procedures require significant crew operations. In an effort to streamline the experiment preparation process for the crew on-orbit, the BioChip Seeding Assembly (BSA) was designed and prototyped at the SCROPIO-V labs for validation tests. Sanitizing and seeding the BioChip can be a tedious process of washing the channels through a series of inlets and outlets making experiment preparation a time-consuming task. The verified sanitization protocol includes the following treatments before each BioChip use: 2x 70% ethanol, 2x sterilized water, 2x PBS, and 1x media. The full process takes approximately 1-2 hours per BioChip and has a high incidence of contamination. In this study, the BioChip Seeding Assembly was created to accelerate this process, minimize contamination, and accurately seed cells. BSA is a human operated piece of lab equipment that is comprised of a series of syringes and check valves that draws a fluid through an inlet and redirects it through the BioChip. The device uses identical syringes to equally distribute fluid to all wells while removing existing fluids. The device designs were developed in SolidWorks and prototypes were 3D printed. CAD specifications were used in manufacturing, and a polycarbonate model was produced for further use and testing. After seeding several BioChips with the BSA prototype, it was confirmed that the device was biocompatible, minimized contamination, reduced operation duration and successfully seeded cells. The SCORPIO-V team will use the BSA for future BCSL crew operations to significantly decrease the complexity and duration of BCSL pre-experiment operations in the microgravity environment of ISS.



Corin Nishimoto was born and raised on the island of Maui. He graduated from Seabury Hall in 2015, and is currently studying Biomedical Engineering at California Polytechnic State University, San Luis Obispo. In the future, he hopes to work R&D at a medical device company. Through undergrad research, he has tested several methods to resuscitate and enumerate Viable But Non Culturable bacteria. He has also developed protocols and tests for his lab's automated enumeration and immunoanalyzer machines. In his free time, he enjoys performing on the Cal Poly Lion Dance team.

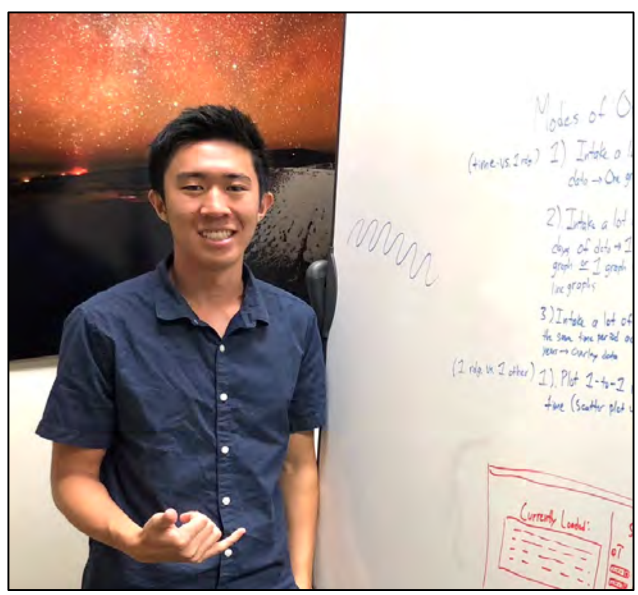
Derek Ogi
University of Southern California

Site: W.M. Keck Observatory
Mentor: Sam Ragland

Telescope Operational Procedure Optimization: Developing a Software Tool to Mine and Visualize Sensor Data from the Keck Telescopes

The W.M. Keck Observatory is a two-telescope observatory that aims to advance the frontiers of astronomy and produce high quality data to inform scientific discovery on an international scale. The current operational model includes setting the dome temperature in the afternoon based on the external temperature forecast for the night and calibrating the science instruments in the early afternoons. As part of their operations, the telescopes collect a wide berth of data regarding conditions such as temperature and meteorological readings. This data is important because as light travels through mediums of differing temperatures, its reflective index changes which result in changes to its behavior. The archived sensor data could be potentially used to investigate the impact of these optical effects and improve the operational procedures. My project is to develop a Python software tool which lets scientists tap into valuable information within these archives via visualization, characterization and statistical analysis. Years of archived text files are compiled into an accessible datastore and visualized using the NumPy and Pandas data science libraries. In addition to making existing data easily accessible and visible, my software tool also allows for the interpolation of new data such as trends over seasons, correlations between various conditions and image quality, as well as niche data such as temperature differentials between various parts of the dome. With this valuable data in-hand, scientists will be able to draw new conclusions regarding telescope operation and hopefully develop new hypotheses to further improve the quality of data being produced at Keck.

Derek Ogi is a second year at the University of Southern California studying Computer Science. He is interested in the wide applications of computer science in today's society and hopes to use his education to leave his mark on the field. Derek has several side projects including work as an engineer on an indie game. In his spare time he also plays tennis and taiko.



Maya Ooki
Rensselaer Polytechnic Institute

Site: HNu-Photonics, SCORPIO-V
Mentors: Dr. Devin Ridgley, Sylvia Loh, Brittany Willbrand

Delivery of Fluids Autonomously within the BioChip SpaceLab

Over the last few decades there has been an increased emphasis on cell biology interrogations onboard the International Space Station (ISS) to elucidate the effects of microgravity on human physiology during long duration ISS missions. The research carried out onboard ISS will better inform NASA and the public of the effects of microgravity on human dysfunction to identify mitigating factors for future long duration missions to the Moon, Mars and beyond. The BioChip SpaceLab (BCSL) is a research platform onboard ISS that enables autonomous cell biology experiments in microgravity. BCSL alleviates the need for intensive crew operations by automating the microfluidic delivery of cell culture reagents to increase the quantity and quality of experiments performed in the microgravity environment. Due to the automated nature of BCSL, an accurate amount of cell medium, reagents and drugs must be pumped autonomously through a series microfluidic channels within the "Manifold" for cell culture delivery. The Manifold has nine inlets, including four direct channels to each well and five communal channels that deliver fluids to any combination of the four wells. These communal channels have varying path lengths and 120 path combinations, meaning discrepancies between the end volume reported through the software interface and the experimental end volume delivered must be resolved. To characterize fluid delivery to the BioChip wells, this investigation tested 20 path combinations within the Manifold to quantify fluid output volume via software measurements compared to fluid output volumes observed experimentally. The results indicate that the experimental fluid volume in the pathways varied slightly from the end volumes reported by the software, giving an average overall percent accuracy of 84.2%. The experimental values reported here will be used to adjust the software measurement parameters to ensure that the microfluidic Manifold system delivers accurate amounts of fluids to each of the BioChip wells for successful microgravity experimentation.

Maya Ooki was born and raised in Haiku on the island of Maui. She graduated from King Kekaulike High School in Pukalani, and is now earning a B.S. in Biomedical Engineering with a minor in Cognitive Science at Rensselaer Polytechnic Institute in Troy, New York. During her childhood on Maui, she discovered her passion for science and understanding the human body. She chose engineering as a balance of her love for science and math with creativity and problem solving. In her spare time, Maya likes to play the ukulele, piano, sing, and paint. In the future, she hopes to help encourage the young students of Hawai'i to pursue their passion for STEM.

Ariel Peterson
University of California, Los Angeles

Site: Akimeka LLC
Mentor: Rob Nelson
Co-mentors: Des Iorgova, Joey Andrews

Using Deep Learning Algorithms to Generate Accurate Training Scenarios

The Theater Medical Data Store (TMDS) and Medical Situational Awareness in Theater (MSAT) systems store Electronic Medical Records (EMR), allowing clinicians and caregivers worldwide the ability to view individual patient records for those treated in a Department of Defense (DoD) operational environment. TMDS/MSAT developers generate synthetic (fictional) EMRs manually which can be time consuming and may not accurately represent the real data in the production tier. TMDS/MSAT is exploring the use of deep learning algorithms to learn more about patterns within the production tier to help improve synthetic data generated for development tiers. Furthermore, once they learn more of those patterns they would like to incorporate them when generating synthetic health records. We researched various deep learning algorithms used within the EMR domain and due to the complexity of mapping the discovered insights, such as patterns in the production tier back onto the training and testing tier decided on a deep generative model to generate synthetic medical records to begin with and then evaluate the validity of the generated data. We show that we can use medGAN a generative model to generate synthetic medical records by learning the distribution of the diagnosis codes in the training data. Once the synthetic data is generated we plan to validate our model using a clustering algorithm to visually compare the patterns from real and synthetic data. This will ensure the model is generating data that resembles the real data. While these methods are useful to generate data and validate the data generated; future work will be done to implement a clustering algorithm and incorporate a broader spectrum of features, not only diagnosis codes, in a medical record when generating synthetic data.

Ariel Peterson is from Punaluu, Hawaii on the island of Oahu and graduated from Kahuku High School. She is currently pursuing a B.S in Computer Science at the University of California, Los Angeles. Upon graduation in March 2019, she plans to move back to Hawaii to work. Her current interests are in computer security, machine learning, and artificial intelligence. In her free time she likes to go to the beach, hike, and do yoga.

Erica A. Sawczynec
University of Hawaii at Mānoa

Site: The Thirty Meter Telescope
Mentors: John W. Miles, Gelys Trancho, Kayla Hardie, Warren Skidmore, Lianqi Wang

Identifying Compliance of Detailed Science Cases to Science Requirements

Before telescopes are built, astronomers develop summaries of scientific studies paired with technical observation information to explain what science they would like to be able to perform with the telescope and how it would be carried out in practice. This information guides the design of the telescope, adaptive optics systems, and instruments, so the observatory is able to support as many science cases as possible. We used The Thirty Meter Telescope (TMT) requirements management tool (DOORS) to link all the technical information from the science cases to the design requirements, showing which science cases are supported by the current design. By transferring the science cases and technical information from a Microsoft Excel spreadsheet to DOORS, TMT is able to evaluate trade studies in order to support as many science cases as possible.

In this project, the original technical information for the science cases was organized and imported from the spreadsheet into DOORS. In DOORS, each science case was linked to requirements in the Science Requirements Document (SRD), for each instrument and mode described. The SRD is the highest level document that describes the observing capabilities that TMT observatory will provide. Science cases were categorized as compliant with the requirement, within the goal of the requirement, or non-compliant with the requirement. The science cases which were not fully compliant were examined to determine if they were mismarked, true errors, or interpretation errors, and any necessary follow up with science case authors was executed via email. We present the preliminary analysis of the Detailed Science Case (DSC) to assess the compliance of science cases with the current TMT design. As a result of the analysis of the DSC, a new and improved method was proposed to collect the data for future science cases. This new database will be used to justify proposed changes to the current requirements in the SRD, for example, evaluating impact on science capabilities due to effects of changing requirements or technical design challenges, or identifying the emerging need for new capabilities.

Erica was born in New York but raised on the island of Maui. She graduated top of her class from Kihei Charter High School in 2017. Currently, Erica is studying Physics at the University of Hawaii at Manoa where she will be a sophomore this fall. After graduation, Erica hopes to pursue a graduate degree in Astrophysics while studying stellar evolution. In her free time, Erica enjoys swimming, reading Sci-Fi books, and star watching from the summit of Haleakala.

Sae Hyun Song
University of Hawai`i at Manoa

Site: Integrity Applications Incorporated / Pacific Defense Solutions
Mentor: Dennis Douglas, Ph.D.
Collaborators: David Sheppard, Ph.D. & Paul Sydney

Two-Dimensional Shadowing Imaging of Geosynchronous Satellites: Shadow Prediction Tool Accuracy Characterization

Geosynchronous (GEO) satellites are essential for modern communications such as television broadcasting, weather forecasting, global communications, and many important defense and intelligence applications. However, because GEO satellites have an orbital distance of about 36,000 kilometers, currently there is no way to image a GEO satellite with any useful amount of spatial information to resolve malfunctions, maladies, and communication errors upon orbit insertion. Obtaining a high spatial resolution image of the GEO satellite can be done through shadow imaging, which consists of measuring the irradiance distribution of a shadow on the Earth's surface generated by a satellite occulting a star. Shadows of a GEO satellite a stellar occultation event travel at very high velocities on the earth, thus an accurate prediction of the location and time of a shadow event is crucial. The purpose of this project is to correlate an existing shadow prediction tool to a database of images containing known GEO satellites within a star field to characterize the accuracy of the prediction tool. We compared predicted GEO shadow events from the existing tool with measurement inferred shadow trajectories from the imagery database using Matlab. This simulation will begin to provide information on the accuracy of the GEO shadow prediction tool and whether bias or statistical anomalies exist. This adjustment will ultimately allow us to predict when and where GEO shadow events occur on Earth with high accuracy so that observations can be routinely scheduled.

Sae Hyun Song was born in Seoul, South Korea but, was raised on the island of Oahu. After graduating from Kaimuki High school in 2015, he is currently a senior pursing a Bachelor of Science degree in Computer Science at the University of Hawai`i at Mānoa. His career interests including working in the software engineering or web development industry. Interests outside of academics are tennis, weight training, computer games, and spending time with family and friends.

Erik Svetin
Syracuse University

Site: Daniel K. Inouye Solar Telescope (DKIST)
Mentors: Brialyn Onodera and Chriselle Galapon

Field Testing the HVAC Fan Systems at the Daniel K. Inouye Solar Telescope

The heating, ventilation, and air conditioning (HVAC) systems at the Daniel K. Inouye Solar Telescope (DKIST) removes contaminants in the air and conditions indoor air, either cooling it or heating it to provide comfort. The HVAC fans at DKIST have been installed , however, they have not been field-tested. Field testing the fan systems is required to check that the fans are not malfunctioning and that they can perform to specifications. This project involved the field-testing and airflow verification in the four critical fans located in DKIST's Utility Building and tunnel. After analyzing the fan and duct systems associated with each fan unit, the precise duct test-port locations were determined and installed in the appropriate positions using the Environmental Protection Agency's Method 1. Prior to testing, a testing procedure was created to address proper safety measures, lock-out/tag-out procedures, and procedural activities as well as a data collection spreadsheet. The field-testing of the fan units involved gathering the flow velocity (ft/min) and static pressure (in H_2O) data using an anemometer and a Fluke 922 airflow meter for each of the four fans. Using these results, the control volume of each fan was calculated. The control volumes and motor powers were then compared to the respective manufacturer's submittal fan curves. The results of the fan field tests met the required margin of error of 5% or lower, which confirmed that each fan is functioning to DKIST requirements and met the airflow specifications. In the future, the fan systems shall be field tested for balancing the volume and pressure of the overall systems. Any modifications made to the fans shall also require additional fan testing. The testing procedure created for this project shall be used as a template for future fan testing at DKIST.

Erik Svetin was raised on the island of Moloka'i and graduated from Moloka'i High School in 2017. Currently, he just finished his first year at Syracuse University, studying Mechanical Engineering. He plans on earning a Bachelor's of Science degree in four years and entering the field of robotics. Erik likes to build and design robots in his college robotics team. If he's not in class, Erik likes to play basketball, hang out with friends, and volunteer within the community.

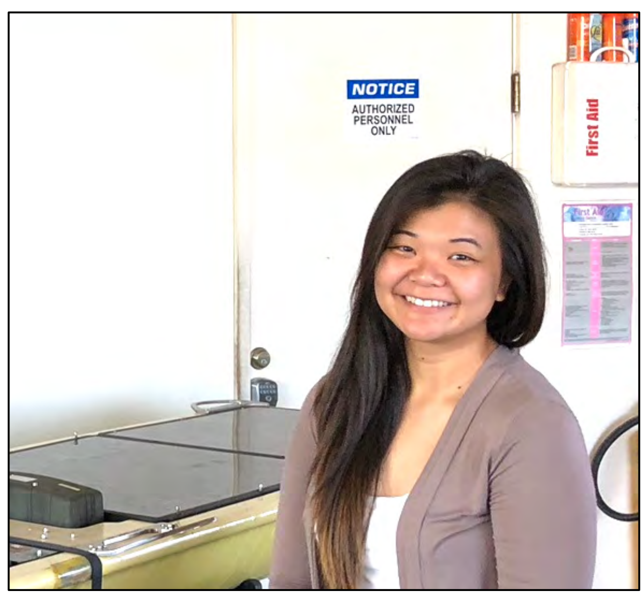
Nicole Tabac
Northern Arizona University

Site: Liquid Robotics – A Boeing Company
Mentors: Billy Middleton, Pono Thronas
Collaborator: Stacey Sueoka. DKIST

Assessing Wave Glider's Lightbar Configurations in Various Test Environments

Liquid Robotics produces autonomous, unmanned vehicles called Wave Gliders, which harvest energy from the ocean and sun to propel themselves and collect data. Wave Gliders are equipped with a Lightbar that uses light emitting diodes (LEDs) that serves as an indication light at sea to alert boaters and larger vessels of their presence. As a precaution, the Lightbars were set to a high brightness level which was discovered to be too excessive to the communities in Puako and Kohala. U.S. Coast Guard regulations were used as a quantifiable guideline and was used as a target goal for testing the Lightbars' luminous intensity in hopes of reducing the amount of light emission. Research was done on U.S. Coast Guard regulations and it concluded that the most applicable classification for a Wave Glider is an "inconspicuous, partly submerged vessel." This type of vessel requires an all-round white light visible at three nautical miles. According to the U.S. Coast Guard, the minimum luminous intensity that such a vessel must project at three nautical miles is 0.003573 candelas. In order to measure the Lightbar's luminous intensity, a testing procedure was designed to measure the illuminance of the Lightbar using an LED light meter in a laboratory setting. The light meter outputs values of illuminance (lux) and were then converted to units of luminous intensity (candelas). The inverse-square law was implemented to calculate the luminous intensity at three nautical miles and these values were compared with the minimum required luminous intensity pertaining to U.S. Coast Guard regulation. Visual tests were conducted both from shore and at sea to ensure that the Lightbars were visible at the desired distances with the naked eye, and images were taken to capture the brightness in photos.

Nicole was born and raised on the Big Island of Hawaii. She was heavily involved in FIRST and VEX robotics in high school and continued to mentor students after she graduated. She continued her education at Northern Arizona University and received her bachelor's degree in mechanical engineering this past Spring. Nicole's interests are robotics and renewable energy and she hopes to find a career that encompass both interests. In her free time she loves to go to the beach, play Overwatch and spend time with her cats.



Kekoa Tacub
Kauai Community College

Site: Gemini Observatory
Mentor: Chris Stark

Network Monitoring Alert System

Knowing when a critical server for a company goes down is very important; it could mean the loss of hours of labor or even thousands of dollars worth of work. Gemini Observatories uses a powerful Information Technology (IT) tool called 'Solarwinds' that allows you to monitor large networks and alerts users when a server or service goes down. Although the servers are being monitored the current Solarwinds server is out of date, incapable of being upgraded due to hardware restrictions, and requires significant fine tuning to reduce the swarm of unnecessary alert messages going through. Gemini requires a new Solarwinds server that has to be brought up with the latest version and hardware that can withstand the extensive network and not be bottlenecked. While the new server is being populated, it is also going through a categorizing phase. The Information Technology System (ITS) department that manages Solarwinds wants to open up this tool for other departments over at Gemini. The new Solarwinds installation will have to be broken down into separate views (Dashboards) so individual departments can view their own servers or instruments without ITS. With this new installment of Solarwinds, one should be able to monitor Gemini's network with ease for many years. Throughout the course of my project, I'll be documenting the steps taken to complete my project which will be used to replicate our work over at Gemini South.

Kekoa Tacub is currently attending Kauai Community College. His goal is to receive an associates degree in Electronics Technology and begin work after graduating college. Kekoa has been interested in computers ever since middle school, and has continued to grow his knowledge of networking and hardware through his classes. His career goal is to work as an IT/System Administrator.
Kekoa's prior electronics experience is working for the Kaua'i Endangered Seabird Recovery Project where he helped assemble prototype laser units and solar panels.

Sean Tadekawa
University of Hawaii, Kapiolani Community College

Site: Submillimeter Array (SMA)
Mentor: Simon Radford
Co-Mentors: Ranjani Srinivasan, Ramprasad Rao

Upgrading the Thermal Monitoring System with a Raspberry Pi at SMA

At the Submillimeter Array (SMA) located on Maunakea, there is a 20+ year old Motorola PowerPC, named Correlator Control (CORCON), that monitors and regulates the temperatures of the electronic equipment. Although the computer is still functional, it takes up a large amount of space; therefore, it would be desirable to replace CORCON with a Raspberry Pi -- a small, inexpensive computer that can fit in your hand. The recovered real estate can then be used to house other electronic equipment. CORCON is outdated as well, as most of CORCON's functions have become obsolete with technological advancements. Furthermore, all of CORCON's code is written in C: a syntax heavy, low level language compared to the more widespread and popular language, Python, which is also platform independent unlike C. In order to begin the process of replacing CORCON with the Raspberry Pi, I reviewed CORCON's code and identified functions currently in use. I then designed code in Python to enable communication between the Pi, power distribution units (PDU), and existing temperature sensors. To monitor the temperature, my code sends a signal to an I/O module, which processes and returns temperature values from the connected sensors. When the temperature values pass a threshold, the code sends commands to the PDU to turn on/off its ports. The code is easy to read and understand in Python, allowing future programmers to spend less time understanding and maintaining the code. I debugged and tested my program by creating a prototype test system with the Raspberry Pi, PDU, I/O module and temperature sensors. The prototype system will be taken up the SMA to compare the Pi's performance against CORCON's. Eventually, to fully replace CORCON, the Pi will also need to be able to communicate with the AC unit and incorporate a key software component that enables the monitored temperatures to be written to a shared distributed memory system.

Sean was born in New Jersey but raised in Honolulu. He is fluent in English and Japanese, and learned Chinese in high school. He is graduating from Kapiolani Community College with an Associate degree in Natural Science – Pre-engineering and transferring to University of Hawaii at Manoa. He is pursuing a B.S. in Electrical Engineering there. Sean is interested in robotics and hopes to gain more knowledge in graduate school. His hobbies include playing the piano, playing basketball, as well as designing, building, and programming robots.

Akira Vernon
University of Hawaii at Mānoa

Site: Subaru Telescope
Mentors: Russell Kackley, Eric Jeschke

Implementation of Web Widgets using the Ginga Toolkit

The Ginga Toolkit is a software toolkit designed for building viewers for scientific image data in Python. Currently, the Ginga Toolkit supports Qt (4&5) and GIMP Toolkit (GTK), but has limited support for web support (HTML5). The Subaru Telescope software engineering team is interested in increasing the support for HTML5 to allow for remote access of current and future applications designed with the Ginga Toolkit, such as the Queue Planner (Qplan) application. In order to increase HTML5 support, we must build web widgets that will lay the foundations for building future complex applications. The systematic reuse of these web widget will allow for the increase of software productivity, shorten software development time, and will produce better quality software applications. These web widgets must be able to mimic their Qt and GTK counterparts, but most importantly, they must be compatible with popular web browsers. To create these web widgets, we must call on an instance of a widget class using the Ginga Toolkit, which will then rely on Python to manipulate HTML5/CSS and JavaScript to display the widget on a web browser. Communication between Python and HTML5/CSS/JS is made possible with the use of Tornado (Python web framework). We have designed and tested each stand-alone widget to ensure that they are fully functional. Currently, we are developing and testing the integration of widgets together to ensure that each widget can be integrated with each other. Having these widgets available will allow for a web based Qplan and will help with future development of web based applications.

Akira was born and raised on the island of Oahu. After graduating from Kaimuki High School, he went on to pursue a Bachelor of Science degree in Computer Engineering at the University of Hawaiʻi at Manoa. Akira is also involved with the Hawaii Undergraduate Initiative Program (HUI), where he is able to work with incoming freshman to support and assist them in their transition from high school to college. Akira's interest outside of academics are hiking, weight training, photography, and spending quality time with family and friends. He hopes to one day pursue a career in STEM in Hawaiʻi.

Makena Wagner
Smith College

Site: Gemini Observatory North
Mentors: Chas Cavedoni, Stacy Kang

Designing a High Resolution Test Rig for Linear Encoders and Motordrives

As technology advances and infrastructure ages, research facilities like Gemini must proactively replace critical obsolete equipment. Linear encoders are mission critical to Gemini's ability to precisely acquire and track astronomical targets with the telescope. Gemini typically replaces critical linear encoders and motor drives on the order of five to ten years, due to age, wear, and technological improvements. Gemini seeks to design a high-resolution test bed to validate and test linear encoders and motor drives. A useful test bed allows one to, evaluate and qualify functional requirements, performance requirements, and critical telescope interfaces, and confirm the hardware operates at standards equal or better than existing hardware. The proposed test bed will allow Gemini to evaluate two linear encoders and three motor drives that are mission critical to Gemini. To create the test bed one must engineer, design, procure of-the-shelf (OFS) and custom fabricated parts, assemble, test, and release the system to test engineers.

Makena was born and raised in Hilo, Hawaiʻi. Makena attended Kamehameha Schools Hawaiʻi from the 6th grade until graduating in 2016. She now attends Smith College in Massachusetts where she is currently pursuing her bachelor's of science in Engineering with a minor in Architecture and Urbanism. She is currently playing for the varsity softball team at Smith. In her spare time Makena enjoys fishing and hanging out with friends. She hopes to return home after graduation and work as a local engineer.

Jonah "Kalani" Wengler
University of Hawaiʻi at Mānoa: College of Engineering

Site: Academia Sinica Institute of Astronomy & Astrophysics (ASIAA)
Mentors: Ranjani Srinivasan, Derek Kubo & Peter Oshiro

Cooling & Reducing Thermocycling of YT Lee Array Field Programmable Gate Arrays

The Yuan-Tseh Lee Array (YTLA) Radio Telescope's current method of digitizing and processing data includes a chassis called a R.O.A.C.H. (Reconfigurable Open Architecture Computing Hardware), which houses the electronics. The primary processing chip is a Field Programmable Gate Array (FPGA). However, these chips, with their current cooling method, tend to exceed their operating temperatures during the warmest parts of the day, which could lead to chip failure. The purpose of this Akamai project is to design a cooling system that will not only keep the FPGAs within their operating range, but also maintain them at a relatively stable temperature (+/- 5 ˚C). There are industrial solutions to this issue; however, because of budget and/or time constraints, they could not be implemented. Thermal analysis done in SolidWorks suggested that a perforated cover design would sufficiently vent the heat from the R.O.A.C.H. into an enclosed bay in which they are located. Stabilization of the temperature of the bay also needed to be done in order to reduce thermal cycling during the day. This was accomplished by incorporating both door fans and internal rack mounted fans into the design, that would operate during the day and be turned off at night. After installing the first perforated cover on site, the temperature of the FPGA chip decreased by ~10˚C. Results of simulations done in SolidWorks with different CFM (ft^3/min) values to determine the most suitable fan will be presented. Once the fans are installed, empirical tests would be required to determine the speed and duration of their operation to optimize the cooling efficiency.

Jonah was born and raised in Wailupe O'ahu and graduated from Kamehameha Schools. He is currently a senior at the University of Hawaii at Mānoa majoring in Mechanical Engineering. Jonah recently participated in First Nations Launch (FNL) for the first time, where he and his team launched a level two high powered rocket nearly 4100 ft high. His career goal is to "have a seat at the table" or be in decision making positions in the advancement of the Hawaiian people.

Akamai Internship Program

Akamai advances students into the Hawai‘i 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 Hawai‘i. Akamai is led by the Institute for Scientist & Engineer Educators (ISEE) at University of California, Santa Cruz.

The 2018 Akamai Internship Program placed 38 college students from Hawai‘i at the following organizations to complete a seven-week project:

- Air Force Research Laboratory (AFRL)
- Akabotics LLC
- Akimeka LLC
- Canada-France-Hawaii Telescope (CFHT)
- Daniel K. Inouye Solar Telescope (DKIST)
- Gemini Observatory
- Hawaii Electric Light Company (HELCO)
- HNu Photonics
- Integrity Applications Incorporated/ Pacific Defense Solutions
- Liquid Robotics
- Natural Energy Laboratory of Hawai‘i Authority (NELHA)
- Pacific International Space Center for Exploration Systems (PISCES)
- Smithsonian Submillimeter Array (SMA)
- Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
- Subaru Telescope
- Thirty Meter Telescope International Observatory (TIO)
- UC Observatories / TMT WFOS
- University of Hawai‘i at Hilo
- University of Hawai‘i Institute for Astronomy, Hilo and Maui
- W.M. Keck Observatory

AWI currently receives funding and other support from:

- Thirty Meter Telescope International Observatory (TIO)
- Air Force Office of Scientific Research (FA95501510427)
- Hawai‘i STEM Learning Partnership at the Hawaii Community Foundation, with support from multiple funders, including the THINK Fund at HCF (funded by TIO), and the Maunakea Fund.
- Monty Richards Award/The Bank of Hawaii Foundation
- Daniel K. Inouye Solar Telescope
- University of Hawai‘i at Hilo
- Canada-France-Hawaii Telescope
- W.M. Keck Observatory

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http://akamaihawaii.org