AKAMAI WORKFORCE INITIATIVE

Summer Internship Symposium
Project Abstracts

Maui **August 4, 2017**
University of Hawai‘i, Maui College

Hilo **August 7, 2017**
Subaru Telescope

Waimea **August 7, 2017**
W.M. Keck Observatory Headquarters

Pasadena **August 10, 2017**
TMT Project Office

UNIVERSITY OF CALIFORNIA SANTA CRUZ

ISEE
Institute for Scientist & Engineer Educators

Advancing Hawai‘i college students into science and technology careers

2017 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 Maui College.

2017 Host Organizations

Hilo, Hawaiʻi Island
- Gemini Observatory
- Smithsonian Submillimeter Array (SMA)
- Subaru Telescope
- UH Institute for Astronomy

Kona, Hawaiʻi Island
- Natural Energy Laboratory of Hawaiʻi Authority (NELHA)

Waimea, Hawaiʻi Island
- W.M. Keck Observatory
- Canada-France-Hawaii Telescope (CFHT)

Kahului, Maui
- UH Maui College and the National Oceanic and Atmospheric Administration

Kihei, Maui
- Air Force Research Laboratory (AFRL)
- Akimeka LLC
- Integrity Applications Inc/Pacific Defense Solutions (IAI/PDS)
- Pacific Disaster Center (PDC)

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

Pasadena, CA
- Thirty Meter Telescope International Observatory, LLC (TIO/TMT)

AKAMAI WORKFORCE INITIATIVE

ISEE Institute for Scientist & Engineer Educators

Akamai Workforce Initiative 2017

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
Rafael Palomino, ISEE Program Manager
Nicholas McConnell, ISEE Program Manager

2017 Akamai PREP Course Instructors

Austin Barnes, Lead Instructor	ISEE/UCSC
Lisa Hunter	ISEE/UCSC
David Harrington, Co-lead Instructor	Daniel K. Inouye Solar Telescope
Jerome Shaw	ISEE/UCSC
Kimberly Bitterwolf, Team Leader	UCSC, Ocean Sciences
Cynthia Carrion	UCSC, Ocean Sciences
Chris Gilbert	University of CO, Astro-Planetary Sciences
Britt Henke	UCSC, Ocean Sciences
Gwen Musial	University of Houston, Biomedical Eng.
Stacey Sueoka, Team Leader	Daniel K. Inouye Solar Telescope

2017 Communication Instructors

Austin Barnes, Lead Instructor	ISEE/UCSC
Lisa Hunter	ISEE/UCSC
Michael Nassir	Univ. of Hawaiʻi at Manoa
Jerome Shaw	ISEE/UCSC

Special Thanks . . .

There are many people and organizations that have contributed to making Akamai a success. Below we note those that played a role in the 2017 Internship Program. We apologize if we have left your name off; thank you all for your contributions!

2017 Akamai Selection Committee
Joey Andrews (Akimeka), André-Nicolas Chené (Gemini), Dennis Douglas (IAI), Angelic Ebbers (Gemini), Justin Fletcher (Air Force), David Harrington (DKIST), Joseph Janni (Air Force), Peter Konohia (Akimeka), Kathy Cooksey (UH Hilo), Jeffrey Kuhn (IfA Maui), Mary Beth Laychak (CFHT), Luke McKay (IfA Hilo), Mike Nassir (UH Manoa), Lucio Ramos (Subaru), Kiaina Schubert (Subaru), Chris Stark (Gemini)

2017 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), Tony Travouillon (TMT), Truman Wold (W.M. Keck)

Air Force Research Laboratory
Capt Justin Fletcher, Lt. Julian McCaferty, and Ryan Swindle. *Mahalo for mentoring!*

Akimeka LLC
Brent Salmon, Peter Konohia and Desislava Iorgova. *Mahalo for mentoring and hosting our Maui selection committee and intern meetings!*

Canada-France-Hawaii Telescope
Doug Simons, Windell Jones, and Mary Beth Laychak. *Mahalo for mentoring and providing housing for our interns!*

Daniel K. Inouye Solar Telescope
Thomas Rimmele, David Harrington, Sarah Jaeggli, Tom Schad and Stacey Sueoka. *Mahalo for being a sponsoring partner, mentoring, and providing PREP instructors!*

Gemini Observatory
Markus Kissler-Patig, Chas Cavedoni, André-Nicolas Chené, Angelic Ebbers, Chris Stark and Stacy King. *Mahalo for mentoring and hosting our Hawai‘i Island selection committee meeting!*

Integrity Applications Incorporated/ Pacific Defense Solutions
Dennis Douglas. *Mahalo for mentoring!*

NELHA
Keith Olson and Alex Leonard. *Mahalo for mentoring and hosting our weekly intern meetings!*

NOAA
Robert Warner. *Mahalo for mentoring!*

Smithsonian Submillimeter Array/ASIAA
Simon Radford, Geoffrey Bower, Derek Kubo and Ranjani Srinivasan. *Mahalo for mentoring!*

Subaru Telescope
Saeko Hayashi, Yuko Kakazu, Russell Kackley, Lucio Ramos, Eric Jeschke, Eiji Kyono and Kiaina Schubert. *Mahalo for mentoring, participating in our PREP course, and hosting this year's Hilo Symposium!*

Thirty Meter Telescope International Observatory
Sandra Dawson, Gary Sanders, Warren Skidmore, Gordon Squires, Tony Travouillon, Lianqi Wang, Holly Novak, and Magnolia Ycasas. *Mahalo for mentoring and being a sponsoring partner!*

University of Hawai‘i at Hilo
Donald Straney. *Mahalo for continuing to provide housing for the Hilo interns!*

University of Hawai‘i Maui College
Donna Brown, Mark Hoffman, Elisabeth Dubuit, Jung Park, Lui Hokoana, and Lani LeBron. *Mahalo for your partnership since the inception of Akamai, all of your help this year with the UHMC course, providing classrooms for the PREP course, and mentoring!*

University of Hawai‘i – Institute for Astronomy
Luke McKay, André Fehlmann, Jeffrey Kuhn, Michael Maberry, Isabelle Scholl, Cindy Giebink, Dan O'Gara, Stuart Jeffries, and Joe Ritter. *Mahalo for mentoring, hosting our intern meetings and practice sessions!*

W. M. Keck Observatory
Hilton Lewis, Rich Matsuda, Jeannette Mundon, Bill Randolph, Drew Medeiros, Adam Vandenberg, Ean James, Josh Walawender, Tomas Krasuski and Truman Wold. *Mahalo for mentoring and hosting our annual Waimea Symposium & our weekly intern meetings!*

Daryl Albano
Current School: University of Hawai`i at Hilo
Internship Site: Thirty Meter Telescope International Observatory
Mentor: Tony Travouillon

Project Title: Integrating a Web-Based Interactive Timeline to Inform the Community about the Thirty Meter Telescope Development Process

Project Abstract:
The current website for the Thirty Meter Telescope (TMT) provides the latest news and progress updates on TMT's development. With the transition to a new website, now recognized as the Thirty Meter Telescope International Observatory (TIO), TIO is interested to add interactive web applications in order to inform the community about TMT with modern tools. With a given topic, the timeline must be able to centralize the content in a graphical interface to engage the audience's attention. To show the history and milestones of TMT on a visual timeline, TimelineJS from Knight Lab was selected because of its clean user interface and framework compatibility. Since the new website is built on the Ruby on Rails framework, web application integration is a crucial step. Thus, we decided to have the timeline written in JavaScript because of its compatibility with various web frameworks. Additionally, we built a content management system in Ruby, allowing the site administrator to effortlessly add, delete, and edit web application content, rather than have them edit the source code directly. Before integrating the timeline to the website, standalone prototypes were developed to demonstrate conceptual designs. Once a suitable prototype is deemed worthy, development and testing of the full version begins. This includes unit and integration testing, and software modifications to confirm that the web applications work well with TIO website standards. Alongside the timeline, we are currently developing other interactive web applications, such as an interactive map and an exposure time calculator. Having these tools available yields further benefits of providing engaging user content and to inform the community about TMT overall.

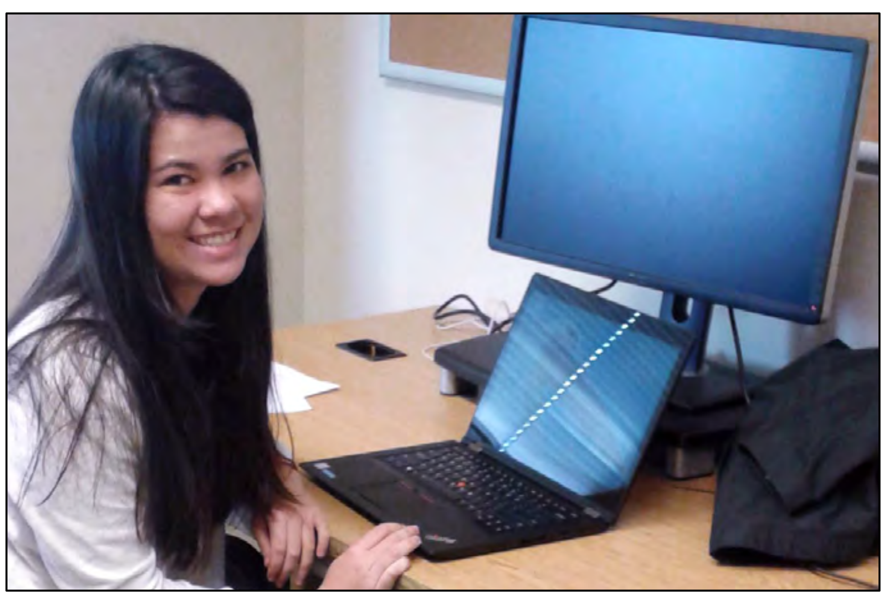
Biography:
Daryl was born and raised on the Big Island. After graduating from Keaau High School, he began attending the University of Hawai`i at Hilo, pursuing a Bachelor's degree in Computer Science. Outside of his coursework, Daryl mentors high school students in STEM projects, as well as manages UH Hilo's robotics team.
After completing his Bachelor's degree, Daryl plans to work on various engineering projects requiring critical-thinking and collaborative skills. During his free time, Daryl enjoys running, working on computers, and film/digital photography.

Jennifer Chun
Current School: University of Hawaii at Manoa
Internship Site: Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
Mentors: Ranjani Srinivasan and Derek Kubo

Project Title: Characterization of the Intermediate and Baseband Frequency Hardware of the Yuan Tseh Lee Array Telescope

Project Abstract:
The Yuan Tseh Lee Array (YTLA) is a radio interferometer that is currently being repurposed for a new cosmology experiment. Throughout the redesign, new intermediate frequency (IF 2-18 GHz) and baseband frequency (0-2 GHz) hardware has been successfully implemented on the telescope, but additional measurements are required to make the system functional. In order to have control over the signal power, the IF hardware contains a variable gain amplifier (VGA) and the baseband hardware contains a voltage varying attenuator (VVA), both of whose control voltage is set by a programmable logic controller (PLC). When setting the control voltage, the PLC must reference a table which relates different control voltages with the corresponding output signal power. The table will be used to keep the power at an optimal level to remain significantly below the 1 dB compression point of the active components. I created this table for the x and y polarizations of the 7 antennae on the YTLA and plotted the signal power as a function of control voltage. These graphs confirmed that the IF and baseband hardware operate in a linear range during observations. The operating range of the control voltage must be linear so small fluctuations in the voltage output by the PLC will not result in a large change in signal power. I also measured the signal to noise ratio (SNR) of the intermediate and baseband frequency hardware and compared it with the theoretical SNR, but there is a large discrepancy between these two values. The source of the discrepancy has not yet been identified so I will continue troubleshooting. While measuring the SNR, I verified that the frequency response of the system output was as anticipated and did not have any unexpected distortions. The completed characterization will be used to make the system operational by providing the necessary data points required to set the optimal signal power throughout the system in an automated fashion.

Biography:
Jennifer was born and raised in Kailua, Oahu and graduated from Kalaheo High School in 2014. She is going into her senior at the University of Hawaii at Manoa majoring in Electrical Engineering with an emphasis on electro-physics. Her interests lie in renewable energy and she hopes to work in that field in the future. In her free time she likes to read and go on hikes.



Nicolas Colon
Current School: University of Arizona
Internship Site: DKIST Akamai Internship, Institute for Astronomy Maui
Mentors: David Harrington and Stacey Sueoka

Project Title: Characterizing Optical Components of the Daniel K. Inouye Solar Telescope's Instruments

Project Abstract:
The Daniel K. Inouye Solar Telescope (DKIST) will conduct spectropolarimetry on the sun with its various instruments. The components of these instruments must have their optical behavior fully characterized to ensure measurement accuracy. To accomplish the goal of characterization, we used a lab spectropolarimeter to measure the ability of DKIST optical components to influence polarization at different spectral regions. We first calibrated the performance of the lab spectropolarimeter's QE65000 Ocean Optics spectrometer. MATLAB codes controlled data acquisition while Python codes controlled data analysis to quantify CCD gain settings, dark current, readout noise, and dynamic range. With this information, the system's signal to noise ratio (SNR) could be quantified as a function of exposure time. At exposure times of 150ms with 10 co-adds, the system could minimally detect 1 count (21 electrons) at an SNR of 1 and maximally detect 65,000 counts at an SNR of 3700. Wire grid polarizers were interchanged in the lab instrument to set the system's contrast ratio across the 350-1100nm spectrum. The contrast ratio increased by an average factor of two when using cover glass protected polarizers as compared to when using uncovered polarizers. At orientations where the polarizers were causing minimal flux, the statistical noise from the CCD detector dominated the errors in contrast ratio calculations. With the contrast ratio and SNR of the lab spectropolarimeter, the system's ability to perform polarimetry across the spectrum of interest can be fully defined. Then, optical elements to be used in DKIST instruments were inserted into the original lab instrument. Test results were compared against the original system performance to quantify the inserted element's polarimetry capabilities. These test results will help define DKIST's ability to accurately perform spectropolarimetry on the sun. Future studies should aim at showing how a polarizer's optical coatings and protective glass can impact contrast ratio.

Biography:
Nicolas is a rising senior at the University of Arizona majoring in Optical Engineering. He grew up in Upcountry Maui where he eventually graduated with high honors from Seabury Hall. He was a varsity athlete in Cross Country, Track and Field, and Paddling, and he continues to strive for personal fitness to compliment his academics. Raised with a keen sense of community, he strives as the Community Service chair for Phi Kappa Tau to give back to the Tucson Community and instill a passion for service among his fraternity brothers. After receiving an undergraduate's degree, he hopes to gain engineering work experience while pursuing a graduate's degree in Solar Physics. He aims to study the sun in Hawaii and understand the electromagnetic fields that allow for solar fusion and solar flares to occur. For the past three summers he has worked at Seabury Hall's Summer School, and last summer he developed his own science courses for the 5th-8th grader attendees, and this stirred his interest to become a teacher.

Brianna Craig
Current School: University of Hawaii, Hilo
Internship Site: University of Hawaii Maui College
Mentors: Robert Warner (NOAA) and Donna Brown (UHMC)

Project Title: Sea-truthing the Visible Infrared Imaging Radiometer Suite - Calibration and Validation of Water Quality in West Maui

Project Abstract:
The National Oceanic and Atmospheric Administration's Ocean Color Project has teamed up with the West Maui Ridge to Reef Initiative (R2R) in an effort to develop long-term monitoring of land-based sources of pollution that disrupt coral reef ecosystem health in West Maui. The Visible Infrared Imaging Radiometer Suite (VIIRS) aboard NOAA's Suomi satellite has the capability to produce images with ocean color data at a resolution of 375 meters. These images provide water quality conditions and allow for daily monitoring of coral systems along coastlines. Satellite-derived ocean color data are processed through a series of algorithms that translate to real-time biogeochemical products of interest in West Maui, such as surface chlorophyll, suspended particulates, and diffuse attenuation. Accuracy of these remotely sensed products is improved through a process called calibration and validation (cal/val), which involves collecting field data and comparing with VIIRS data. In order to corroborate efforts in algorithm translation for monitoring water quality in West Maui, matching satellite data products and field data is required. We began cal/val by performing seawater quality field collections at multiple points along mile-long transects in Wahikuli and Honokowai watersheds in Ka'anapali. At each point, we recorded GPS coordinates and used a DASWIN optical profiler to measure irradiance data in the water column. Seawater was also collected at each location and processed in the laboratory for chlorophyll-a and total suspended solids. Field results were recorded and geotagged on a map, divided into 375 meter pixels, and averaged as a mean value per pixel. The results for each pixel will be compared to the VIIRS data for the date of collection. The correlation will show that VIIRS sensors are in calibrated order to a certain degree of error when compared to field data. Results will be discussed at the Akamai Intern Symposium. This link will provide validation that synoptic monitoring of West Maui's coastal water quality is achievable through use of VIIRS' real-time biogeochemical products. Through the calibration and validation of VIIRS in West Maui, R2R will be able to assuredly assess the primary productivity and ecosystem health in the ocean.

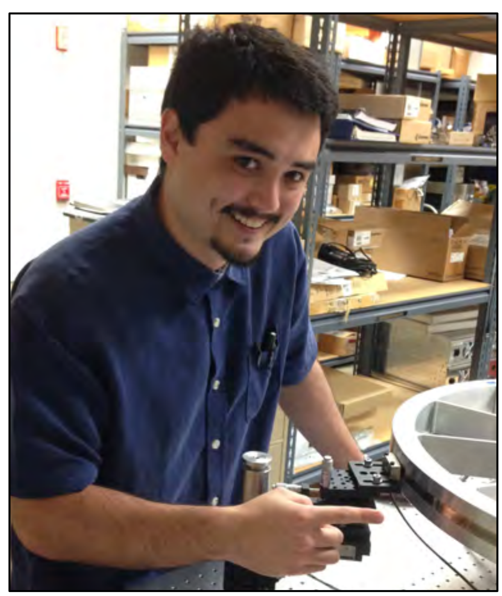
Biograhy:
Brianna has lived on Maui for 4 years, and is a transferring junior to UH Hilo majoring in Marine Science with a focus on physical oceanography and marine geology. Brianna's goals after graduation are to conduct environmental impact research on native Hawaiian ecosystems, restore and preserve these ecosystems, and educate and involve youth in conservation efforts. She spends her free time exploring the ocean by SCUBA and free-diving, and hiking around the beautiful islands.

Sean Endo
Current School: University of Portland
Internship Site: W.M. Keck Observatory
Mentors: Tomas Krasuski and Ben McCarney

Project Title: Designing an Encoder-Based Velocity Feedback System for the Keck Telescopes

Project Abstract:
W.M. Keck Observatory is currently working on a Telescope Control System Upgrade (TCSU) project that improves the telescope's performance and reliability, while reducing maintenance needs and addressing serious obsolescence issues. Part of the original TCSU project was to replace the telescope's motor tachometers that are used for velocity feedback. Replacement of the tachometers would be accomplished through calculating velocity from the new position encoders but this sub-project was de-scoped due to a time-budget. The purpose of this Akamai project is to restart the old TCSU tachometer replacement sub-project by developing a prototype encoder-based velocity feedback system that may be used to replace the current motor tachometers at some point in the future. The main approach to the project is to take position data from the new Heidenhain encoders, filter them to eliminate noise, and then differentiate them to derive noise-reduced velocity data. A lab setting was constructed using the same encoder devices that are currently implemented on the Keck telescopes. Real and generated encoder data was simulated in Matlab to test various filter designs though analysis of the filtered data's standard deviation in order to determine which filter eliminated the most noise. Matlab simulations determined that the best filter design was a low-pass Hamming window filter with a sampling frequency of 1000 Hz, a cutoff frequency of 100 Hz and a down-sampling of 10 taps. The filter is used to provide the control system with noise-reduced position data that will be differentiated into velocity data to replace noisy and inaccurate tachometer velocity data. The increased accuracy of feedback velocity data in the control system leads to higher stability of the system meaning that the adjustments needed to correct the telescope's position is reduced. It is recommended to test the Hamming window filter in the constructed lab setting to determine any hardware limitations of the Encoder Interface Box, the feasibility of the filter in the current control system and the performance of the new filter compared to the motor tachometers.

Biography:
Sean was born and raised on the Island of Maui and graduated from H.P. Baldwin High School, Class of 2014. He attends the University of Portland and will be a senior in the fall. Sean is pursuing a Bachelor of Science degree in Electrical Engineering with a minor in Computer Science. His engineering skills began with his Intermediate and High School robotics clubs. Sean's technical interests are in the fields of power and communication systems, and signal processing. After graduating, he plans on returning home to work on Maui. Sean enjoys playing basketball, coaching youth basketball, and playing video games with his friends and family.

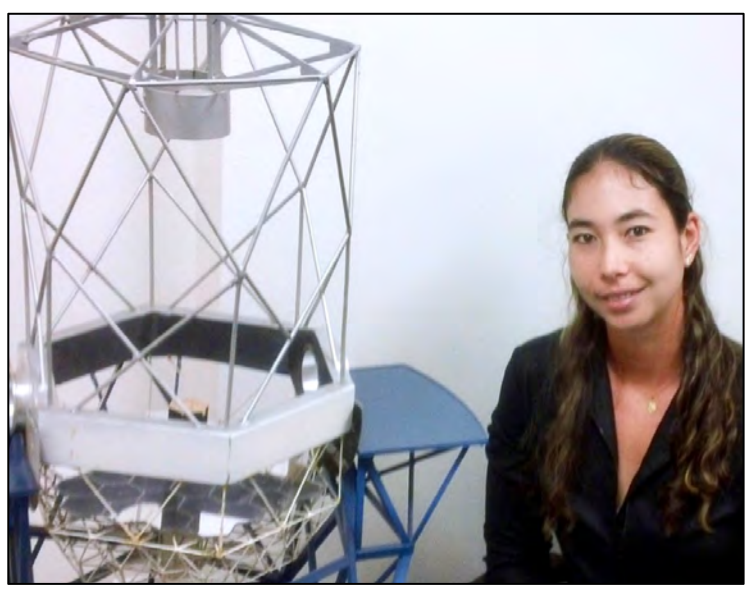


Jeri Goodin
Current School: University of Hawaii at Manoa
Internship Site: W.M. Keck Observatory
Mentors: Truman Wold and Ean James

Project Title: Instrument Transfer Shock Reduction Design Concepts

Project Abstract:
Keck 1 telescope is home to multiple instruments, some which can be interchanged through a rail and gear system specifically designed for this telescope. One of the instruments, MOSFIRE (Multi-Object Spectrograph for Infrared Exploration), is Keck 1's heaviest instrument and is commonly used by astronomers for its ability to record up to 46 different objects simultaneously. Due to MOSFIRE's 4-ton weight, the rail system on both the floor and the transport handler became misaligned with the connecting rails on the telescope. When the MOSFIRE is being transported on and off the telescope, these misalignments cause the MOSFIRE to ram into the connecting rails before rolling onto those rails which produces 5-7 G's of shock which could lead to internal damage. The purpose of this project is to come up with several design concepts that will ultimately reduce the amount of shock transferred to the MOSFIRE. There are two major areas where most of the shock is produced: between the handler and the Cassegrain socket rails and between the Nasmyth deck and the Cassegrain platform. The two main concepts that were selected consisted of a roller mechanism, between the transport handler and Cassegrain socket rails, and an increase in the tapered angle of the floor rails on the Nasmyth deck. These were selected because of a roller's capability to reduce friction while providing a smoother connection between the rails and because changing the tapered angles was a simple and practical approach to smoothing out the vertical misalignments in the floor rails. These concepts were drawn up in detail and analyzed through SOLIDWORKS and ANSYS to ensure the selected designs will reduce as much shock as possible by providing the instruments with a smoother ride with the intent that they could be fabricated and implemented later in the year. These concepts were specifically designed for the MOSFIRE, however, with minor alterations the same concepts could be applied to the other instrument's rail systems as well.

Biography:
Jeri is a mechanical engineering student at the University of Hawaii of Manoa. She is currently pursuing her second degree after obtaining a Bachelor's degree in Equine Studies/Business Management and an Associate's degree in Business at the University of Findlay. She decided to change her career path because she enjoys the challenges that engineering entails. A few goals she currently has are to be involved in space travel as well as helping to steer the world towards self-sustainability. During her free time, Jeri spends most of her time at a barn, riding and training horses. But when she is not at the barn she likes to go to the beach, go on hikes, watch movies and hang out with friends.

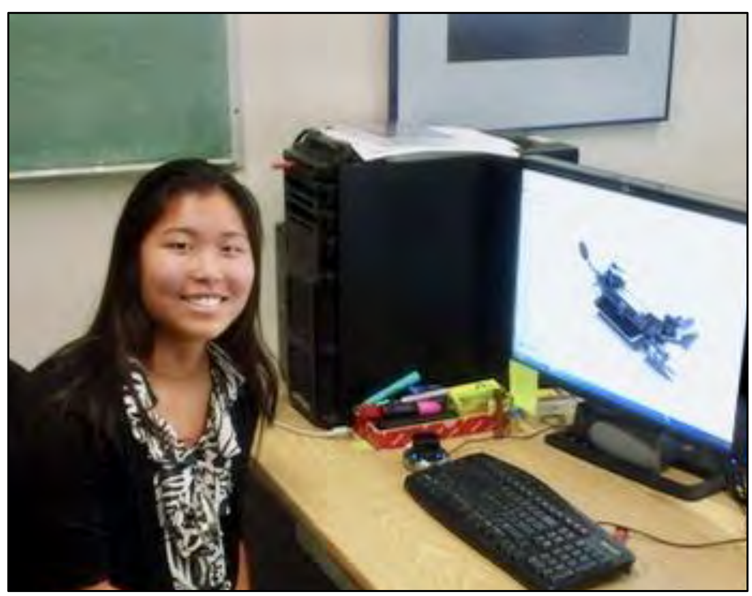


Nikki Imanaka
Current School: University of Idaho
Internship Site: Canada France Hawai'i Telescope
Mentor: Windell Jones

Project Title: Redesigning the Cassegrain Guide Camera Mount for the Canada-France-Hawaii Telescope

Project Abstract:
The cassegrain guide camera is used to estimate the guide corrections for the ESPaDOnS and SITELLE instruments while they are used on the Canada France Hawaii Telescope. The guide camera is a critical component of CFHT's Telescope Control System and is used to keep the target fixed in the field of view during exposures and thus reducing smearing of the target during long exposures. The current guide camera and its supporting hardware are obsolete. Therefore, a new digital camera made by Quantum Scientific Imaging has been purchased to replace the existing camera with a modern equivalent. A mount was designed and fabricated for its implementation at CFHT. This project evaluated multiple configurations of the new camera mount. To establish a baseline design and identify constraints, a Solidworks model of the existing assembly was created. From there, the F8 beam focus movement, possible interference with the neutral density filter wheel motors and optical axis alignment were identified as constraints for the new design. It was found that the camera needed to be positioned on its side and its detector could not be positioned farther than 80.45 mm from the leading edge of the original camera mounting plate. A new camera plate was designed to allow adjustment for the sidewards shift of the camera body to center its detector with the F8 beam optical axis. The new mounting plate was designed to be easily exchanged with the existing camera to allow for a rapid exchange during testing. The final design meets all identified constraints and maintains compatibility with the existing assembly. It is predicted that the new camera will provide increased sensitivity and less centroiding noise. A simulation using the new camera as feedback for the CFHT TCS was performed to explore the impact on the telescope tracking error as a function of correction frequency and filtering of the centroid position.

Biography:
Born and raised in Kane'ohe on the island of O'ahu, Nikki is currently working towards a B.S. in Mechanical Engineering at the University of Idaho with a Pre-Health minor as well as being a Division 1 NCAA athlete for the Women's Swim & Dive team as a spring-board diver. Nikki loves learning and trying new things. She has an analytical mind, but also has a creative side with a passion for art, design, and nature. She hopes to one day use her engineering career to work along side the medical field or in the field of prosthetics.



Chantelle Kiessner
Current School: University of Hawai'i at Hilo
Internship Site: Daniel K. Inouye Solar Telescope
Mentors: David Harrington and Tom Schad

Project Title: Statistical Evaluation of Polarization Noise for DKIST data

Project Abstract:
One feature of the sun that the Daniel K. Inouye Solar Telescope (DKIST) aims to study is its magnetic field. The solar magnetic field cannot be observed directly, so it is studied through the polarizing effect it has on light. When the light from the sun enters the atmosphere of the Earth, however, the wavefront changes and introduces errors in the data collected. To help with evaluation of these errors, DKIST has a simulation tool to degrade images of the surface of the sun in response to atmospheric turbulence and to show the limited correction applied by adaptive optics (AO). The purpose of this project is to determine how these errors behave with different atmospheric conditions and how well the AO system can correct for these errors using the data from the simulator. We analyzed several data sets generated by the simulator to determine and compare time-dependent errors. Using the standard deviations of normalized differences between frames in the data sets, it was found that the error follows a $\sqrt{N}$ statistic for both uncorrected and AO corrected frames. To more accurately evaluate the polarization errors at smaller scales, the same statistical process was used to compare the AO performance in the edges and the center of the frame. Results indicate that the AO correction is many times better in the center of the frame than at the edges. The simulator only produces a 'snapshot' of what the data would look like after a given exposure time, whereas a real camera would be collecting light for the entire exposure. To assess the difference, the 'snapshot' frames were co-added to better reflect a true exposure time and compared with the original 'snapshots'. The co-added images are blurrier around the edges than the 'snapshots' because the AO system stabilizes the center of the frame better as time goes on. While the simulator does not perfectly reflect reality, these methods of analysis confirm that the AO correction works best for the center of the frame and for better atmospheric conditions when collecting polarimetric data to study the solar magnetic field.

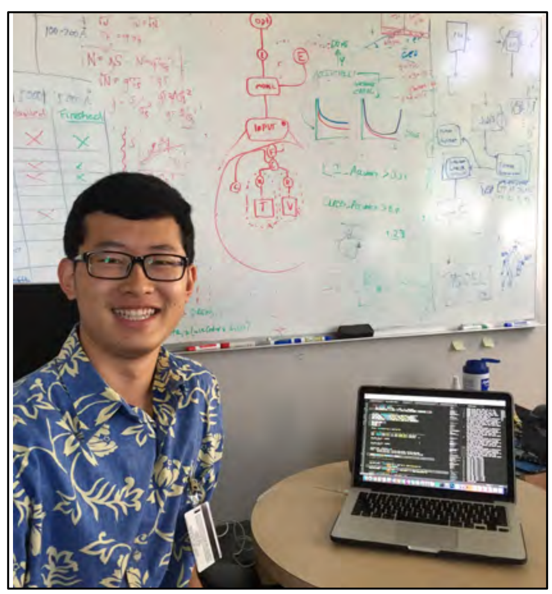
Biography:
Chantelle was born in Herford, Germany, but has lived most of her life in Salt Lake City, Utah. She currently attends the University of Hawai'i at Hilo, where she is studying astronomy, physics, and mathematics. Chantelle plans to go to graduate school, where she will work towards a PhD in astronomy or physics. Outside of her coursework, Chantelle regularly volunteers at the Mauna Kea Visitor Information, bringing astronomy to the local community through their stargazing program and outreach events. She also takes part in the University Astrophysics Club, for which she was elected secretary last year. Other activities Chantelle enjoys include hiking and snowshoeing.

Christopher Kim
Current School: Yale University
Internship Site: Air Force Maui Optical and Supercomputing Site
Mentors: Capt. Justin Fletcher and 1st Lt. Julian McCafferty

Project Title: Localization of Closely-Spaced Deep Space Objects Using High Frame Rate Imagery via Deep Learning

Project Abstract:
Space situational awareness is the discipline associated with understanding the state of the space environment and objects in that environment. Deep space closely-spaced object localization (C-SOL) is one problem within this domain. C-SOL is the problem of determining the relative locations of two resident space objects in geosynchronous orbit with dissimilar brightness in close proximity to one another. Previous investigations demonstrated that separation information may be extracted from a sequence of high frame rate images. These efforts did not yield software modules capable of localizing CSOs. High frame rate imagery captures the instantaneous state of atmospheric turbulence and contains information about the location of objects that would be lost due to the accumulation of turbulence-derived signal perturbations. In this work, we demonstrate the applicability of machine learning techniques to the C-SOL problem. As real data from this domain is fairly rare, simulation of the relevant phenomena is required. Thus, this work required the transliteration and modernization of legacy MATLAB code that performed physics-based simulations of high frame rate imagery into Python. The produced software generates and organizes high frame rate imagery data into datasets to be used for training and empirical validation of machine learning models. These datasets are used train a convolutional neural network to extract salient features and localized objects using those features. The findings of this work suggest that deep learning is a viable means of solving the C-SOL problem.

Biography:
Christopher is a Class of 2015 graduate of Maui High School and will be a junior at Yale University in the Fall of 2017. He is working towards B.S. degrees in computer science and economics and is particularly passionate about the potential of computer science in opening new frontiers. He hopes to utilize his higher education to pioneer advancements that will enrich the lives of others. At Yale, Chris is involved with Yale's student-run hackathon, YHack, teaches computer science to New Haven middle school students, is a teaching assistant for Yale's introductory computer science courses, and is an active member of an on-campus Christian fellowship.

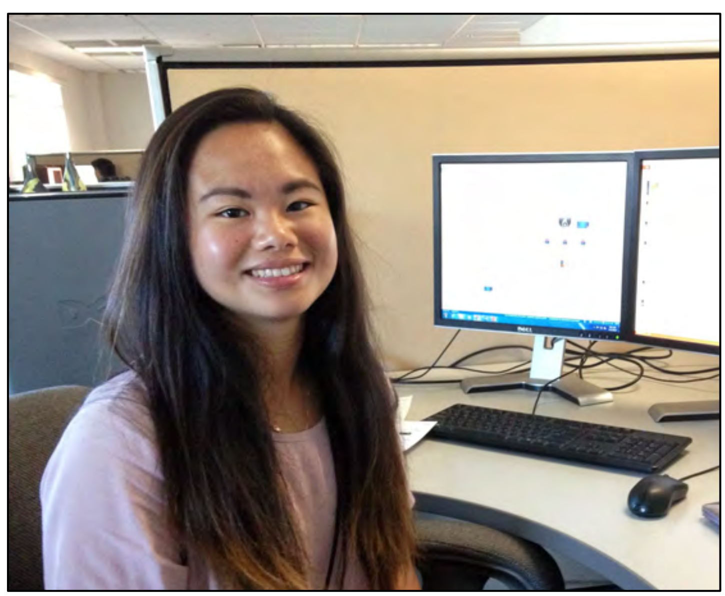


Michelle Lau
Current School: University of Portland
Internship Site: Akimeka, LLC
Mentors: Brent Salmon and Des Iorgova

Project Title: Performing an Analysis of Alternatives for Security Testing Tools to be Incorporated into a Penetration Testing Suite

Project Abstract:
The emergence of cyber security threats in both the commercial and government Information Technology world has given rise to an urgent need to secure existing and future applications and data across the world. Theater Medical Data Store (TMDS) and Medical Situation Awareness in Theater (MSAT) are web-based applications managed by the Department of Defense that are used to view and track a soldier's medical treatment in the combat zone. Due to the nature of the data in these systems, it is a matter of patient safety to ensure that the applications are secure. Akimeka's quality assurance team performs manual functional testing to validate that the systems execute as expected, but there is currently no framework for performing security testing. This project has been tasked with the empirical discovery of a tool that will provide a security testing component to a future security testing framework. Specifically, we focused on open source security testing tools and developed an evaluation criteria to empirically determine the best tool to use. The Department of Defense requires performing an Analysis of Alternatives (AoA) before new tools can be chosen. We conducted research on common security vulnerabilities for web applications identified by Open Web Application Security Project (OWASP), a worldwide not-for-profit charitable organization focused on improving the security of software, AoA methodologies, evaluation criteria standards, and security testing tools. This background analysis was used to develop a web page in Eclipse, a Java Integrated Development Environment, using JSP, HTML, and JavaScript with a backend MySQL database that included some of OWASP's top ten vulnerabilities such as cross site scripting, SQL injection, and sensitive data exposure. The web page is used to evaluate the performance of the security testing tools, allowing the highest ranked tool to be selected for the security testing framework. The chosen tool will be the backbone to developing a security testing framework for TMDS and MSAT through the discovery of vulnerable areas that can potentially be exploited by bad actors. Future work on this project should include the incorporation of this tool into a Penetration Testing Suite for TMDS and MSAT.

Biography:
Michelle was born and raised on the island of Oahu. She is currently attending University of Portland studying Computer Science. Michelle plans to work in industry as a software engineer after graduating from college. She is currently interested in cybersecurity, but would also like to explore other fields of computer science. During her free time, she likes spend quality time with her family and friends and go hiking.



Junhao Li
Current School: Northwestern University
Internship Site: Subaru Telescope
Mentor: Russell Kackley

Project Title: Improving the Subaru Telescope Alarm System's Graphical Interface

Project Abstract:
The Subaru Telescope alarm system notifies telescope operators of situations that could be hazardous to the telescope or routine operation. The original alarm system showed active alarms and past alarms but had no method for operators to access alarms that were inactive or hidden. This restricted the alarm information that could be used by operators. This project aimed to create a new interface in the existing GUI that would allow telescope operators to access any alarm at all times. To make this interface, we created a new back-end application to process alarm configuration data with a GUI built around it to accept user commands. Both the back-end application and the GUI were written using Python and the PyQt4 library, a framework for developing applications and GUI's. The application processes through the alarm system's YAML configuration files to build a complete list of alarms and the GUI then displays the alarms. The alarms are organized by category in a tree view and are shown with configuration information such as possible severity levels and threshold values. Using the new interface, we also implemented new features for the alarm system including a 'snooze' function that allows operators to ignore minor alarms for a selected duration of time. Telescope operators can now access alarms that were inactive or hidden in the original GUI. In the future, the new interface can be used to add further features from editing alarm configurations directly through the GUI to viewing statistics on individual alarms.

Biography:
Junhao moved to Hawaii at the age of one and grew up in Hilo where he graduated from Waiakea High. He is currently a Computer Science Major at Northwestern University with interests lying in machine learning and software development. After he graduates he intends to pursue a master's degree in Computer Science. Some of Junhao's hobbies are cooking, playing video games, and reading novels.

Brandi Liu
Current School: Arizona State University
Internship Site: The Institute of Astronomy Maui
Mentors: Cindy Giebink & Dan O'Gara

Project Title: Integrating Lightning Detection to the Haleakala Weather System

Project Abstract:
A lightning detection device on the summit of Haleakala is needed due to the tremendous amount of damage lightning strikes have previously caused. However, there is currently no lightning detection device in place at the summit of Haleakala. The purpose of this project is to collect lightning strike data through the implementation of a lightning strike detection system in order to send out warnings to stakeholders of nearby lightning. This system would be integrated into the current Haleakala weather system, allowing for equipment to be disconnected and people to be brought to safety. We designed a Python program that was coupled to a lightning sensor chip, which was incorporated into a Raspberry Pi device. When the interrupts are read, the Python program writes this lightning strike data to a database. Once the data is stored in the database, the latest lightning strike data is published to the weather website, and an alert email is sent to stakeholders. The integration of displaying the lightning strike data on the Institute for Astronomy Weather page and receiving the data from the database is up and working. In 64 hours of the lightning detection device being up and running it has detected 104 strikes ranging from 5 km to 31 km away from the Institute for Astronomy Maui Maikalani Advanced Research and Technology Center. Next steps include making the lightning strike portion of the web page more visually appealing when lightning is actively taking place. With our developed lightning detection device, stakeholders at the summit of Haleakala will be able to know when lightning strikes are in close proximity in order to prevent damage to technological equipment.

Biography:
Brandi was born and raised in Kapolei, O'ahu. She graduated from Kapolei High School in 2015 and will be entering her 3rd year at Arizona State University this fall. Brandi is pursuing her Bachelor of Science in Computer Science. At the moment she is very interested in learning more about web design. She hopes after graduation to work for a big company with lots of different options to fill her many interests such as app, front-end, and back-end development. At college Brandi loves to be involved through clubs such as Rotaract (Rotary International), Women in Computer Science (WiCS), The Software Developers Association (SoDA), and the Hawai'i and Pacific Islander Club (HPIC). In her free time she enjoys spending time with her friends and family, playing soccer, dancing hula, and loving animals.

Jamal Marshall
Current School: Seattle University
Internship Site: W. M. Keck Observatory
Mentors: Bill Randolph, Drew Medeiros and Adam Vandenberg

Project Title: Modeling Keck II with Work Points

Project Abstract:
The W.M. Keck Observatory offers two terrific telescopes to an endless list of observers, and there is a continual effort to maximize the number of observers that each night can accommodate. However, to make any advancements toward such a goal, the current instrumentation and state of the telescope must be improved. An issue that slows the process of updating the infrastructure of either telescope is that both lack an accurate and complete telescope model to base new designs off of. The current process of creating new access platforms or re-designing instruments for quick and easy usage requires creating a model for the area of interest. To expedite this process, the goal of this project is to research and create a work point model of the Keck II telescope that can be used to cross-check existing models, and also be referenced when designing or redesigning components around the telescope. To create this model, I began by researching and compiling work points from the as-built drawings of the Keck II telescope. After transcribing work points for the telescope into Excel spreadsheets, the data was used to make individual parts in SolidWorks. The complete work point model was composed by making an assembly of the desired reference telescope data. The model results appear congruent with the drawings and show an overall symmetry within all structural components. This resulting model has been effective when applied to check existing CAD telescope structures for accurate positioning and has been used to build new modeling data for Keck II. It also allows for quick and accurate reference when new instrument designs or access platforms are meant to be implemented.

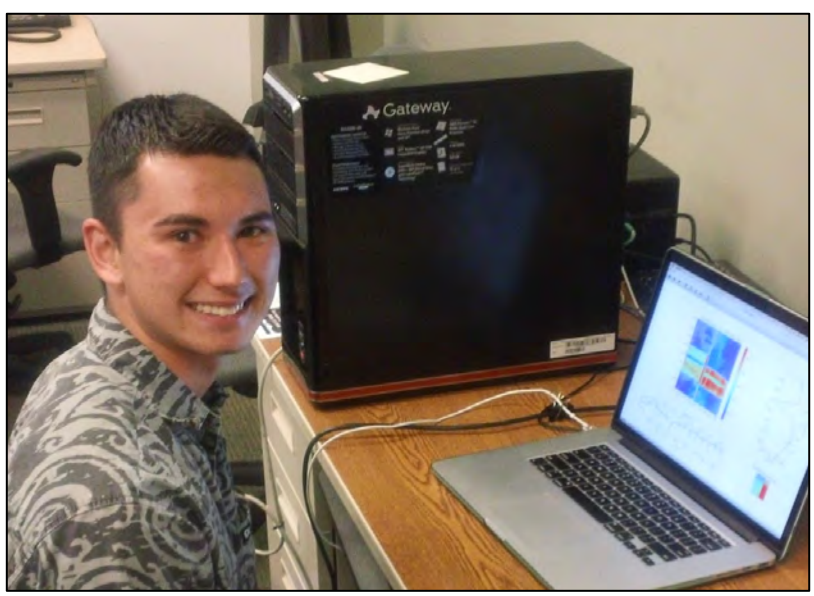
Biography:
Jamal is an optimistic individual that looks forward to helping improve the world in one manner or another. He is a Waiakea class of 2015 graduate and enjoys taking part in various extracurricular activities such as sports, community service, and other clubs. Jamal is studying Mechanical Engineering at Seattle University and currently has his sights set on joining the field of renewable and sustainable energies after achieving a Bachelor of Science degree. Out of the things he loves to do playing soccer, going on adventures with friends, and listening to music are at the top of the list.

Keoki Massad
Current School: University of Portland
Internship Site: Institute of Astronomy, Maui
Mentors: Dr. Jeff Kuhn and Dr. Andre Fehlmann

Project Title: Observing The Sun's Invisible Force: An Analysis Of Polarized Dual-Beam Spectra Data Through An Algorithm

Project Abstract:
Given that the sun's magnetic field is responsible for many phenomena in space that pose possible dangers, being able to observe the sun's magnetic field can allow us to better prepare ourselves against these potentially dangerous events. Currently, the scientists working with the Cryogenic Near Infrared Spectro-Polarimeter (CryoNIRSP) have data in the form of images of polarized dual-beam spectra, but do not have a specific way to analyze these images. When the corresponding pixels from the opposite beams of the spectral image are mapped together and then added/subtracted from each other, the polarization of the light being observed can be determined. The purpose of this project was to create an algorithm and interface that the scientists can use to analyze and map the corresponding pixels of specific segments of the polarized dual-beam spectra that are captured through the CryoNIRSP. With the ability to determine the polarization of the light coming from the corona of the sun, the weak magnetic field at that point in space can be observed. We used Python coding language and many of its public modules, such as Matplotlib, to create the interface where the Flexible Image Transport System (FITS) image of the polarized dual-beam spectra is displayed and analyzed. We developed additional click and key press events that were uniquely adapted to enable/disable features in which the original FITS image could be analyzed. These features allow the user to determine the type of data and area in which they want to analyze, depending upon their preferences and needs. Most importantly, the algorithm and the interface are able to find and display the correlation of a small rectangle in a larger boundary rectangle through the implementation of a cross correlation function. This correlation brings us closer to the ability to correctly and accurately map the corresponding pixels of orthogonal polarizations together. This interface can be implemented to analyze FITS images of other spectra due to the simplicity of the functions that the key press events call and the flexibility of Python to allow for modification to complete more specific tasks. When the mapping of the corresponding pixels is completed, the scientists using the CryoNIRSP at the Daniel K. Inouye Solar Telescope on the summit of Haleakalā on Maui will be able to accurately observe the magnetic field of the corona of the sun.

Biography:
Keoki is a senior attending the University of Portland working towards a double degree in Mechanical Engineering and Computer Science with a minor in Mathematics. Originally from Honolulu, he is a 2014 graduate from the Kamehameha Schools Kapalama. In his free time, he likes to play sports such as soccer and to surf with family and friends.



Reyn Mukai
Current School: University of Hawaii at Manoa
Internship Site: Thirty Meter Telescope International Observatory
Mentor: Tony Travouillon

Project Title: Developing a VR Application Modeling the TMT Observatory for Risk Analysis and Outreach

Project Abstract:
With the growing adoption of virtual reality (VR) as an immersive media experience, TMT decided to develop a VR application for risk analysis and outreach. TMT's telescope facilities, being in the development/construction phase makes it difficult for safety personnel to simulate evacuation procedures and for TMT to showcase the telescope model. To address these problems, M3 Engineering developed a VR application. This application however uses 3rd party proprietary software which limits the turnaround time for modifications. To address these concerns, we developed a VR application using the game engine Unity. The models for the application used the actual 3D design models of the observatory. High quality 3D CAD models, however, do not transition well to real-time, performance-focused VR applications. To make the models more VR friendly, we developed workflow between the source model and the game engine. Various optimizations were explored such as precomputed lighting polygon simplification. Numerous algorithms for simplification were explored, each yielding different reduction percentages and visual distortions. Due to the large scale of the project, not all aspects of the workflow were fully explored or tested. For example, one of the programs used in the optimization workflow for 3D models has limited format support and simplifies object hierarchy arbitrarily. While the performance impact of the simplifications was significant, arbitrary object hierarchy simplification can be detrimental when animating game features. Due to the large scale of the project, Most of the basic project requirements were met. These include viewing the 3D model of the telescope, fly and walk player modes, and VR headset support. Additional features such as player interaction with the game world can be implemented in the future.

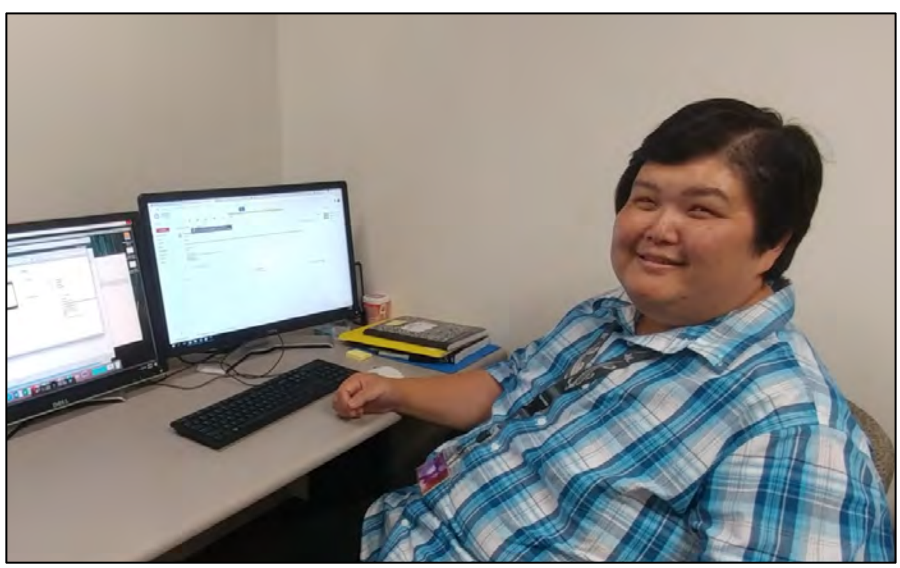
Biography:
Reyn was born and raised in Hilo, Hawaii. He graduated in 2014 from Waiakea High School, is an Eagle Scout, and currently a junior pursuing a Bachelor's Degree in Computer Engineering at the University of Hawaii at Manoa. At the UH, he is involved in the Electrical Engineering Student Advisory Board, UH Drone Technologies, UH Smart Campus Energy Lab, and is Co-chairperson for the 2017 IEEE Conference STEM Program. After graduation, he hopes to pursue a career in software development or smart device development. Outside of school, he enjoys playing video games, working on electronics projects, and playing airsoft with friends.

Elton Nakagawa
Current School: Hawaii Community College
Internship Site: Gemini Observatory
Mentor: Chris Stark

Project Title: Designing a Mobile Device Management Solution

Project Abstract:
Mobile devices are becoming more common in the workplace today because they are able to emulate the traditional roles of desktop computing. Gemini Observatory (North) in Hilo, Hawaii, have systems management solutions to fulfill the needs of both IT and end users for desktop computers, but have no complete mobile solutions. The software and hardware devices that Gemini owns fulfill some of the requirements for an Mobile Device Management (MDM) solution but collectively, they do not meet the specific needs of the organization. Despite the abundance of systems management tools available to manage desktop computers, most of these tools do not have the functionality to support mobile device platforms such as iOS or Android. We performed an assessment to determine if an Enterprise Mobile Management (EMM) solution was necessary or if smaller solutions could be implemented to manage specific needs. After meeting with the stakeholders of the MDM project, a decision was made to narrow the scope of the project in order to produce a solution that specifically managed iOS devices tied to Zoom-enabled conference rooms located within Gemini's areas of operation. Comparing the documentation to the needs assessment produced a list of 7 potential solutions. We discovered that the Apple Configurator 2 application, which provides the device supervision, and the macOS Server software, which provides the MDM capabilities, are necessary for the MDM solution to function. In order for this to become a full MDM solution, further testing is needed. Implementing macOS Server and Apple Configurator 2 will solve the iOS and MacOS MDM needs of Gemini however it is limited to these two platforms. In order for future mobile device platforms to be incorporated into the MDM solution, other products must be researched.

Biography:
Elton is currently a second year student attending Hawaii Community College majoring in IT and Cybersecurity. He has previously attained an A.A.S degree in Data Processing from Hawaii Community College, and a Certificate of Competence in Electronic and Computer Engineering Technology (Cybersecurity) from UH Maui College. Elton's short-term goals are to either continue his education in Information Assurance and Cybersecurity or to find a career in the Cybersecurity field. Elton hopes to eventually create a cloud data center for the Big Island in hopes of attracting future high-tech companies to the island and create better career opportunities for local STEM graduates. In his free time, Elton enjoys exploring new technologies, creating digital media, and finding recipes online to expand his culinary skills.

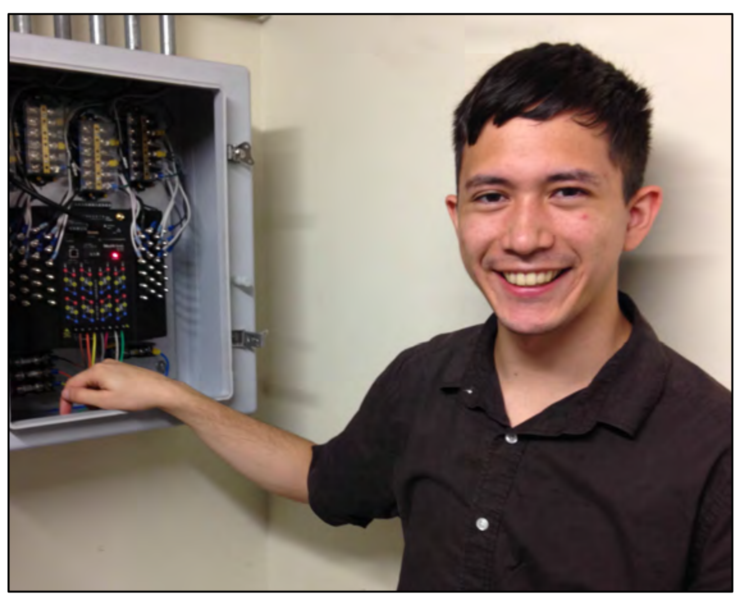


Talmage Nakamoto
Current School: Brigham Young University
Internship Site: The Natural Energy Laboratory of Hawaii Authority (NELHA)
Mentor: Keith Olson

Project Title: Determining the Efficiency of Sea Water Air Conditioning in the Hale Iako

Project Abstract:
The Natural Energy Laboratory of Hawaii Authority (NELHA) has a newly remodeled blue technology incubation center for its clients- the Hale Iako building. This new facility is cooled by a Sea Water Air Conditioning (SWAC) system, which uses seawater taken 674 m depth at 6°C to cool air, as opposed to a traditional air conditioning system, which would use a refrigerant. The system became operational with the building in fall of last year, but has not been monitored until now. The purpose of this project is to install a multifunctional power meter to acquire real-time data and compare it with a calculated model of the traditional air conditioning system that would be required to cool the same building. First, a Shark MP200 power meter was installed in the building to measure electricity usage at four key circuit breakers that the SWAC system utilizes. That data was then processed to isolate the SWAC system's load from the rest of the building's power consumption. Then, using the schematics of the building, a thermodynamic analysis was performed to determine the cooling load and then matched with existing commercial air conditioning systems to determine a theoretical energy load. By comparing the theoretical specs with the readings on the SWAC system, it has been determined that the SWAC system can handle the cooling load while consuming up to a tenth of the power of a traditional air conditioning system. SWAC has additional advantages over HVAC systems, such as the lack of refrigerant and the reuse of the seawater by other NELHA clients.

Biography:
Talmage was born and raised in Kona, on the Big Island of Hawaii. Since he was a kid he always liked knowing how things worked, and wanted to be a scientist. As he entered his college years he chose mechanical engineering as his main academic pursuit. He just finished his second year at Brigham Young University in Utah.



Kurt Noe
Current School: University of Hawai'i at Manoa
Internship Site: Akimeka, LLC.
Mentors: Peter Konohia and Jennifer Schiltz

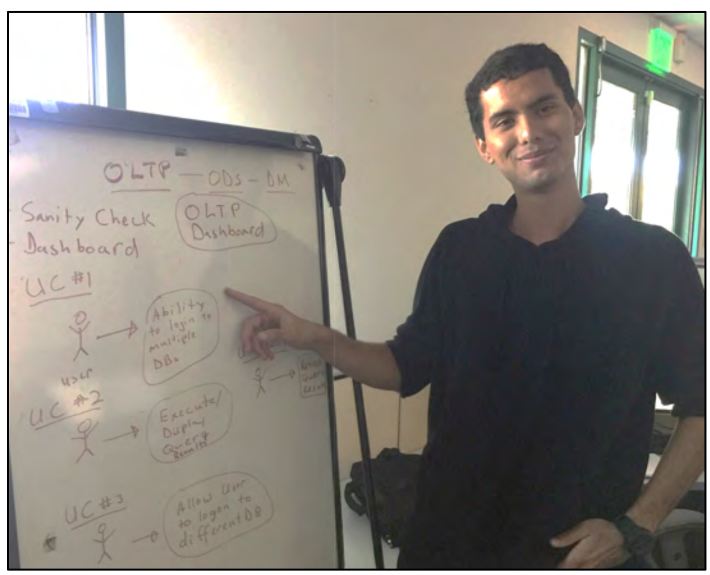
Project Title: DEVELOPING WEB APPLICATIONS FOR THE MANAGEMENT AND MONITORING OF DATA WAREHOUSES

Project Abstract:

When operating data warehouses that contain thousands or millions of file counts, the ability to effectively access and read file entries becomes more important than writing the file entries to the database. Akimeka, as a company, primarily works with the Department of Defense with one focus being the management and support of large quantities of military health records. Due to the large amount of files that Akimeka works with, a streamlined means of accessing and tracking these files is necessary to ensure readability and ease of use. The current interface does not centralize the information resulting in extra steps needed to access the health records archived in the various company databases. The goal of this project is to develop a web application that serves as an Online Transaction Processing (OLTP) Dashboard that will provide situational awareness of the states of data as it migrates to the existing Data Marts within multiple databases. We plan to implement the application for use within the company by the members of the team tasked with handling database operations. The starting point to developing the application was creating use case diagrams, which later evolved into requirements. A design document was then developed which laid out the solution that satisfied the requirements. Following the planning stage, we developed prototypes to test the design, resulting in a complete version that underwent implementation tests before finalization. The initial prototype for OLTP Dashboard would navigate between a single table from multiple databases. Following successful testing we then expanded functionality to display multiple query results in a single screen to centralize the information. Some of the key features we focused on were periodic refreshes of the implemented queries as well as allowing the user to select a record to access a more detailed view for further information. Upon completion we found that the OLTP Dashboard provided the user with a centralized and intuitive interface for bringing up any necessary information with much less effort over manually running the included search queries individually. Further testing showed the increase in efficiency that this application would bring to the workflow of the team by replacing the older methods of database querying. Within the development time provided, we were able to set up an infrastructure that would work as a good base to build further features upon as needed.

Biography:

Kurt is a senior at the University of Hawaii at Manoa, double majoring in Information and Computer Sciences (ICS) as well as the Academy for Creative Media: Animation Track (ACM). He successfully premiered his first short film titled "Mighty Ward" at the 2016 Hawaii International Film Festival and is currently collaborating on another animated short titled "Kai and Honua" that received a funding award from the Academy of Creative Media Pitch Day and is a story inspired by Hawaiian mythology. Kurt is originally from the island of Kauai and is fascinated with the creative process that goes behind the development of films, games, and software. He hopes to continue working towards forging a career using the skills he has developed in both majors. For independent projects he hopes to develop a mix of creative media that help contribute to Hawaiian cultural representation in games and film as well as developing projects about other topics that interest him.



Joshua Parep
Current School: University of Hawai'i at Hilo
Internship Site: Institute for Astronomy in Maui
Mentors: Isabelle F. Scholl and Andre Fehlmann

Project Title: Building a GUI for the Instrument Performance Calculator for the CryoNIRSP Instrument

Project Abstract:
The Cryogenic-Near-Infrared Spectro-Polarimeter (CryoNIRSP) is a newly developed instrument from the Institute for Astronomy in Maui that samples the broadest wavelength range and highest photometric sensitivity. Currently, CryoNIRSP does not have any assisting software or interface to help new users of the instrument to learn how to use it. The goal of this project is to develop the Graphical User Interface (GUI) of the Instrument Performance Calculator (IPC) to help new users of CryoNIRSP preparing an observation program, validate data, and get an estimate of the performance of the instrument configuration. First, we created the GUI main frame using python, Qt, Matplotlib and Sunpy. Python was used for everything, mostly for the functionalities, Sunpy was used to embed sun disk into GUI, Matplotlib was used to plot data and Qt was used to create buttons and layouts. Examples of buttons created include a combo-box button for possible list of spectral lines, and a radio buttons for selecting telescope Field of View (FOV). The IPC provides users with a guided and an expert mode. During this internship, we designed the Guided mode to guide new users on how to use the instrument. In this mode, the user will be able to graphically select the field of view and other parameters. These parameters will be used to call existing functions that will calculate the performance of the instrument if run with these parameters.

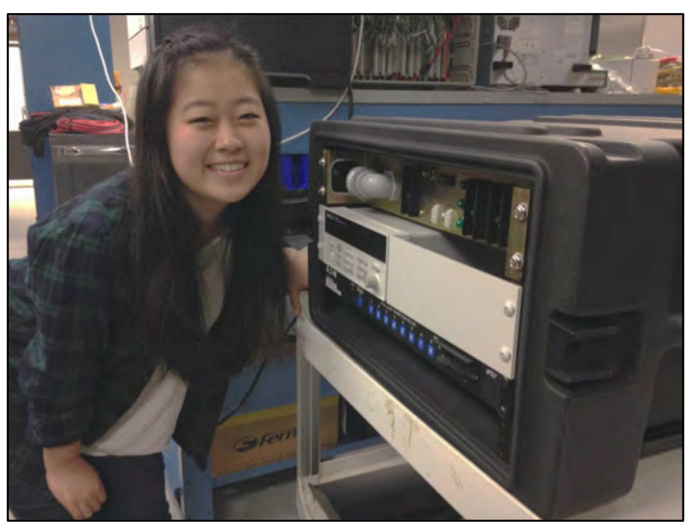
Biography:
Joshua was born and raised in one of the island countries in Oceania (Papua New Guinea). He moved to Hawaii in 2014 after finishing high school He is a senior computer science student at UH Hilo. He is the president of the International Student Association and also president for one of the RISO clubs in UH Hilo. He is a tutor for computer science and math at UH Hilo. His dream is to become a data scientist.

Katie Park
Current School: University of Washington
Internship Site: Subaru Telescope
Mentor: Lucio Ramos

Project Title: Designing and Building a Portable Power Distribution and Diagnostics Unit

Project Abstract:
Subaru Telescope is commissioning several new instruments that need to be tested and powered. Currently, Subaru Telescope only has large distribution units made solely for supplying power to an instrument. This is inconvenient and time consuming for testing purposes at the telescope because all the configurations and setup for the various devices must be done separately each time the unit is in use. However, because Subaru Telescope is currently nearing its electrical capacity, another source is required to provide the power needed for the instruments. This new source must power the instrument, be portable, and have remote power control and communications capabilities. The purpose of this project is to build a portable power distribution and diagnostics unit that can easily be wheeled across to access different instruments and areas. Due to budget constraints, we used existing devices at Subaru Telescope and components were chosen to build a unit that met our requirements in an empty container with a built-in power rack. The unit consisted of the power distribution unit, remote power controller, serial server, network switch, emergency power off switch, and the data logger. The initial design of the unit did not meet the size requirements so I designed a holder using SolidWorks to be able to fit multiple devices into a smaller space that the devices and rack did not originally allow for. This design was sent to the machine shop to be manufactured. Post fabrication and assembly, the holder was inserted to hold both the network switch and serial server so that they could be mounted next to the data logger. This will make it possible for all devices to fit while being completely accessible within the unit. After the completion of this unit, the devices will be configured and brought up to the telescope to be tested.

Biography:
Katie graduated from Maui High School in 2015 and working towards a degree in Aerospace Engineering at the University of Washington, Seattle. She is involved with the Society of Women in Engineering and is a Resident Advisor for first year engineering students. After graduation, Katie hopes to pursue a field in Aerospace Engineering specializing in avionics. During her free time she likes finding new cafes and dessert places, working on different creative DIY projects, and reading.



Christopher Roof
Current School: University of Hawaii at Hilo
Internship site: Institute for Astronomy - Hilo
Mentor: Luke McKay

Project Title: Optimizing the UH 2.2-Meter Telescope Engineering Databases

Project Abstract:
The Institute for Astronomy's 2.2-Meter telescope engineering team has two databases that exhibit suboptimal system performance. One database, "uh88weather," stores telescope and environmental sensor readings and is written to at a high rate, while the other database, "catalogs," is a large set of astronomical data which is frequently read from. The existing databases respond to user requests slowly and occasionally time out due to memory overflow. To optimize the performance of these databases, I installed them on a new server with significantly more RAM and CPU cores; by doing so, I could allot more memory to each database in the PostgreSQL configuration file. Using a test query, I found the catalogs database to have an execution time of approximately 18 seconds prior to editing the configuration file. However, changing memory allotment in the file brought execution time consistently to 6 seconds. This creates a noticeable improvement in larger and more complex queries. For the uh88weather database, newly updated scripts will allow for easy maintenance and added sensors. By configuring the databases with optimal memory allocation on more powerful hardware, the engineering team will have much quicker and more desirable performance going forward.

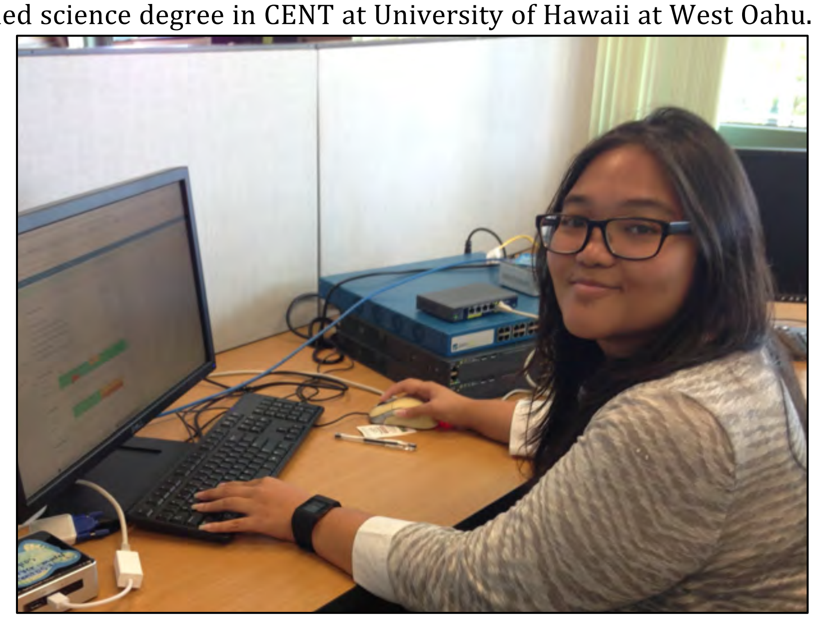
Biography:
Christopher was born and raised on the Big Island. After finishing his associate's degree in Information Technology from Hawaii Community College, he will continue his education in Computer Science at the University of Hawaii at Hilo. He is passionate about software programming/engineering, cyber security, and learning new things. He developed an Access database for Royal Hawaiian LLC during his IT program internship and continues to work with them, modifying the database as needed. Although he hasn't decided yet, he wants to become a software engineer, database programmer, or an information security specialist. In his free time, Chris enjoys going to the beach, playing video games, and playing the clarinet with the Hawaii County Band.

Catherine Sarte
Current School: University of Hawaii at West Oahu
Internship Site: Subaru Telescope
Mentors: Eiji Kyono and Kiaina Schubert

Project Title: Implementation of a Network and Application Monitoring System for Subaru Telescope's IT Infrastructure

Project Abstract:
Subaru Telescope handles more than 150 devices at three different locations that need to be monitored by only two system administrators. In order to work more proactively and troubleshoot more quickly, more records of the devices' performances need to be gathered, while at the same time the two system administrators need to receive automated notification alerts when a problem has been detected anywhere in the infrastructure. The purpose of this project is to either improve the current monitoring tool, Nagios Core 3.5.1, or implement a new tool that will help monitor critical infrastructure components, system metrics, network, applications, services, and servers. An evaluation of Subaru's IT infrastructure and the current monitoring tool was undertaken, as well as an evaluation of several alternative monitoring tools to help decide the best monitoring tool Subaru should use. A test environment, which consisted of switches, firewalls, and server models, was created and configured to test Nagios Core 4.3.2 and Zabbix 3.2.6. A virtual machine has also been developed to test the monitoring tools in the production environment. Considering the results after testing both monitoring tools, Zabbix provides flexible data gathering, straightforward administration management, configurable alerting, real-time graphing, historical data storage, and easy configuration. Zabbix 3.2.6 fits Subaru Telescope's requirements and was implemented in place of the current Nagios Core 3.5.1 due to Zabbix's superior ability to monitor and provide real-time data and graphs of CPU, memory pool, flash devices, fan, temperature, interfaces, and other records which Nagios does not accomplish easily.

Biography:
Catherine was born and raised in the Philippines. She immigrated to the US when she was young, but finally moved to Hawaii to finish High school, graduating from Waipahu High school. She is bilingual, knowing Tagalog and English. She graduated with her associate of science degree majoring in Computing, Electronics, and Networking Technology (CENT) at Honolulu Community College and she is graduating in December 2017 with her bachelor of applied science degree in CENT at University of Hawaii at West Oahu. Catherine is a member of a student held organization, named Hawaii Advanced Technology Society (HATS) that bridges the gap between students, alumni, professors, IT professionals, and Hawaii's youth. HATS also participates in numerous competitions and recently competed in At Large Regional Collegiate Cyber Defense Competition (ALCCDC) with her team finishing in second place. They also competed in the National Cyberleague Competition (NCL), which her team finished in third place. Her goal before graduating this year are to get a full time job to gain more experience in her field and also her VCA, CCNA, and CISSP certifications.



Heather Situ
Current School: University of Hawaii at Manoa
Internship Site: Gemini North Observatory
Mentor: Chas Cavedoni

Project Title: Designing a Holder for Anodized Aluminum Slit Masks

Project Abstract:
Slit masks pass light emitted by celestial objects into a diffraction grating that disperses the light into a spectrum, providing many details, such as mass, temperature, and chemical composition, on these bodies. Created using laser cutting, slit masks fabricated from sheets of 0.20 mm carbon fiber fit into the Gemini Multi-Object Spectrograph (GMOS) while those made from 0.08 mm aluminum sheets supplement the Flamingos-2 (F2) instrument. Currently, Gemini North only has a laser cutter mask holder allowing it to manufacture carbon fiber slit masks; however, Gemini North will need to supply aluminum masks to Gemini South in the future. The purpose of this project is to design, fabricate, and test a new holder for the existing LPKF Microline 2120P laser cutter to assist in the production of aluminum slit masks at Gemini North. The product must ensure slits are cut in a precise orientation while also fitting into the LPKF and remaining within the laser's focal range. Using Inventor, we 3D-modeled the present fixture and redesigned its components to meet the needs of the aluminum masks. After design review and approval, fabrication drawings were created and sent to the machine shop to manufacture the holder. The final product will then be inserted back into the LPKF machine to cut slits into the aluminum material. Based on these test results, the design of the mask holder will be adjusted accordingly. Gemini's new in-house ability to quickly and accurately manufacture both carbon fiber and aluminum slit masks on-demand enable it to meet the demanding needs of its scientific community and fulfill the organization's mission of "Exploring the Universe, Sharing its Wonders."

Biography:
Heather was born and raised in Honolulu, Oahu. She is currently a junior at the University of Hawaii at Manoa, pursuing a Bachelor of Science in Mechanical Engineering. After graduation, she plans to attend graduate school, focusing on either Materials Science and Engineering or Aerospace Engineering. She is particularly interested in the development of spacecraft and in the application of materials in the biomedical and nanotechnology field. Outside of school, Heather likes to doodle, watch movies, hike, and travel.

Michael Spetich
Current School: Willamette University
Internship Site: Institute for Astronomy Maui
Mentor: Cindy Giebink

Project Title: Integrating a Guider Camera with an Updated Coelostat System

Project Abstract:
A coelostat mirror is a circular mirror mounted on a machine that rotates and continuously reflects a portion of the sky. Coelostats can be used to test new instrument concepts as well as characterize new components before use at remote locations. Before the summer of 2017, the coelostat system at the Institute for Astronomy (IfA) Maui was operational, but in need of an upgrade, including integrating a new control computer and guider camera. These new components would allow the coelostat to better track an object such as the sun, moon, or stars by sending a reflection of it into the new guider camera in the IfA lab. Using guide software and drivers found online, we tested and attempted to get the ASI120MM-S USB 3.0 guide camera to command the coelostat to better track a star. We were able to connect the camera software, LuSol-Guide, with the software that commands the coelostat, coelostat control and TheSky6, and are currently testing the tracking/guiding capabilities. Once fully operational, this system will be used to test the Cryo-NIRSP and other instruments that require direct sunlight in the IfA lab.

Biography:
Michael is a physics major and math minor at Willamette University in Salem, Oregon, where he will be a senior this fall. He grew up on Hawai‘i Island in the town of Waimea, home to the W.M. Keck Observatory and the Canada-France-Hawai‘i Telescope. The island’s phenomenal night sky sparked his interest in physics, astronomy, and cosmology. He plans to attend graduate school to further his education in physics. Michael’s hobbies include running, biking, videography, and bodyboarding/surfing. He also is a huge movie fan.

Varrick Suezaki
Current School: Illinois Institute of Technology
Internship Site: W.M. Keck Observatory
Mentors: Josh Walawender and Wilfred Gee

Project Title: Transforming PANOPTES Accelerometer Output Data into Celestial Coordinates

Project Abstract:
The discovery and research of exoplanets is not only important, but exciting because it gives us more information about how life started on earth and can reveal planets that support life. One method of detecting exoplanets is known as the transit method. By measuring how much and how often a star dims, the planet size and distance from the star can be determined. Project PANOPTES (Panoptic Astronomical Networked Observatories for a Public Transiting Exoplanets Survey) aims to distribute PANOPTES units (low cost observatories that can be built by the general public) and create a global network of small, autonomous observatories that cumulatively cover a larger portion of the sky. Currently an accelerometer within a PANOPTES unit is being used to keep track of the unit's position. However, the coordinates of stars and other celestial objects are referenced in celestial coordinates. Celestial coordinates can be described by declination and hour angle which are analogous to latitude and longitude on the "celestial sphere." In order for PANOPTES units to operate in an autonomous manner, the accelerometer is used to independently determine the mount position. The output data from the accelerometer must be converted from Cartesian coordinates to celestial coordinates. In this project, rotation matrices were used to derive an equation for declination and hour angle in terms of the accelerometer's Cartesian x, y, z output and the geographical latitude of the telescope. Using the programming language Python, the resulting equations were utilized to determine the declination and hour angle values of the PANOPTES unit's position from the accelerometer readings. We compare accelerometer derived values to measured declination and hour angle values recorded by a calibrated PANOPTES unit and examined both systematic sources of error (such as hardware limitations in the accelerometer position readings) and statistical uncertainty (from the intrinsic measurement uncertainty in the accelerometer).

Biography:
Varrick is a junior at the Illinois Institute of Technology majoring in Applied Physics specializing in aerospace engineering. He grew up on the Big Island but graduated from Maryknoll in 2014. His main interests involve AMO (atomic, molecular, optics) physics and he hopes to attend graduate school and continue doing research or go into the private sector. Right now his research involves improving code for MICE (muon ionization cooling experiment).

Dallas Tada
Current School: University of Hawaii at Hilo
Internship Site: Gemini Observatory
Mentor: André-Nicolas Chené

Project Title: Creating a Public Database of Star Clusters from the VISTA Variable in Via Lactea (VVV) Survey

Project Abstract:
The Visible and Infrared Survey Telescope of Astronomy (VISTA) in Chile has recently finished its survey of the Milky Way Galaxy's Bulge and its adjacent Galactic plane region. The VISTA Variable in Via Lactea (VVV) survey covers approximately 10^9 point sources including multi-wavelength (ZYJHKs) coverage of the area as well as time monitoring in Ks band. The main objective of this project was to compile information of star clusters from the VVV survey into a uniform database that the public domain can access. At this stage of the project, the database contains only the names, the coordinates and an approximate size of the clusters. Future implementations will add information about the stars in the clusters, such as brightness, proper motion, dust extinction and spectral type. In the meantime, the SIMBAD Database - a collection of astronomical objects that have been studied in published articles and research reports - was used to identify any star clusters that may have already been studied prior to the VVV survey. Open text editors Brackets and Sublime Text were used to create the web interface using HTML, CSS, and JavaScript, while Sequel Pro in conjunction with MariaDB and Docker were used to create the database to store the information of the VVV survey. The analyzed data was then stored into the database, and the database was connected to the newly formed web interface using XAMPP. The website can search for star clusters by entering queries for specific parameters, and its most useful feature is the ability to select a specific tile number from the VVV survey area and it will display all star clusters within that area. VISTA has plans to expand the VVV survey area in the next few years, so any new data it collects will be recorded and stored in the constructed public database.

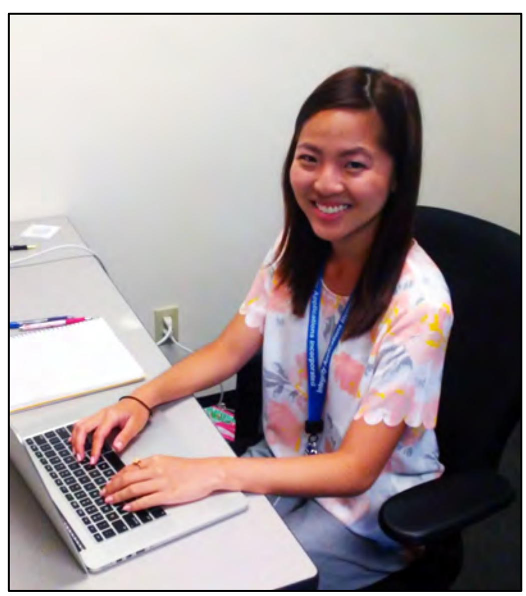
Biography:
Dallas was born and raised in Hilo, Hawaii, and is currently a junior in the University of Hawaii at Hilo. He was originally pursuing a Nutrition degree, but his fascination in the cosmos convinced him to switch his major to Physics. His pursuit for knowledge is his main drive in his academics, and he aspires to find his calling as he continues to learn and challenge what he believes in. His main interests has always been in the STEM fields - especially in natural sciences - but at this time has not decided on a specific career. After obtaining his undergraduate degree, he hopes to continue his studies in astrophysics, medical physics or neurology. Besides educational endeavors, Dallas is a national qualifying Olympic weightlifter, loves to travel, enjoys bad puns, and probably knows more facts about Pokémon than you.

Ariel Todoki
Current School: Willamette University
Internship Site: Integrity Applications Incorporated/Pacific Defense Solutions
Mentor: Dennis Douglas

Project Title: Analysis of Shadow Prediction of Geosynchronous Satellites

Project Abstract:
Geosynchronous (GEO) satellites are located about 36,000 km above Earth's surface, making it difficult to get a fine resolution image of the satellite using a telescope. One way to produce a resolved image of these satellites is through shadow imaging. Shadow imaging is a method for obtaining high spatial resolution images of GEO satellites from an Earth based system by measuring the irradiance distribution on the ground resulting from the occultation of the satellite passing in front of a star. Light collection requires accurate prediction of location and time of the shadow events. This requires knowledge of satellite location in the sky, allowing for determination of stars that are being occulted. The purpose of this project is to correlate the number of occultation events to the apparent position of a GEO satellite with respect to the stars in the galaxy. We used simulated occultation events for GEO satellites Galaxy3C and TDRS11 in MATLAB to create animated graphs showing the number of occultation events versus time as a function of viewing geometry through the galactic star density. This analysis found that the rises in occultation events during the year are due to the satellite passing in front of the galactic plane, which has a high density of stars. This correlation provides information on what times during the year to expect more shadow events to occur, resulting in a higher probability of capturing a shadow. The next step to shadow prediction is correlating the current shadow prediction tool to past shadow events that were captured serendipitously.

Biography:
Ariel was born and raised in Honolulu, Hawaii and graduated from Kalani High School in 2014. She is a rising senior at Willamette University in Salem, Oregon pursuing a double major in Computer Science and Music Performance as well as a minor in Math. After graduating, she plans to go to graduate school to study Computer Science. Her hobbies include playing flute in the Willamette University Wind Ensemble and playing taiko with the Willamette Taiko Club.



Akira Vernon
Current School: University of Hawaii at Mānoa
Internship Site: Thirty Meter Telescope International Observatory
Mentor: Lianqi Wang

Project Title: Optimization of the Ray Tracing Algorithm for TMT Adaptive Optics Reconstruction Parameter Generator

Project Abstract:
The Adaptive Optics (AO) team from the TMT International Observatory is looking to maximize the performance and efficiency of the ray tracing algorithm that deals with large scale numerical computations. The Reconstruction Parameter Generator (RPG) relies on the ray tracing algorithm to calculate the parameters for AO wavefront reconstruction, in order to drive the deformable mirrors to correct the turbulence distorted wavefront. The ray tracing routine is a critical part of the wavefront reconstruction algorithm. Massive parallelization and efficient use of processing power is critical to meet timing requirements. The Intel Xeon Phi many-core CPU emerges as a viable architecture for TMT's RPG. The computing efficiency of the ray tracing algorithm can be determined by calculating the floating-point operations per second (FLOPS) of the program and comparing it to the central processing units (CPUs) rated FLOPS. We compared the efficiency achieved using several parallel programming techniques from the Open Multi-Processing (OpenMP) Application Program Interface (API). Parallel programming has allowed the ray tracing function to execute many calculations simultaneously by dividing the large calculations into smaller calculations and letting them execute in parallel in many computing cores. To achieve peak efficiency, we examined the current algorithm and determined where most of the time is spent in the program. Then we improved the algorithm with the use of parallelization, which has reduced the computational time from 1.46 seconds down to 9.548 milliseconds. However, the ray tracing algorithms FLOPS is only 1% of the Intel Xeon Phi rated FLOPS, which means that the program does not fully maximize the processing power of the Intel Xeon Phi CPU. The ray tracing algorithms can be improved in both computational time and FLOPS by implementing scalar performance computing, vectorization with structure of arrays (SoA), and managing memory traffic efficiently. With these improvements, the RPG will be able to utilize the Intel's 64 cores and 256 threads to compute the ray tracing algorithm in time and will allow the RPG to finish preparing reconstruction parameters in time for the remaining part of the AO system.

Biography:
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 Mānoa. 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.

Matthew Yuen
Current School: University of Portland
Internship Site: Pacific Disaster Center
Mentors: Steve Kunitzer, Kevin Madaya, Yannick Guenet

Project Title: Design and Implementation of the D2P2 System Status Dashboard

Project Abstract:
Dynamic Data Processor and Publication (D2P2) is a core component of Pacific Disaster Center's (PDC's) hazard monitoring platform, DisasterAWARE. It is a multitiered system, which can fail at any stage during its processing and publishing of data. Currently, developers need to run queries on multiple tables simply to determine the system's status. PDC needs a dashboard that can first summarize the overall health of D2P2 and then let users look into more specific areas of malfunction. The D2P2 System Status Dashboard consists of two parts, a back end Representational State Transfer (REST) Application Programming Interface (API), and a front end web application. The REST API was built with Java's Jersey 2 and queries PDC's database using Hibernate ORM. The API retrieves information from queues located between each of D2P2's stages and from exception tables holding information relating to failures. The web application was created using Yeoman and AngularJS. The interface uses graphs and tables to display the information and gives options for the user to refine and filter through the data. With the dashboard, both developers and non-developers can access information about the system's status. Since more people will be monitoring D2P2, the speed that problems can be identified and resolved increases which results in an increase in the overall quality of DisasterAWARE.

Biography:
Matthew was born and raised on the island of Oahu. He attended high school at Iolani School, graduating in 2014. Currently, he is pursuing degrees in Computer Science and Electrical Engineering at the University of Portland and will be a senior in the fall. His current technical interests include signal processing and embedded systems. After graduation, he plans on working in industry. In his free time, he enjoys playing piano, watching movies, and spending time with family.

Akamai Workforce Initiative

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

The 2017 Akamai Internship Program placed 29 college students from Hawaiʻi at the following organizations to complete a seven-week project:

- Air Force Research Laboratory (AFRL)
- Akimeka LLC
- Canada-France-Hawaii Telescope (CFHT)
- Daniel K. Inouye Solar Telescope (DKIST)
- Gemini Observatory
- Integrity Applications Incorporated/ Pacific Defense Solutions
- Natural Energy Laboratory of Hawaiʻi Authority (NELHA)
- National Oceanic and Atmospheric Administration (NOAA) and University of Hawaii Maui College
- Pacific Disaster Center (PDC)
- Smithsonian Submillimeter Array (SMA) / Academia Sinica Institute of Astronomy and Astrophysics (ASIAA)
- Subaru Telescope
- Thirty Meter Telescope International Observatory (TIO)
- University of Hawaiʻi 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)
- Hawaiʻi STEM Learning Partnership at the Hawaii Community Foundation, with support from nine funders, including the THINK Fund at HCF (funded by TIO), and the Maunakea Fund.
- National Solar Observatory
- Daniel K. Inouye Solar Telescope
- University of Hawaiʻi at Hilo
- Canada-France-Hawaii Telescope

For more information please contact:

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http://akamaihawaii.org