AKAMAI

Big Island Observatory
Student Internship Symposium

August 9, 2011
IfA Hilo Auditorium

Maui Internship Symposium

August 10, 2011
Maui Arts and Cultural Center
Alexa Higashi Meeting Room

Program Information
Intern Abstracts

Advancing Hawaii college students into science and technology careers.

2011 Maui Akamai Internship Program

Akamai Workforce Initiative
Institute for Scientist & Engineer Educators
Institute for Astronomy
UH Maui College

Akamai – smart, clever

The Akamai Internship Program is a unique program that combines re-search experiences, coursework, communication skill building, and mentoring. Through the Akamai Program, college students from Hawaiʻi are placed in the Maui high-tech industry and Big Island Observatories for the summer, and then are provided with guidance and mentoring as they advance in their education and careers. The Akamai program is based on an internship model designed by the Center for Adaptive Optics (CfAO) using National Science Foundation (NSF) Science and Technology Center funding, with the specific aim of developing and piloting a program to address the workforce needs related to astronomical research and technology in Hawaiʻi

The Akamai Internship Program includes:

- 40-hour optics and workforce preparation short course
- 7-week research experience at a Maui technical facility or Big Island Observatory
- Science & Engineering Communication course in which all interns prepare:
  - -Oral presentation
  - -Poster presentation
  - -Technical abstract
  - -Personal statement
  - -Résumé
- Symposium and many other opportunities for students to present their work
- Ongoing educational and career support
- 2 units credit from UH Maui College

2011 Host Organizations

Big Island Host Observatories

Canada France Hawaii Telescope
Gemini Observatory
Subaru Observatory
Smithsonian Submillimeter Array
W.M. Keck Observatory

Maui Host Organizations

HNu Photonics
Institute for Astronomy
Maui High Performance Computing Center
Pacific Defense Solutions
Pacific Disaster Center
Trex Enterprises

Akamai Workforce Initiative

Institute for Astronomy
Jeff Kuhn, Lisa Hunter, Lani LeBron, Samara Phillips, Cindy Giebink,
David Harrington

UH Maui College
Mark Hoffman, Elisabeth Reader

Air Force Maui Optical and Supercomputing Site
Joseph Janni

AWI Assessment Specialist
Jerome Shaw

2011 Akamai Short Course Instructors

Garrett Elliott - Lead Instructor
UH Institute for Astronomy

Hamed Dehnavi
UH Manoa

Geoff Mathews
UH Institute for Astronomy

Richard Ordonez
UH Institute for Astronomy

Ryan Swindle
UC Institute for Astronomy

Brooks Thomas
UH Manoa

Reid Yamura
UH Manoa

2011 Communication Instructors

Michael Nassir - Lead Instructor
University of Hawaii at Manoa, Institute for Astronomy

Garrett Elliott - Instructor
UH Institute for Astronomy

Special Thanks . . .

The Akamai Workforce Initiative would like to thank the following individuals for their commitment and support of the 2011 Big Island Akamai Internship Program:

J.D. Armstrong – UH Institute for Astronomy
Steve Bauman – Canada-France-Hawaii Telescope
Tom Benedict – Canada-France-Hawaii Telescope
Shawn Callahan – W.M. Keck Observatory
Jason Chin – W.M. Keck Observatory
Steve Colley – Subaru Telescope
David Cook – Subaru Telescope
Sandra Dawson – Thirty Meter Telescope
Scott Fisher – National Science Foundation
James Gaines – Univ. of Hawai'I
Sarah Gajadhar - Canada-France-Hawaii Telescope
Dave Harrington – UH Institute for Astronomy
Günther Hasinger – UH Institute for Astronomy
Klaus Hodapp – UH Institute for Astronomy, Hilo
Mark Hoffman – UH Maui College
Haydn Huntley -- UH IfA/Pan-STARRS
Stuart Jefferies – UH Institute for Astronomy, Maui
Joshua Ka'akua – UH Mānoa
Scot Kleinman – Gemini Observatory
Rolf Kudritzki – UH Institute for Astronomy
Jeffrey Kuhn – UH Institute for Astronomy
Carrie Masanda - UH Institute for Astronomy
John Maute – Smithsonian Submillimeter Array
Tim Minick – Gemini Observatory
Stephen Mohr – UH IfA/Pan-STARRS
Craig Nance – W.M. Keck Observatory
Atsuko Nitta – Gemini Observatory
Adrienne Notley – Gemini Observatory
Larry O'Hanlon - W.M. Keck Observatory
Jung Park – UH Maui College
Nataliya Prymak – UH IfA/Pan-STARRS
Bill Randolph – W.M. Keck Observatory
Elisabeth Reader – UH Maui College
Scott Seagroves - University of California, Santa Cruz
Chris Schaab – Smithsonian Submillimeter Array
Isabelle Scholl – UH Institute for Astronomy
William Walters – UH Institute for Astronomy
Skip Williams – Air Force Research Laboratory

Presentation Schedule

Opening Remarks

Günther Hasinger
Director, UH Institute for Astronomy

Lisa Hunter
Director, Akamai Workforce Initiative

W.M. Keck Observatory

Platform Design for a Next Generation Adaptive Optics Laser Infrastructure on the Keck II Telescope
Sean Jones — *UH Mānoa*

Smithsonian Submillimeter Array

Troubleshooting Circuit Boards for the Digital Correlator of the SMA
Elizabeth Claire Vanaman — *Hawai'i CC*

Subaru Telescope

Building a Central Web-based Instrument Temperature Control System for Subaru Telescope
Keone Hiraide — *UH Hilo*

UH Institute for Astronomy — Maui

Designing a Mechanical Support System for a Telescope Primary Mirror
Bo Li — *Illinois Inst. of Technology*

Trex Enterprises

Designing a Mechanical Cycler to Test a Wave Energy Generator
Jasmine Pahukula — *Oregon State Univ.*

~Intermission~

Pacific Defense Solutions

An Interactive Analytical Tool for Optical Systems Evaluation
Chihiro Sasaki — *Northern Arizona Univ.*

Canada-France-Hawaii Telescope

3-D Modeling of the CFHT Declination Gearbox
Anthony Sylvester — *UH Mānoa*

Maui High Performance Computing Center

The Faster Tracker: Simulating Satellite Tracking Using Parallel Computing
Andrew Lindstrom — *UH Hilo*

Gemini Observatory

Moving Gemini Observatory Toward Sustainability: Greening an Astronomical Data Center
Amber Fulkerson — *Oregon State Univ.*

Asteroseismology of White Dwarf GD 358 Using Optical and Ultraviolet Light Curves
Devin Chu — *Dartmouth College*

Closing Remarks

ABSTRACTS

Platform Design for a Next Generation Adaptive Optics Laser Infrastructure on the Keck II Telescope

Sean R. Jones
University of Hawai'i at Mānoa

W.M. Keck Observatory
Mentors: Shawn Callahan, Jason Chin & Bill Randolph

The W.M. Keck Observatory, a pair of 10-meter telescopes atop Mauna Kea, Hawaii, is developing a Next Generation Adaptive Optics (NGAO) System. NGAO instruments, such as lasers, provide for sharper images and the ability to observe fainter objects. The goal of this project is to design a sub-platform under the Right Nasmyth deck of the Keck II telescope to support components for NGAO. These include three laser electronics cabinets and a dedicated heat exchanger to cool the electronics. The platform location, size, shape, and instrument placement must accommodate numerous design constraints. For instance, the platform must support the weight of the instruments, all instruments must be accessible by at least one meter of clearance for maintenance, and the laser enclosures must be less than 6 meters away from the telescope's cable-wrap. Furthermore, the sub-platform and instruments must be able to withstand the seismic activity of Mauna Kea, and they must adhere to all OSHA requirements and International Building Codes. Multiple design iterations were modeled using 3-D computer-aided design software, and a final optimal design was selected. A support frame and its connections to the telescope frame will be designed, followed by safety railings and cable trays. The design will be analyzed for deflections and structural integrity using finite element analysis software. Finally, a detailed plan for installing the instruments on the sub-platform will be devised. This platform design will support the Keck Observatory in the development of NGAO, maintaining Keck as a leader in astronomical research and discoveries.

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Sean Jones is a senior in Mechanical Engineering at the University of Hawai'i at Mānoa and a member of the Native Hawaiian Science Engineering Mentorship Program (NHSEMP). Sean received a 2010 Malolo Award for academic achievement and made the Dean's List for the Spring 2011 semester. While attending college, Sean works part-time as a lifeguard and is certified by the American Red Cross in lifesaving, first aid, and CPR. He is also a four-year regional champion playing in-line hockey.

Troubleshooting Circuit Boards for the Digital Correlator of the SMA

Elizabeth Claire Vanaman
Hawai'i Community College

Smithsonian Submillimeter Array
Mentors: Chris Schaab & John Maute

The Smithsonian Submillimeter Array (SMA), situated on the summit of Mauna Kea, includes eight antenna dishes and a digital correlator back-end — a large array of electronics that amplifies incoming signals and reduces noise by comparing signals between pairs of antennas. Each correlator is responsible for relaying, digitizing, and down-converting incoming signals from hundreds of GHz to just a few GHz, and it accomplishes this with a branching series of large circuit boards, each with its own processor. Given the large number of individual circuit boards, a systematic approach is needed to diagnose and repair boards as they fail. We have developed a troubleshooting method that begins by examining the faulty board's output signal with a specialized display terminal. Once the problem is identified, schematic diagrams are used to pinpoint the computer chips that are most likely responsible for the particular malfunction. Suspect chips are replaced, and finally, the board is tested for full functionality. A handful of receiver boards have already been successfully repaired with this method and have been returned to service. Because of the complexity of the correlator electronics, keeping track of past failure modes and successful repair strategies is essential for troubleshooting boards efficiently in the future. As receiver board malfunctions and their repair steps are documented, a troubleshooting flowchart will be constructed as a clear guide to assist future correlator technicians.

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Elizabeth Claire "Beth" Vanaman was raised in rural upcountry Maui and moved to Hilo in 2008. Despite her meager exposure to science during childhood, the bits of knowledge she did acquire inspired her to pursue a degree in Electronics Technology at Hawai'i Community College. With a solid understanding of circuit-board design and troubleshooting, Beth plans to enter a four-year degree program and put her current skills into practice in the workforce, striving toward a deeper understanding of both the applied and natural sciences.

Building a Central Web-based Instrument Temperature Control System for Subaru Telescope

Keone Y. Hiraide
University of Hawai'i at Hilo

Subaru Telescope
Mentors: Stephen Colley & David Cook

Many instruments used at Subaru Telescope require precise temperature control for their imaging detectors and optics. Currently, each of these instruments has its own system for programming and controlling equipment. Even though each system has the same functionality of controlling temperature, they vary in quality, interface design, and characteristics. As a result, telescope operators are required to learn the unique behavior of each instrument's system in order to maintain temperature control. The purpose of this project is to build a central temperature-control system which can program and monitor all of the controllers remotely using a central-operator web-based interface. We have designed and written a temperature-control system application using the C programming language, HTML, and StarGate, a Subaru scripting language for Web development. The instruments are connected to a terminal server by serial ports, which allows our application to send commands to the instruments through a GUI over a network or the Internet, in order to query and set various parameters to monitor and control an instrument's temperature. Currently, our application is able to measure the temperature of Subaru's FMOS instrument with a precision of ±0.1 K, and users are able to use the GUI to raise or lower its temperature by remote command. Future development may include the ability to monitor and control additional instrument systems, or the inclusion of additional control algorithms to further meet the needs of Subaru astronomers and instrument users.

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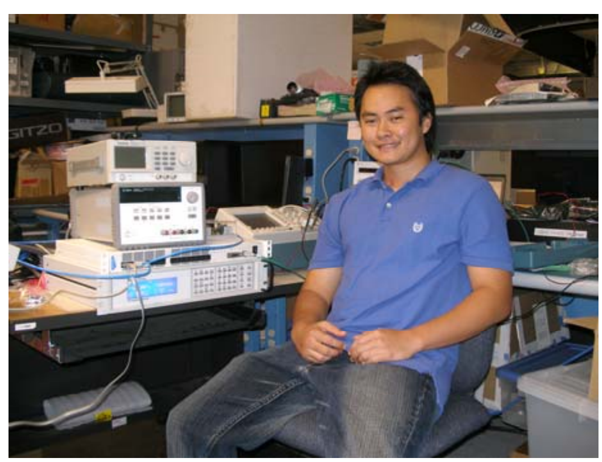
Keone Hiraide graduated in spring 2011 from the University of Hawai'i at Hilo with a major in Computer Science. He plans to work for a year in order to gain more experience, then enter graduate school on the mainland. He is interested in studying either informatics, databases, or systems of computing. In his spare time, Keone enjoys fishing, billiards, martial arts, golfing, camping, hiking, video games, and expanding his knowledge relating to computer science.



3-D Modeling of the CFHT Declination Gearbox

Anthony Sylvester
University of Hawai'i at Mānoa

Canada-France-Hawaii Telescope
Mentor: Steven Bauman

The Canada-France-Hawaii Telescope (CFHT) has been in operation since 1979. Due to the telescope's age, mechanical parts are beginning to show signs of wear and may soon fail. This can result in poor observing and ultimately telescope downtime. Recently, increased telescope pointing errors indicated that original gears in the telescope's declination gearbox were showing symptoms of wear. The declination gearbox is responsible for the telescope's motion about one of its two rotation axes. The primary purpose of this project is to generate a 3-D computer-aided design (CAD) model of the entire gearbox. The new 3-D CAD model will replace the telescope's original hand-drawn 2-D mechanical plans, and the model will be verified via functional animation of the gearbox's moving parts in the CAD program. Using the newly created CAD models, manufacturers can then be contacted and custom replacement parts will be ordered. The completed model can also be used to create a parts list for the gearbox, an animated assembly/disassembly tutorial, and a stress analysis test to determine areas of possible failure in the future. Creation of this CAD model of the declination gearbox will facilitate rapid mechanical repairs when needed, and help avert catastrophic telescope failure by allowing for preemptive replacement of worn or damaged parts.

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Anthony Sylvester grew up on the east side of the Big Island and graduated from Waiākea High School in 2008. He is entering his senior year at the University of Hawai'i at Mānoa, pursuing a Bachelor of Science in Mechanical Engineering. After completing his bachelor's degree, he hopes to continue on toward a master's degree. In his free time, Anthony enjoys numerous hobbies, including hiking, hunting, skimboarding, skateboarding, camping, fishing, and building things.

Moving Gemini Observatory Toward Sustainability: Greening an Astronomical Data Center

Amber Fulkerson
Oregon State University

Gemini Observatory
Mentor: Tim Minick

The Gemini Observatory spends over one million dollars per year in electricity charges to operate their Hawai'i facilities. A major component of this high bill is the continuous operation of their data centers. Each data center is a room full of computer equipment including servers, storage systems, backup power supplies, environmental controls, and security devices. Since Gemini employees need around-the-clock access to the data archives and online services, this equipment is never turned off, and therefore the cooling system to prevent overheating is also never turned off. We have begun a feasibility study of techniques that would reduce Gemini's operational support costs for its data centers. Any final recommendations must provide a return-of-investment within two years, require less than one day of data center downtime during installation, and allow for future expansion of the data center. Various techniques being assessed include using renewable energy, upgrading to more efficient servers, improving the cooling system's efficiency, converting to more efficient lights, and implementing distributive power management software. We have completed our study of the cooling systems, and we recommend the installation of vinyl curtains as the best way to isolate different temperature zones in the rooms and reduce energy use. Using more efficient lights in their two Hawai'i facilities can save Gemini nearly $200 in electricity charges every year. We anticipate additional energy savings in the other areas mentioned above, and a full feasibility report will be provided to Gemini at the end of our study. Future research is needed to investigate the transferability of our recommendations to Gemini's other facilities located in Chile.

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Amber Fulkerson grew up in Kaimukī on the island of O'ahu and graduated from Sacred Hearts Academy in 2009. She will be a junior this fall at Oregon State University, studying to become a Civil Engineer. Amber enjoys hiking, going to the beach, and hanging out with family and friends.

Asteroseismology of White Dwarf GD 358 Using Optical and Ultraviolet Light Curves

Devin Chu
Dartmouth College

Gemini Observatory
Mentors: Atsuko *Nitta & Scot Kleinman*

Asteroseismology is the study of the internal structure of stars. Similar to the way seismologists use the Earth's vibrations during an earthquake to draw conclusions about the Earth's inner structure, astronomers analyze a pulsating star's light curve — the intensity of the light over time — to characterize its internal structure. Pulsating white dwarf stars are ideal for asteroseismology because they have relatively simple structures that make them easier to model than other stars. Asteroseismology relies on accurately identifying the pulsation modes that are simultaneously present as a star vibrates. The goal of this project is to attempt to identify pulsation modes via the "chromatic amplitude method." The pulsating white dwarf GD 358 was observed simultaneously in the ultraviolet using the Hubble Space Telescope (HST) and in the optical by the Whole Earth Telescope (WET), a network of telescopes around the world that enable an object to be observed continuously for many days. Light-curve amplitudes will be extracted from both the ultraviolet and optical data, and the ratios of amplitudes at different wavelengths will be found. Based on these ratios, the modes of GD 358 can be identified. The identified modes will be compared to the modes found by previous studies using the "period method," an analysis of the distribution of periods present in a single-color light curve. If the chromatic amplitude method accurately identifies previously known modes of GD 358, it will serve as a confirmation of a powerful new method for asteroseismology, especially useful for stars with sparse modes that are difficult to analyze via the period method alone.

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Devin Chu was born in Los Angeles, California, and moved to Hilo when he was two years old. He graduated as valedictorian from Hilo High School, and this fall he will enter his sophomore year at Dartmouth College in Hanover, New Hampshire. Devin plans to major in astronomy (his interest since childhood) and minor in history. After finishing his undergraduate education, Devin intends to complete a doctoral degree in astronomy and hopes to return to Hilo as a research astronomer. In his free time, Devin enjoys cycling, watching sports, and socializing with friends.

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Michael Bush - Oceanit
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Ken Chambers - UH IfA/Pan-STARRS
Ned Davis - Trex Enterprises
Sandra Dawson -Thirty Meter Telescope
Dennis Douglas - Pacific Defense Solutions
Mike Engelmann - Trex Enterprises
Scott Fisher- National Science Foundation
James Gaines - Univ. of Hawaiʻi
Cindy Giebink - UH Institute for Astronomy
Randy Goebbert - Pacific Defense Solutions
Dave Harrington - UH Institute for Astronomy
Richard Harris - UH IfA/Pan-STARRS
Günther Hasinger - UH Institute for Astronomy
Mark Hoffman - UH Maui College
Carl Holmberg - Maui High Performance Computing Center
Haydn Huntley -- UH IfA/Pan-STARRS
Stuart Jefferies - UH Institute for Astronomy, Maui
Joshua Kaʻakua - UH Mānoa
Rolf Kudritzki - UH Institute for Astronomy
Jeffrey Kuhn - UH Institute for Astronomy
Kawai Kuluhiwa - Pacific Defense Solutions
Brian Lee -- Oceanit
Curt Leonard - Oceanit
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Riki Maeda - Pacific Defense Solutions
Sharon Mielbrecht - Pacific Disaster Center
Stephen Mohr - UH IfA/Pan-STARRS
Michael Murai - Oceanit
Craig Nance - W.M. Keck Observatory
Richard Nezelek - Pacific Disaster Center
Daron Nishimoto - Pacific Defense Solutions
Gary Nitta - UH Institute for Astronomy
Adrienne Notley - Gemini Observatory
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Jung Park - UH Maui College
Nataliya Prymak - UH IfA/Pan-STARRS
Richard Puga - HNu Photonics
Elisabeth Reader - UH Maui College
Michael Reiley - HNu Photonics
Isabelle Scholl – UH Institute for Astronomy
Paul Schumacher -- Maui High Performance Computing Center
Ray Shirkhodai - Pacific Disaster Center
Dean Stensrud -- Oceanit
Dee Symonds - Trex Enterprises
William Walters - UH Institute for Astronomy
Skip Williams - Air Force Research Laboratory

Presentation Schedule

Opening Remarks

Jeffrey Kuhn
UH Institute for Astronomy
Lisa Hunter
Director, Akamai Workforce Initiative

Maui High Performance Computing Center

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Andrew Lindstrom — *UH Hilo*

Trex Enterprises

Designing a Mechanical Cycler to Test a Wave Energy Generator
Jasmine Pahukula — *Oregon State Univ.*

Pacific Disaster Center

Geographic Information System (GIS) Metadata Portal Website Migration
Alan Hanesana — *Honolulu CC*

Using Social Media to Enhance PDC's Relationship with the Online Community
Kanoe Hardin — *UH Maui College*

UH Institute for Astronomy

Designing an Automated Calibration-Screen Cover for the Pan-STARRS PS1 Telescope
Jonathan Torigoe — *UH Mānoa*

Improving the Uniformity of Thin-Film Coatings for Optical Mirrors
Diana Agdeppa — *UH Maui College*

Designing a Mechanical Support System for a Telescope Primary Mirror
Bo Li — *Illinois Inst. of Technology*

~Intermission~

Oceanit

Optimizing the Software Development Process: Implementing a Build Automation System
Kimberly Oyama — *Northern Arizona Univ.*

HNu Photonics

A Debris Mitigation Study for a Commercial Solar Panel Installation
Mariflor Caronan — *Northern Arizona Univ.*

System Optimization of a Self-Replicating 3D Printer for Creating Visual Model Designs
Ryan Daugherty — *UH Mānoa*

Pacific Defense Solutions

Modeling Small-Telescope Chopping and Nodding Methods for Faint-Object Detection in Daylight Conditions
Amanda Yamamoto — *UH Mānoa*

Detection of GEO Satellites Through Shadow Imaging
Dylan Schwarzmeier — *UH Maui College*

An Interactive Analytical Tool for Optical Systems Evaluation
Chihiro Sasaki — *Northern Arizona Univ.*

Closing Remarks

ABSTRACTS

The Faster Tracker:
Simulating Satellite Tracking Using Parallel Computing

Andrew Lindstrom
University of Hawai'i at Hilo

Maui High Performance Computing Center
Mentors: Carl Holmberg & Paul Schumacher

The task of tracking and detecting satellites orbiting the Earth is performed using a number of ground-based sensors around the world, each one tasked as an isolated system. Objectives may include tracking specific, known satellites, or detecting previously unknown objects. Both types of observations are used to update a central catalog of satellites. This data collection and catalog updating process is largely manual, and it may not scale sufficiently to handle the growing number of objects to be tracked. However, networking the sensors together and tasking them from a single facility may obtain the required scalability. This concept can be tested using software models of the existing sensors. This project's first step is to use an existing MATLAB model in its alpha stage of development, and from it create a version that will take on a larger data set without sacrificing turnaround time. The existing model simulates the FPS-85 radar. The model was analyzed to determine which types of performance optimizations would likely provide the desired throughput using the computational resources at MHPCC, within the time constraints of a summer internship. A data parallel approach was selected. This process included taking advantage of the MATLAB Parallel Toolbox, removing user interactive features, and adding output file I/O. Initial development was completed on a multi-core Windows-based PC using a 10-satellite test set before moving the work to MHPCC's Linux-based "Mana" cluster. The next task is to test the parallelized model's scalability on Mana using increasing numbers of CPUs and nodes. Final outcomes will include process timing, measurements of performance vs. the number of processors used, and suggestions for more suitable parallel-processing approaches using MATLAB Parallel Toolbox, if any. Future goals of this project will include testing against a larger data set, and to test multiple models linked over a network to a resource manager. Also, the original PC-based radar simulator would benefit from additional optimization of the user interface and data displays.

Andrew Lindstrom is a senior studying Computer Science at University of Hawai'i at Hilo, but his home is on the island of O'ahu. He enjoys troubleshooting problems and working with his hands. He plans to graduate with a Bachelor of Science in Computer Science and to work as a system administrator. Andrew likes playing games and guitar during his spare time.

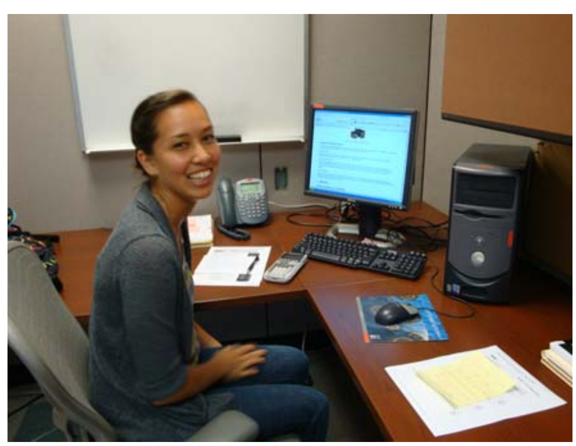
Designing a Mechanical Cycler to Test a Wave Energy Generator

Jasmine Pahukula
Oregon State University

Trex Enterprises, LLC
Mentors: Dee Symonds, Michael Engelmann & Ned Davis

The ocean has great potential to provide vast amounts of power, which can be generated from the kinetic energy carried by ocean waves, tides and currents. Trex Enterprises has already made significant advances in harvesting ocean waves to produce electricity by developing a rotary-drive wave energy generator. Trex has applied this same concept and design to develop a self-powered emergency position-indicating radio beacon (SEPIRB) intended for use by submarines and ships in distress. Our goal was to design a mechanical cycler to test the lifetime, durability, and power generated by the SEPIRB. Design requirements included the ability to run continuously for 1-2 weeks, change the period and height of the simulated waves, and pull with a force of at least 60 lb, which is necessary to generate a target power of 15 W. This was accomplished with a combination of a ball-screw driven translation stage, a cable with a series of pulleys, and a motor with an electronic controller. In order to simulate a variety of wave patterns, we programmed the controller to create variations in the ball nut's speed and distance traveled. Due to the inherent mechanical efficiency of ball-screw driven translation stages, we anticipate that our cycler will easily provide the desired 60 lb of force and two-week operation period. In the future, this cycler can be modified to fit specific requirements to test other wave energy generators, allowing for continued research and development of alternative energy resources.

Jasmine Pahukula was born and raised in Kailua, O‘ahu, and graduated from Sacred Hearts Academy in Honolulu. She will be entering her junior year pursuing a B.S. in Civil Engineering at Oregon State University. She also plans to attend graduate school to earn a master's degree. Jasmine is a member of the Hui O Hawai‘i Club at Oregon State, and she also plays intramural volleyball.



Geographic Information System (GIS) Metadata Portal Website Migration

Alan K. Hanesana
Honolulu Community College

Pacific Disaster Center
Mentors: David Askov & Richard Nezelek

The Geographic Information System (GIS) metadata portal website at the Pacific Disaster Center (PDC) in Kihei, Hawaii, provides online geospatial and natural-disaster data to the public. PDC currently serves more than 2,400 metadata records to users, both locally and worldwide. The existing GIS metadata portal website, the Global Hazards Information Network (GHIN), uses a software backend that has been deprecated by the vendor and will no longer be supported beyond the current release. Our goal is to migrate the legacy GHIN metadata search-and-retrieval website to a modern Spatial Data Infrastructure (SDI) portal environment. The new portal server must support International Organization for Standardization (ISO) and Federal Geographic Data Committee (FGDC) metadata profiles. Also, data cataloging and harvesting must be compliant with standard Open Geospatial Consortium (OGC) CS-W 2.0.2 or Z39.50 protocols. User account mechanisms for authentication, access, and security must be handled by Lightweight Directory Access Protocol (LDAP), and users must be able to contribute, review, rate, and comment on individual metadata. Two candidate software frameworks, Geonetwork Opensource and Geoportal Server were set up and evaluated against our requirements. For greatest compatibility with PDC's existing Esri ArcGIS, ArcSDE, Postgresql, OpenDS, Microsoft Exchange, and UNIX system, we selected Geoportal Server 1.1.1 as the new SDI implementation. The Geoportal Server will be installed on Apache Tomcat 6, configured with eXtensible Markup Language (XML) properties and modified JavaServer Pages, JavaScript, HTML as needed. The newly implemented Geoportal Server will ensure that users worldwide can more easily discover and access PDC's full archive of geospatial data, services, and products.

Alan Hanesana is from Bangkok, Thailand. He will be entering his second year at Honolulu Community College, and he is pursuing a Bachelor of Applied Science degree through the Computing, Electronics, and Networking Technology (CENT) program at University of Hawai'i–West O'ahu. After graduating, Alan plans to move forward with further education In computer science.

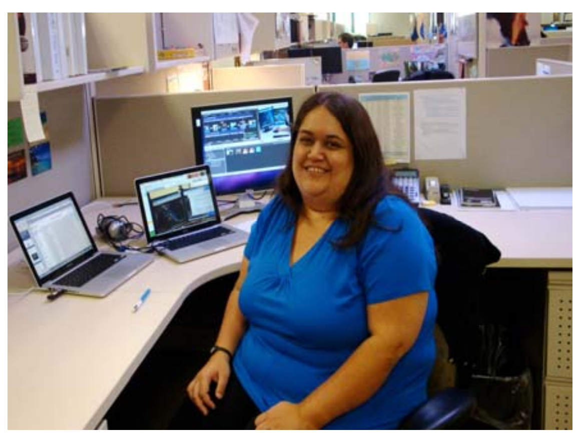
Using Social Media to Enhance PDC's Relationship with the Online Community

Kanoe Hardin
University of Hawai'i Maui College

Pacific Disaster Center
Mentor: Ray Shirkhodai

The Pacific Disaster Center (PDC) seeks to build a more resilient world by supplying both decision makers and the general public with the information they need to better prepare for, respond to, mitigate, and recover from disasters. In order to do this, PDC collects complex data sets from a variety of different sources, and transforms and consolidates them into an easy-to-understand format. The goal is to harvest discrete and sparse data, translate and combine them into comprehensible and actionable knowledge, and to provide easy access for the public and emergency managers, so that the results can be used in life-saving operations and in mitigation planning. In order to reach out to more people, PDC is expanding its use of social media outlets such as YouTube, Facebook, and Twitter. As part of this strategy, we have created brief but informative videos that introduce and explain PDC's Web-based and mobile applications and posted them to the PDC channel on YouTube. The newly designed and developed short videos incorporate graphics, photos, demonstrations of the applications, and archival footage. Once the YouTube channel is populated with instructional videos, we plan to continue enhancing PDC's social media presence by finding ways to reuse, cross-link, and improve content of our YouTube, Facebook and Twitter sites. By providing this information in a mode that the online community is familiar and comfortable with, we hope to reach and educate more people about disaster reduction means, tools, and information, and ultimately, move one step closer to fostering a society that is better able to prepare for and respond to disasters.

Kanoe Hardin grew up in Santa Cruz, California, but has always had strong family ties to Maui. She earned a B.A. in Creative Writing from Linfield College, but returned to school to learn a new trade. She is currently a sophomore working toward an A.S. degree in Electronic and Computer Engineering Technology at the University of Hawai'i Maui College, where she is a member of Phi Theta Kappa and the Tech Club. When she finishes her degree, she hopes to find a job as a system administrator or computer programmer.



Designing an Automated Calibration-Screen Cover for the Pan-STARRS PS1 Telescope

Jonathan Torigoe
University of Hawai‘i at Mānoa

Univ. of Hawaii Institute for Astronomy/Pan-STARRS Consortium
Mentor: Richard Harris

The Panoramic Survey Telescope And Rapid Response System (Pan-STARRS) PS1 telescope on the summit of Haleakalā, Maui, uses a large, white screen mounted on the inside of its dome for taking “dome flat” calibration images. This calibration screen must be covered during nighttime observations made during bright phases of the lunar cycle, otherwise the screen can degrade images by scattering moonlight into the PS1 camera. Unfortunately, whenever telescope users wish to switch between observing and calibration, a minimum of two people must travel to the telescope on the summit and manually mount or remove the existing six-foot-wide cover while standing on precarious scaffolding. In order to prevent such situations, an automated screen cover has been designed that is remotely operable by astronomers in the PS1 control room at the Advanced Technology Research Center (ATRC) in Pukalani. To parallel the tilt of the screen, the automated cover will be mounted and must operate at an angle of 30° to the vertical. Guide rails will be used to assist the motor and constrain movement of the cover. The cover controller will require integration into the current observatory control system, OTIS, with its own command scripts. Finally, candidate materials for the cover must be carefully tested, as the cover should ideally absorb light at all visible and near-infrared wavelengths. After final approval, purchasing and construction of the cover will occur later this year.

Jonathan Torigoe is entering his sophomore year studying Mechanical Engineering at the University of Hawai‘i at Mānoa. After completing his bachelor’s degree, he hopes either to attend graduate school on the mainland or seek a career in Hawai‘i, depending on the state of the economy. When he’s not studying, Jonathan likes to participate in sports like tennis and soccer, play video games with friends, or practice sketching and graphic arts.

Improving the Uniformity of Thin-Film Coatings for Optical Mirrors

Diana Agdeppa

University of Hawai‘i Maui College

Univ. of Hawai‘i Institute for Astronomy

Mentors: J.D. Armstrong & Jeffrey Kuhn

The Institute for Astronomy (IfA) facility on Maui houses a vacuum chamber capable of coating substrates up to a half-meter in diameter with thin films of aluminum or other substances. In thin-film deposition, the pre-coating and coating processes both contribute to obtaining a high-quality result with a uniformity of coverage similar to that of commercial-grade mirrors. However, samples coated in the IfA vacuum chamber were observed to have a number of imperfections, including scratches, pits, and tiny pinholes. Therefore, a series of experiments were conducted in order to find the most effective techniques for preparing and coating future telescope mirror substrates. Both electron-beam (“e-beam”) and thermal evaporation methods were used to vaporize aluminum and produce thin-film coatings on a series of flat glass substrates. Microscopy was used to image both the uncoated substrates and the coated end-products in an effort to trace the source of the imperfections. Ultimately, the following factors were found to play a part in eliminating defects in the final mirror coating: polishing the substrate, modifying the cleaning method, and implementing a “clean room” near the coating lab. A polished substrate and/or a different method for cleaning provides a smoother initial surface to be coated, while the use of a clean room near the coating lab decreases the chance that the substrate will be contaminated with particles. As long as the pre-coated surface of a substrate remains smooth and free of contaminants, the result should be a decreased number of defects.

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D.J. Agdeppa was born in the Philippines and moved to Maui during the summer of 1998. She graduated from H.P. Baldwin High School in 2006 and later decided to enroll in UH Maui College. D.J. is majoring in Electronics and Computer Engineering Technology and plans to graduate with an associate degree in 2012.

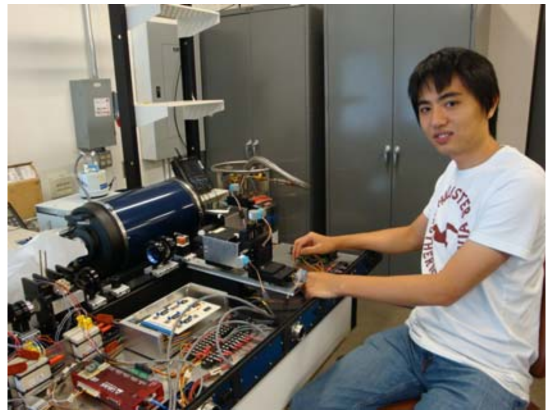
Designing a Mechanical Support System for a Telescope Primary Mirror

Bo Li
Illinois Institute of Technology

Univ. of Hawaii Institute for Astronomy
Mentor: Jeffrey Kuhn

Thousands of scientists observe the night sky to try to better understand the universe. They need small yet high-performance telescopes to collect cutting-edge data at visible wavelengths. The Institute for Astronomy (IfA) proposes to build an optical telescope with a primary mirror 1.85 m in diameter. The objective of this project is to design a mechanical support system for the primary mirror that would prevent mirror deflection greater than 100 nm during normal operation. First, we used GUI-PLOP, a finite element analysis (FEA) software package designed specifically for telescope mirror analysis, to determine the number of support points that could be used. Next, we created a realistic 3D computer model of the mirror and used regular FEA software to simulate the mirror's deformation while in its horizontal position atop the support points. We iterated this model to determine the best location for each support point that minimizes mirror deformation. Once the support structure design is completed, we will test mirror deflection at a variety of tilt angles from zenith to horizon. Also, to prevent the primary mirror from sliding as it tilts, we will add a "sling" support (a rubber or metal strap around the edge of the mirror) to the model. The final model will be successful if it permits full movement of the primary mirror without exceeding its allowed deformation tolerance. If time permits, we will investigate additional designs that reduce the total number of support points, in order to minimize both construction cost and complexity.

Bo Li was born in China and moved to Hawai‘i at the age of 13. He is currently a senior at the Illinois Institute of Technology, pursuing a B.S. degree in Civil Engineering. In his spare time, Bo enjoys fixing computers, reading books, and hanging out with friends.



Optimizing the Software Development Process: Implementing a Build Automation System

Kimberly Oyama
Northern Arizona University

Oceanit
Mentor: Michael Bush
Collaborators: Michael Murai, Brian Lee, Dean Stensrud

Oceanit's software development teams often collaborate on large software systems. However, each developer has a different method of handling his or her checked-out source code. When developing software with multiple interdependent projects, developers must check-out the project that they want to work on, along with all of the projects' dependencies. Before they can build and test their project, they must first assemble the dependencies in the correct order; this requires prior knowledge of the system or process documentation and time. To speed up the building and testing process, we have evaluated and implemented a continuous integration tool, Hudson, the build tools Ant and CMake, and the unit testing tools JUnit and CPPUnit. Hudson, the job scheduling software, will run pre-scheduled builds according to each development team's specifications. Ant and CMake, script generating tools, help the developer create build scripts that also simplify the building process. These scripts can be executed in Hudson, minimizing the amount of time the developers spend setting up the build schedule. To optimize this build automation system, unit testing tools are employed to help developers write test scripts that will run module tests automatically. This development process is more efficient than the current process, making it easier for new developers to work on the software because they will not need to spend as much time learning about the hierarchical structure of the system.

Kim Oyama grew up on Lāna‘i and graduated in 2008 from Lāna‘i High School. She is a senior studying Computer Science and Computer Engineering at Northern Arizona University. Before transferring to NAU for its Electrical Engineering program, she was a double major in Computer Science and Mathematics at the University of Hawai‘i at Hilo. Once she has completed her undergraduate education, Kim would like to study computer architecture and design in graduate school.

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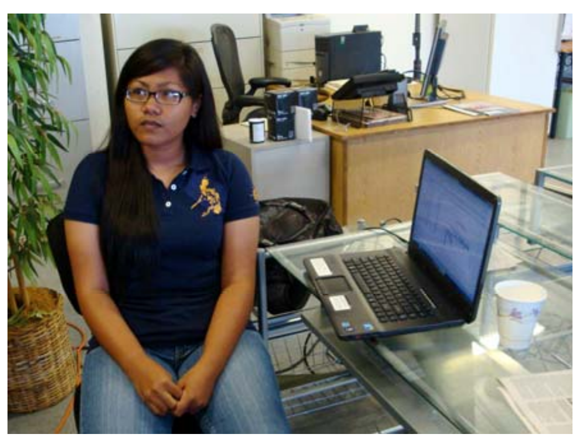
A Debris Mitigation Study for a Commercial Solar Panel Installation

Mariflor Caronan
Northern Arizona University

HNu Photonics
Mentor: Richard Puga
Advisor: Dan O'Connell
Collaborator: Ryan Daugherty

In December 2010, HNu Photonics installed and began operation of 550 solar panels at Pi'ilani Shopping Center on the island of Maui. The project includes a 20-year period of monitoring and maintenance of all systems with future improvements. HNu Photonics recommends that the arrays be cleaned twice per year, due to the dry and dusty climate of the system location. As dirt accumulates on top of each panel, power output will slowly decrease, adversely affecting any systems that depend upon the generated energy. The purpose of this study is to analyze the panels' power output and determine how the power is affected by the amount of dirt on the modules. Before cleaning the panels, the total, average, and peak power generated per day were monitored and recorded for 30 days. After collecting these baseline data, each of seven different locations of solar panel installations will receive a cleaning method recommended by the solar panels' manufacturer. By doing this, we expect to find measurable improvements in the panels' performance, as well as differences in improvement between the seven locations, so we will be able to better understand performance degradation due to dust particles. This study can be applied to develop a customized cleaning method for each solar panel location that minimizes cost and time, as some locations tend to accumulate more dust and debris than others.

Mariflor Caronan was born and raised in the Philippines and has lived on O'ahu for the past two years. She graduated from Waipahu High School in 2010. She is entering her sophomore year at Northern Arizona University, where she is majoring in Electrical Engineering. In her spare time, Mariflor enjoys listening to music, hanging out with friends, snowboarding, singing, and drawing.



System Optimization of a Self-Replicating 3D Printer for Creating Visual Model Designs

Ryan Daugherty
University of Hawai'i at Mānoa

HNu Photonics
Mentors: Michael Owens, Mary Liang & Richard Puga
Advisor: Dan O'Connell

Communication difficulties can arise when companies attempt to explain project plans to clients who lack background knowledge. Companies often enhance their explanations with 2D graphical representations in proposals and presentations, but these methods frequently do not convey all the information that the client wants. To address this problem at HNu Photonics, we have assembled a rapid three-dimensional plastic prototyper ("3D printer") in order to create visual models to better convey 3D products and concepts. The 3D printer is considered self-replicating because it can generate over 50% of the parts needed to build a copy of itself. This is an important quality because it significantly lowers the cost of subsequent printers if one chooses to expand printing production capacity. We have optimized the system by generating and printing calibration models that test the accuracy and the limits of the printer. We will also optimize production time and materials usage in printing residential and commercial solar installation models for company proposals. Two plastics, ABS and PLA, will be tested, and we will determine which material is best suited for generating different types of prototype models or for use in particular applications. Certain plastics are faster to produce and/or have better accuracy at certain temperatures and feed rates. Further testing and improvements could include the use of different colored plastics for better visual representation, and minimizing system vibrations in order to decrease production time.

Ryan Daugherty was born and raised in Kona on the Big Island of Hawai'i and is a graduate of Konawaena High School. He is currently pursuing a Mechanical Engineering degree at the University of Hawai'i at Mānoa, where he is a Regents Scholar and a member of Pi Tau Sigma, a national honorary society for mechanical engineers. After he graduates in the spring of 2012, he hopes to work in the fields of materials science or renewable energy.

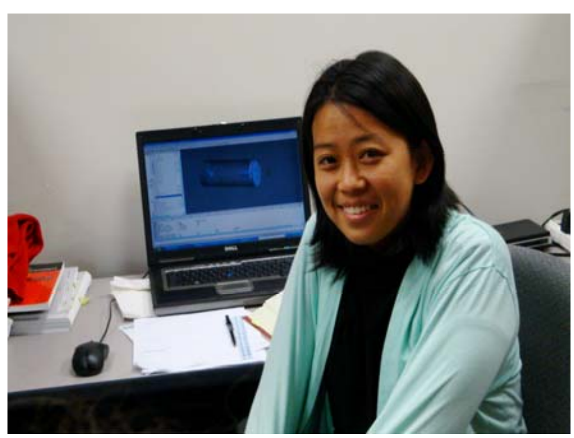
Modeling Small-Telescope Chopping and Nodding Methods for Faint-Object Detection in Daylight Conditions

Amanda Yamamoto
University of Hawai'i at Mānoa

Pacific Defense Solutions, LLC
Mentor: Dennis Douglas

Metric quantification of Earth-orbiting space objects is of paramount interest in the ongoing proliferation of man-made objects in space. Objects with non-quantified orbits pose a serious threat to operational communication and scientific satellites. The use of small (sub-meter) telescopes during nighttime conditions has been demonstrated to be very effective in determining satellite positions. To achieve a similar effectiveness through the use of these telescopes in daytime conditions is highly desired. However, this is a challenging task given the radiant conditions imposed by a bright daytime sky. In this project, the application of chopping and nodding techniques to detect faint objects on a bright sky background is explored in the context of sub-meter telescopes. A generalized optical model was constructed using the FRED optical engineering software package, which fuses accurate radiometric conditions with detailed physical models of small telescopes, including Ritchey-Chrétien and Schmidt-Cassegrain designs. The simulation also incorporates detailed coatings and scattering properties onto optical and non-optical surfaces within each telescope system. Chop/nod methods are tested by ray-tracing light from the sun, sky, and object through the telescopes onto a detector. Investigated chopping methods include tilting the secondary mirror, tilting a turn mirror in front of the sensor, and tilting a transmissive wedge in front of the sensor, while nodding simulations simply involve tilting the entire telescope. The results of these tests will determine which chop/nod method is optimal for daytime observation of satellites.

Amanda Yamamoto was raised on Maui and graduated from Lahainaluna High School. She currently attends the University of Hawai'i at Mānoa as a Mechanical Engineering major and will be a junior this fall. She likes to cook, hike, and watch movies .



Detection of GEO Satellites Through Shadow Imaging

Dylan Schwarzmeier
University of Hawai'i Maui College

Pacific Defense Solutions, LLC
Mentor: Riki Maeda

Due to the spatial resolution limits of current satellite-tracking systems, successful imaging of satellites within a geostationary Earth orbit (GEO) has never knowingly been performed. The scenario of a malfunctioning GEO satellite, prompting a long costly damage assessment, could be mitigated by a visual assessment of the satellite. Shadow imaging proposes an inexpensive solution to this problem by capturing the diffraction pattern created from a satellite occultation. When a satellite passes between the Earth and a specific star, a shadow of the satellite can be observed from Earth in the form of a diffraction pattern. By utilizing an array of inexpensive mobile 14-inch-diameter telescopes equipped with rapid readout photon counting detectors, the diffraction pattern created by a satellite's occultation can be measured and mapped. The diffracted silhouette of the satellite can then be processed in an algorithm that corrects for diffraction to produce a high-resolution silhouette of the satellite.

Born in New York and raised on Maui, Dylan Schwarzmeier is currently working toward a Bachelor of Applied Science in the field of Engineering Technology at the University of Hawai'i Maui College. Dylan's ultimate goal is to work in a cutting-edge technical career on Maui that would support a comfortable lifestyle. When he is not busy with school or work, Dylan can be found windsurfing somewhere on the north shore of Maui.

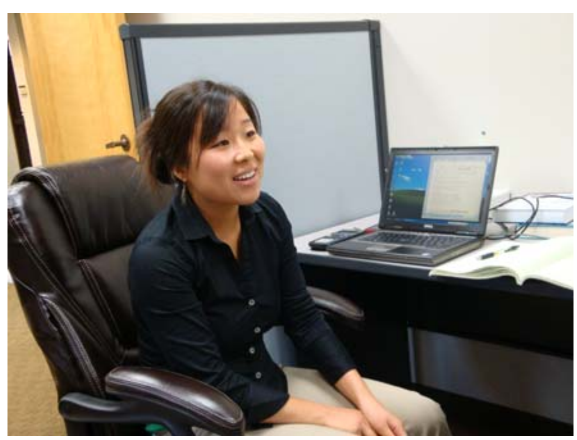
An Interactive Analytical Tool for Optical Systems Evaluation

Chihiro Sasaki
Northern Arizona University

Pacific Defense Solutions, LLC
Mentor: Dennis Douglas

There is a disparity between first-order optics (geometric or ray-tracing) computer models and rigorous wave-optics simulations. In order to bridge the gap between the two distinct types of optical models, Pacific Defense Solutions, LLC needed an analysis tool to identify the resolution limits and explore capabilities of existing and potential future optical systems. Furthermore, the tool required implementation in a MATLAB GUI environment, and it needed the capability to model both wide and narrow field-of-view systems. Hence, a new interactive tool has been developed that allows the user to quickly change system parameters, such as telescope type, sensor type, static wavefront error, system jitter, atmospheric seeing conditions, and overall system transmission. The main interface takes in parameters through a number of different input modules presented to the user as separate GUI windows. Using these parameters, the tool performs a series of analytical calculations based on vetted transfer functions to generate performance metrics of the given system, including an image of the final point-spread function. After being compiled in MATLAB, the tool will be tested on multiple computer platforms for consistency of the user interface and accuracy of plots and data. Once completed, the tool will guide users in designing optical system configurations that fit their particular requirements, and it will also provide a starting point for wave-optics simulations. The completed tool is expected to be released in January 2012.

Chihiro Sasaki was born on Oʻahu and lived in Japan until eight years old, when she moved to Hilo, Hawaiʻi. She graduated from Waiākea High School in 2008 and attended the University of Hawaiʻi at Hilo for two years, majoring in Computer Science and Mathematics. After attending Northern Arizona University for a year through the National Student Exchange program, she is transferring to NAU to pursue degrees in both Computer Science and Electrical Engineering with an emphasis in Computer Engineering .



Akamai Workforce Initiative

University of Hawai‘i Institute for Astronomy (IfA)
University of California, Santa Cruz Institute for Scientist & Engineer Educators (ISEE)
UH Maui College

The Akamai Workforce Initiative (AWI) partners industry, observatories, educational institutions, and community to meet needs in astronomy, remote sensing, and other technology industries in Hawai‘i. The AWI includes internships, the Teaching and Curriculum Collaborative, development of engineering technology courses, and outreach to high schools.

The AWI will advance Akamai – smart, clever, expert – students into the technology workforce on Maui, and more broadly in Hawai‘i.

AWI includes internships on Maui and the Big Island

Maui Akamai Internship

Akimeka, hν Photonics, Institute for Astronomy, Maui High Performance Computing Center, Pacific Defense Solutions, Pacific Disaster Center, Textron Systems, Trex Hawaii

Hawai‘i Akamai Internship

Canada-France-Hawaii Telescope, Gemini Observatory, Institute for Astronomy, W.M. Keck Observatory, Smithsonian Submillimeter Array, Subaru Telescope

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