AKAMAI WORKFORCE INITIATIVE

Maui Summer Internship Symposium

August 13, 2014
Pacific Disaster Center

Program & Intern Abstracts

Advancing Hawai'i college students into science and technology careers

2014 Akamai Internship Program

Akamai Workforce Initiative
Institute for Scientist & Engineer Educators, University of California Santa Cruz
Thirty Meter Telescope International Observatory
University of Hawai‘i Institute for Astronomy
University of Hawai‘i at Hilo

Akamai = smart, clever

The Akamai Internship Program is a unique program that supports Hawai‘i college students in completing an authentic science or technology project in a professional setting. Students are prepared through an intensive one-week short course, then spend 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, they 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) using National Science Foundation (NSF) Science and Technology Center funding, with the specific aim of developing a program to address the technical workforce needs in Hawai‘i and advancing students from diverse backgrounds into science, technology, engineering and mathematics (STEM) careers. Interns receive college credit from UH Hilo.

2014 Maui Host Organizations

Akimeka
HNu Photonics
UH Institute for Astronomy
Makani Kai Tech
Pacific JITC

~ In addition, 21 interns completed internships with Big Island-based observatories and companies ~

Akamai Workforce Initiative

Leadership

Lisa Hunter – Director
Univ. of California, Santa Cruz & UH Institute for Astronomy

Jerome Shaw – Associate Director
Univ. of California, Santa Cruz

Akamai Partnership Advisors
Sandra Dawson – TMT International Observatory
Joseph Janni – Air Force Maui Optical & Supercomputing Site
Jeffrey Kuhn – UH Institute for Astronomy
Claire Max – Univ. of California, Santa Cruz

Program Coordinators

Beth Walker – Univ. of California, Santa Cruz
Lani LeBron – UH Institute for Astronomy
Austin Barnes – Univ. of California, Santa Cruz

2014 Akamai Short Course Instructors

David Harrington, Lead Instructor – UH Institute for Astronomy
Austin Barnes, Team Leader – Univ. of California, Santa Cruz
Sarah Beganskas, Team Leader – Univ. of California, Santa Cruz
Sean Goebel – UH Institute for Astronomy
Ali Mousavi – Univ. of Hawai‘i at Manoa
Kauahi Perez – Univ. of Hawai‘i at Manoa
Liang Shi – Univ. of Hawai‘i at Manoa
Richard Smith – Univ. of California, Santa Cruz

2014 Communication Instructors

Michael Nassir, Lead Instructor – Univ. of Hawai‘i at Manoa
Clay McKell, Instructor – Univ. of Hawai‘i at Manoa
Lisa Hunter – Univ. of California, Santa Cruz
Jerome Shaw – Univ. of California, Santa Cruz

Special Thanks . . .

The Akamai Workforce Initiative would like to thank the following individuals for their commitment and support of the 2014 Maui Akamai Internship Program:

AMOS – Joseph Janni

Akimeka
Matt Granger
Tad Dicks, Rob Nelson & many past mentors
Peter Konohia, Lakulish Patel, Joey Andrews, Kyra Vila
Mahalo for hosting our weekly intern meetings!

HNu Photonics
Michael Reiley
Riley Aumiller, Richard Pultar & many past mentors

Makani Kai Tech
Michael McDougall
Bryan Berkowitz, Philip Brooks

Pacific Disaster Center
Sharon Mielbrecht, Jen Stolpe & staff, and many past mentors at PDC
Mahalo for hosting our Symposium!

Pacific JITC
Todd Lawson – 2C4 Technologies
Michael Strack – Pelatron
Mikol Westling – Hawaii Resource Group

Thirty Meter Telescope International Observatory – Sandra Dawson
Mahalo for being a sponsoring partner!

Univ. of Hawai'i System – James Gaines, Vassilis Syrmos
Mahalo for being a sponsoring partner!

UH Hilo
Donald Straney, Matthew Platz
Faculty & staff of the Dept. of Physics & Astronomy
Mahalo for hosting our Short Course!

UH Institute for Astronomy
Günther Hasinger, Robert McLaren, Klaus Hodapp, Stuart Jefferies, Mike Maberry
Cindy Giebink, Dan O'Gara, Garry Nitta, Andre Fehlmann, Tim Bond, Jeffrey Kuhn, J.D. Armstrong & many past mentors at IfA-Maui
Cristal Koki, Johanna Estrella, Laura Fiorentino & staff at IfA-Maui
Nancy Lyttle, Diane Tokumura, Karen Toyama, Faye Uyehara & staff at IfA-Manoa
Mahalo for hosting our weekly intern meetings!

Opening Remarks

Lisa Hunter
Director, Akamai Workforce Initiative
Univ. of California, Santa Cruz – Institute for Scientist & Engineer Educators
UH Institute for Astronomy

Internship Project Presentations

Makani Kai Tech

Creating a Web Portal for Hospital Vendor Certification of Pharmaceutical Supplies
John Evans — *UH Hilo*

Creating a Web Portal for Medical Product Certification
Kekai Clarke — *Lewis & Clark College*

Pacific JITC

A Video Repository for the Pacific JITC ITEC
Kisa Giebink — *McGill Univ.*

Automation of Software Development Sandboxes
Andy Tonthat — *UH Manoa*

~ Intermission ~

Akimeka

Developing a System for Cyber Security
Helaman Tafua — *UH Hilo*

There's an App for That: A Solution for Mobile Blood Packet Scanning
Eric Yamasaki — *UH West O'ahu*

UH Institute for Astronomy

Developing an iOS Weather App for the Institute for Astronomy
Micah Lau — *Brown Univ.*

Structural and Finite Element Analysis of Astronomical Instrument Components
Mark Galiza — *Univ. of Washington*

HNu Photonics

Developing an Instrument to Characterize Large Optical Surfaces: The Swing-Arm Profilometer
Michael Gorman — *Syracuse Univ.*

Closing Remarks & Reception

Creating a Web Portal for Hospital Vendor Certification of Pharmaceutical Supplies

John R. Evans
Univ. of Hawai'i at Hilo

Makani Kai Tech
Mentors: Bryan Berkowitz & Philip Brooks
Advisor: Michael McDougall
Collaborator: Kekai Clarke

Electronic health records offer many advantages, including reductions in cost and inaccuracies associated with paper-based systems. Makani Kai Tech has a client that relies on paper records for vendor certification of pharmaceutical supplies, and the client has requested the construction of a secure Web portal to be used by internal product managers and customer suppliers. The portal is broken down into four components, each comprised of smaller subcomponents: Layer 1 is a cloud server containing the Web portal's database, along with the Application Programming Interface (API) for interacting with the database. Layer 2 exposes Layer 1 via Representational State Transfer (RESTful). Layer 3 authenticates Layer 2, exposing the API to authorized users. Product managers log in using credentials existing within the server, while suppliers log in via a separate website using a session cookie. Before a supplier is permitted to log in, a product manager must create a contact for the supplier and send a linked email invite to opt-in to the site. Once clicked, the supplier selects a unique password and provides this, along with the email address, as means of authentication. Lastly, Layer 4 provides the user interface that allows users to interact with the previous three layers. To date, all back-end systems (i.e., database, RESTful API, and user authentication) have been implemented, leaving only the HTML5-based front-end. Once completed, the portal will be subjected to testing, then deployed for customer review.

John R. Evans

John Evans was born on the mainland, and relocated to the Big Island after spending three years studying Chemical Engineering at the University of Nevada, Reno. In 2009, he enrolled at Hawai'i Community College, where he obtained his Associate of Science in Information Technology two years later. John is currently pursuing his bachelor's degree in Computer Science at UH Hilo, and will graduate in Spring 2015. After completing his degree, John plans to pursue employment in industry working on big data solutions, and would prefer to stay within the islands. In his spare time, John enjoys practicing the martial arts, working on personal programming projects, reading, writing books, and spear fishing.

Creating a Web Portal for Medical Product Certification

Kekai Clarke
Lewis & Clark College

Makani Kai Tech
Mentors: Bryan Berkowitz & Philip Brooks
Advisor: Michael McDougall
Collaborator: John Evans

Since the Health Information Technology for Economic and Clinical Health Act of 2009, the health industry has seen an expansion in health-related information technology. This expansion includes upgrading from hardcopy to electronic documents and automating processes online. Our task was to create a Web portal to assist a hospital supplier in acquiring product certifications from pharmaceutical suppliers. The portal would allow for product suppliers to enter and update product information used in the certification process. In addition, the portal would provide a way for the hospital supplier's product managers to monitor and assist the product suppliers with the certification process. The project consisted of designing a relational database using SQL Server, then creating an HTML/Javascript user interface using Breeze and Angular. To connect the server and interface, we created an object-relational mapping framework using Entity Framework and added an OAuth authentication layer. This portal will increase the efficiency and reliability of the certification process by providing a central location for product and certification information to be stored, accessed, and updated.

Kekai Clarke

Kekai Clarke was born and raised in Waimea, graduating from Hawai'i Preparatory Academy in 2010. He is a senior at Lewis & Clark College in Portland, Oregon, pursuing a B.A. in Computer Science and Mathematics. He is working towards a career in software development and video game design.

A Video Repository for the Pacific JITC ITEC

Kisa Giebink
McGill University

Pacific JITC
Mentor: Todd Lawson

The Pacific Joint Information Technology Center (JITC) is the Defense Health Agency (DHA) resource for innovation, advanced concept development, piloting, and prototyping for medical mission solutions. Pacific JITC's Integrated Test and Evaluation Center (ITEC) plays a key role in developing such solutions, reducing time-to-market for information management/information technology (IM/IT) solutions — the Pacific JITC can evaluate, innovate, and develop solutions that are transferred to the DHA Program Offices for speedy deployment. Once developed, the results of these solutions and/or projects need to be published to inform various government agencies as well as the public. The primary mechanism for disseminating information is via the Pacific JITC website, which hosts a repository of videos and project information sheets. My project consisted of coordinating with the Pacific JITC customers in creating the videos, then transcribing, captioning, and editing the videos to maximize their accessibility. This satisfies compliance with the Rehabilitation Act of 1973, which requires federal agencies to make their electronic and information technology accessible to people with disabilities. The results of this project produced a collection of informative videos to assist in the marketing of the Pacific JITC projects. The videos were presented during the Defense Health Information Technologies Symposium (DHITS) in July 2014 and are now available on the Pacific JITC website.

Kisa Giebink

Kisa Giebink was born and raised on Maui, and graduated from King Kekaulike High School in 2013. She currently attends McGill University in Quebec, where she is pursuing a B.A. & Sc. in Cognitive Science. After earning her degree, Kisa would like to attend graduate school. She also enjoys reading, swimming, hiking, and playing soccer.

Automation of Software Development Sandboxes

Andy Tonthat
Univ. of Hawai'i at Manoa

Pacific JITC
Mentors: Michael Strack & Mikol Westling

The Pacific Joint Information Technology Center (JITC) Integrated Test and Evaluation Center (ITEC) hosts developmental "sandboxes" — isolated environments in which customers can test new software, without the risk of adverse effects to existing systems. There are four parts to the creation of developmental sandboxes: hosting of disk space, creation of virtual machines on disk, configuration of the virtual machines, and the creation of users and directories. Currently, this process requires many manual executions, and therefore takes a considerable amount of time to complete. In order to automate the setup of these sandboxes, we created scripts that will execute these commands with little or no manual interaction. This is done through the combined programming languages of Powershell, which is used to run high-level programming such as the creation of users and virtual machines, and C#/ASP.Net, which is used to host all of the scripts and execute all of the commands in order. Currently, the automation process can execute the steps of the creation of sandboxes individually; however, the commands are not yet linked together. Future work will combine the automated executions of the commands, and error checking will also be implemented in order to improve usability.

Andy Tonthat

Andy Tonthat was born on O'ahu and raised on Maui. He is currently a student at UH Manoa, where he is majoring in Computer Science and plans to graduate in Spring 2015. After graduating, Andy would like to pursue a career in software engineering or to attend graduate school. In his free time, he enjoys playing tennis and video games.

Developing a System for Cyber Security

Helaman Tafua
Univ. of Hawai‘i at Hilo

Akimeka
Mentor: Rob Nelson

With growing concerns for preserving confidential information across the Internet, Akimeka is researching automated system development to detect nefarious behavior at the application server level. This detection mechanism applies advanced analytics algorithms against data collected from application server logs. The result of these analytics is a set of indications and warnings that imply nefarious behavior, either by authorized system users or by intruders intent on stealing information. Our work in this research involved implementing analytics through business intelligence tools and NoSQL database implementations. Our research was focused on evaluating NoSQL database platforms, choosing a platform to best model our problem space, and then implementing the platform using data collected from Akimeka application servers. After completing the data modeling in a NoSQL database, we were able to collect measures that allowed analysis of the data. The measures formed vectors that were implemented in a Support Vector Machine (SVM), a form of machine learning that allowed us to train software to predict whether a group of activities were an indication of nefarious behavior. While the expected result of this work will be better protection of application data at Akimeka, the techniques we developed can also be extended to other organizations and be used to protect their systems.

Helaman Tafua

Helaman Tafua was born in North Carolina, but has lived in Hawai‘i for most of his life. He has traveled to England and Ireland, and lived in Australia with his sister for a year. Helaman currently lives in Pahoa, Hawai‘i, where he attends UH Hilo, and plans to complete his bachelor’s degree in Computer Science in spring 2015. After graduating, he would like to earn experience anywhere within the tech industry, but one day wishes to become a video game/app developer. In his spare time, Helaman enjoys spending time with his family, playing video games, improving his programming skills, and practicing his Samoan fire knife dancing.

There's an App for That:
A Solution for Mobile Blood Packet Scanning

Eric Yamasaki
Univ. of Hawai'i–West O'ahu

Akimeka
Mentor: Tad Dicks

The blood module of the Theater Medical Data Store (TMDS) is currently the only way that military personnel can electronically track, receive, and analyze the current inventory of blood packets at any medical treatment facility (MTF). TMDS has persistent issues with its limited capacity for Internet connectivity, its mobility, and its extensive interface. We have chosen to construct an Android application ("app") called Blood Packet Scanner to complement TMDS and resolve these obstacles. Specifically, the Android operating system (OS) was selected because it is an open OS, unlike Apple's iPhone operating system (iOS), which is closed. Utilizing Android's open OS allows for greater flexibility and control of its architecture and features, allowing it to be custom-tailored to specific environments. Both TMDS and Blood Packet Scanner have scanning capabilities, but Blood Packet Scanner employs its built-in camera as a scanner, creating an all-in-one solution. Data storage on the mobile device is handled by an integrated database on the phone itself, without the need for network connectivity. Blood Packet Scanner's ability to be integrated with 3G, 4G, global positioning system (GPS), and Wi-Fi technologies creates multiple solutions for mobile connectivity and network redundancy. Implementing Blood Packet Scanner specifically on mobile phones would be a benefit in-theater because of phones' inherently small size, making transportation effortless. The design of our user interface (UI) was influenced by mobile phones' small screen size — a simplistic approach was implemented, applying only the core essentials, which also contributed to ease-of-use. Further development of the Blood Packet Scanner app would attempt to integrate more of TMDS's capabilities, while still maintaining mobility, connectivity, and ease-of-use.

Eric Yamasaki

Eric Yamasaki is a senior at UH West Oahu majoring in information technology. He previously was enlisted in the United States Air Force in 2007 and deployed to Iraq in 2009. After the successful completion of his first term, he was honorably discharged. In 2011, he joined the Air Force Reserves and is still currently a member. After a successful endeavor in the military, Eric decided that a bachelor's degree was the next challenge to accomplish. Currently, he has a 3.81 GPA and is projected to graduate in the fall of 2014. His future goals are to have a fulfilling career and to pursue a master's degree.

Developing an iOS Weather App for the Institute for Astronomy

Micah Lau
Brown University

UH Institute for Astronomy
Mentors: Cindy Giebink & Dan O'Gara

Weather data gathered at the summits of Haleakala and Mauna Kea is currently displayed on webpages hosted by the Institute for Astronomy (IfA). Several different webpages also provide graphs of archived weather data, charts comparing data from multiple stations, and live satellite and web-cam images. Scientists working at the summits use this information to determine whether conditions are favorable for research. However, viewing IfA webpages from mobile devices may be difficult, due to slow load times and an unoptimized layout. We have created the IfA Weather App for iOS, built with Objective-C, to offer a convenient and streamlined display of Haleakala and Mauna Kea weather data and the various features provided by the IfA websites. PHP web services and MySQL queries are used to obtain and format data to be parsed in the application. CorePlot, an open-source graphing library, provides the framework for 24- and 48-hour weather-trend visualizations. The app also features 24-hour animated satellite imagery of the Hawaiian Islands and the greater Pacific Northeast region.

Micah Lau

Micah Lau is from Mililani on the island of O'ahu. He is currently concentrating in Computer Science at Brown University. After graduating in 2016, he would like to work in software engineering, web development, or computer law. Micah's interests include creative writing, photography, music, and Korean food.

Structural and Finite Element Analysis of Astronomical Instrument Components

Mark Galiza
Univ. of Washington

UH Institute for Astronomy
Mentors: Garry Nitta, Andre Fehlmann, Tim Bond
Advisors: Stuart Jefferies, Jeffrey Kuhn

Optical systems are subject to thermal expansion when placed in extreme temperature conditions, resulting in a reduction of data quality. Therefore, creating three-dimensional models and conducting finite element analysis of these systems is crucial in order to analyze how these systems respond to the conditions. This internship involved two projects that focused on designing, modeling, and simulating components of optical systems. The first project involved analyzing the entire MOTH telescope to determine whether proper heating is achieved with the use of silicon heating pads and insulation — a desired internal temperature of approx. 20˚C should be maintained, even when conditions outside the telescope are below freezing. To accomplish this goal, we replicated all of the different components of the MOTH telescope using Autodesk Inventor. Then, using the Finite Element package, we conducted various thermal simulations to analyze the internal temperature of the telescope enclosure. We determined that each heating pad must produce a maximum of approx. 75 watts to meet the criteria. The second project, involving the CyroNIRSP instrument, was to design a mount to hold a prism mirror firmly in place without deforming the optical surface by greater than 79 nanometers RMS. To accomplish this, we devised a proposed design consisting of spring plungers and dowels. We conducted various stress analyses to determine that the maximum force that can be exerted on the prism is 151 newtons (33 lbf). For both optical systems, our results provide a good foundation for the design team to build a model, test their systems, and determine whether changes should be implemented.

Mark Galiza

Mark Galiza was born in the Philippines, and moved to Hawai‘i when he was seven years old. Mark is a 2013 alumnus of Maui High School and a Class of 2013 Gates Millennium Scholar. He is currently a Sophomore at the Univ. of Washington, Seattle, where he plans to major in Mechanical Engineering. Mark is a part of the UW Engineering Without Borders Program, and one day he would like to work in the aviation industry or in the sustainable/renewable energy field. In his spare time, Mark enjoys playing basketball, going on outdoor adventures, or simply just enjoying the company of others.

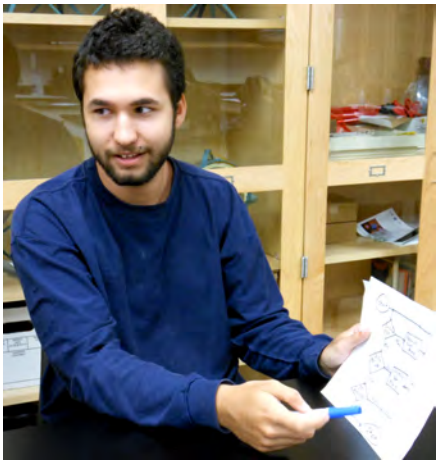
Developing an Instrument to Characterize Large Optical Surfaces: The Swing-Arm Profilometer

Michael Gorman
Syracuse University

HNu Photonics
Mentors: Richard Pultar & Riley Aumiller

Eyeglasses, mirrors, lenses, computer screens — optics are a part of everyday life. Many applications require optical elements with high-precision surfaces: defense systems, medical analysis, and astronomical research, to name just a few. To ensure peak performance, these optics must be machined and characterized to the most precise level possible. One method is to measure optical surfaces through the use of a profilometer, a device used to measure the deviation from an ideal surface, reaching accuracies down to nanometer levels. Currently, there are two types of profilometers: linear and swing-arm. The linear design is generally used to measure small optical parts (4–6 inches), and as the name suggests, moves in a linear fashion. The use of a swing-arm profilometer provides multiple advantages, including cost efficiency and high accuracy. Its ability to measure the surface figure of larger optical parts stems from the fact that the tool can swing through an arc-shaped path of any length as the arm pivots. By designing a swing arm that utilizes a near-frictionless air bearing, a high-torque, high-accuracy stepper motor, and a depth gauge accurate to 0.2 μm, optical elements as large as 1.5 meters can be measured to extreme accuracies. With the addition of Arduino and MATLAB programming, a tool is created that can be adapted to any-sized part and measure with the same accuracy each time, as well as vary resolution of the data and number of data points recorded. This improvement in accuracy of measurement allows regions of the optical part to be addressed where it has deviated most from ideal. These points can then be polished or machined in order to create a more ideal surface.

Michael Gorman



Michael Gorman was born on Maui, but moved to New Zealand and then to Florida, before finally returning to Maui for middle and high school; during his life, he has traveled to five continents and over 35 different countries. After graduating from Kamehameha Schools Maui in 2012, Michael has furthered his education at Syracuse University and is entering his junior year with a major in Mechanical Engineering and a minor in Entrepreneurship. He plans to one-day work in a career dealing with the space program, whether that job is directly or indirectly related. In his free time, he enjoys working with computers, playing sports, watching movies, and building prototypes.

Akamai Workforce Initiative

University of California, Santa Cruz Institute for Scientist & Engineer Educators (ISEE)
University of Hawai‘i Institute for Astronomy (IfA)
Thirty Meter Telescope International Observatory
University of Hawai‘i at Hilo

The AWI advances Akamai (smart, clever) students into the Hawai‘i technical and scientific workforce. AWI partners industry, observatories, government, educational institutions, and community to meet workforce needs in astronomy, remote sensing, and other science and technology industries in Hawai‘i. The Akamai Internship Program is one of the major programs of the Akamai Workforce Initiative.

The 2014 Akamai Internship Program placed college students from Hawai‘i at the following organizations to complete a seven-week project:

- Akimeka LLC
- Cellana, Inc.
- Gemini Observatory
- HNu Photonics
- W.M. Keck Observatory
- UH Institute for Astronomy (*Maui facility*)
- Makani Kai Tech
- Natural Energy Laboratory of Hawai‘i Authority (NELHA)
- Pacific International Space Center for Exploration Systems (PISCES)
- Pacific Joint Information Technology Center (JITC)
- Smithsonian Submillimeter Array (SMA)
- Subaru Telescope
- Thirty Meter Telescope International Observatory (*Pasadena facility*)
- University of Hawai‘i at Hilo

The AWI currently receives funding from:

Air Force Office of Scientific Research (FA9550-10-1-044)

University of Hawai‘i

Thirty Meter Telescope International Observatory

For more information please contact:

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

http://akamaihawaii.org

For more information on the Akamai Internship Program please contact:

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AKAMAI WORKFORCE INITIATIVE

Big Island Summer Internship Symposium

Hilo

August 8, 2014

'Imiloa Astronomy Center

Waimea

August 11, 2014

W.M. Keck Observatory Headquarters

Hualalai Public Conference Room

Program & Project Abstracts

Advancing Hawai'i college students into science and technology careers

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2014 Host Organizations

~ Hilo ~

Gemini Observatory
Pacific International Space Center for Exploration Systems (PISCES)
Smithsonian Submillimeter Array
Subaru Telescope
University of Hawai‘i at Hilo

~ Waimea ~

W.M. Keck Observatory

~ Kona ~

Cellana, Inc.
Natural Energy Laboratory of Hawai‘i Authority (NELHA)

~ Pasadena ~

Thirty Meter Telescope International Observatory

~ In addition, 9 interns completed internships on Maui ~

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Univ. of California, Santa Cruz & UH Institute for Astronomy

Jerome Shaw – Associate Director
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Jerome Shaw – Univ. of California, Santa Cruz

Special Thanks . . .

The Akamai Workforce Initiative would like to thank the following individuals for their commitment and support of the 2014 Big Island Akamai Internship Program:

Cellana Inc.
Valerie Harmon, Reyna Javar, Radu Mihaila
Serena Chamberlain, Tina LePage & staff at Kona facility

Gemini Observatory
Markus Kissler-Patig
Tom Cumming, Jason Kalawe, Andreea Petric, Chris Stark, Tim Minick & many past mentors
Adrienne Notley & staff at Gemini
Mahalo for hosting our weekly intern meetings!

'Imiloa Astronomy Center – Aaron Pacheco & staff

Keck Observatory
Taft Armandroff, Hilton Lewis
Andrew Cooper, Pete Tucker & many past mentors
Mahalo for hosting our Symposium & our weekly intern meetings!

NELHA
Alex Leonard, Laurence Sombardier, Keith Olson

PISCES
Rob Kelso
Christian Andersen, Rodrigo Romo & past mentors

Smithsonian Submillimeter Array
Rob Christiansen, John Maute, Ramprasad Rao, Ranjani Srinivasan & past mentors

Subaru Telescope
Lucio Ramos, Kiaina Schubert & past mentors
Josh Walawender, Brendan Hora

Thirty Meter Telescope International Observatory
Sandra Dawson
Eric Williams, Lianqi Wang & past mentors
Holly Novack, Magnolia Ycasas & staff at Pasadena facility
Mahalo for being a sponsoring partner!

Univ. of Hawai'i – James Gaines, Vassilis Syrmos
Mahalo for being a sponsoring partner!

UH Hilo
Donald Straney, Matthew Platz
Kathy Cooksey & past mentors
Philippe Binder, John Hamilton, faculty & staff in the Dept. of Physics & Astronomy
Mahalo for hosting our Short Course!

UH Institute for Astronomy
Günther Hasinger, Robert McLaren, Klaus Hodapp
past mentors at IfA-Hilo
Ruisheng Peng, Sandra Miyata, Pamela Lau & staff at IfA-Hilo
Nancy Lyttle, Diane Tokumura, Karen Toyama, Faye Uyehara & staff at IfA-Manoa
Mahalo for hosting our intern meetings!

Presentation Schedule

Hilo

August 8, 2014

‘Imiloa Astronomy Center

Host Organizations

Gemini Observatory

Smithsonian Submillimeter Array

University of Hawai‘i at Hilo

PISCES

Subaru Telescope

Thirty Meter Telescope International Observatory

Opening Remarks

Lisa Hunter
Director, Akamai Workforce Initiative
Univ. of California, Santa Cruz – Institute for Scientist & Engineer Educators
UH Institute for Astronomy

Internship Project Presentations — Concurrent Session I

Gemini Observatory

Is "Bigger" Really Better?
An Investigation of Jumbo Packets and Network Efficiency
Doan Pham — *Honolulu CC*

Gemini SciOps Observations Web Portal
Jonathan DeCosta — *UH Maui College*

Gas in Luminous Infrared Galaxies
Derek Hand — *UH Hilo*

The Fault in Our System:
Improving Event-Handling Response at Gemini Observatory
Tuan Giang — *UH Hilo*

~ Intermission ~

Univ. of Hawaii at Hilo

Characterizing C IV and Mg II Absorption Systems
Using a Median Stacking Analysis
Natalie Nagata — *UH Manoa*

Thirty Meter Telescope

A Website Prototype for Displaying Real-Time Data
from the Adaptive Optics Real-Time Controller
Sean Carlos — *UH Hilo*

Designing a Cushioning and Immobilization System
for the TMT Mirror Shipping Container
Patrick Peng — *Northwestern Univ.*

Developing Economical Protective Shipping Containers
for TMT Polished Mirror Assemblies
Evan Akuna — *UH Mānoa*

Internship Project Presentations — Concurrent Session II

PISCES

Documentation and Mobility for the PISCES Rover
Nasre Manasrah — *UH Maui College*

Characterizing Planetary Analogue Sites
Leila Olivar — *UH Mānoa*

Subaru Telescope

Design and Security of the Wireless Network for the Subaru Telescope Base Facility
Devin Rasco — *Honolulu CC*

Chilling in Subaru: Investigating and Upgrading the FMOS IRS2 Climate Control System
Marley Rutkowski — *Univ. of Portland*

~ Intermission ~

Smithsonian Submillimeter Array

Design and Optimization of PV Systems for the SMA Summit and Base Facilities
Tiffanee Pahia — *UH Manoa*

Repackaging of an RF Beam Scanner and Beam Pattern Analysis
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Modeling Star Formation: Simulating the Magnetic-Field Structure of Collapsing Molecular Clouds
Andrew McNichols — *UH Hilo*

Closing Remarks & Reception

Is “Bigger” Really Better?
An Investigation of Jumbo Packets and Network Efficiency

Doan Pham
Honolulu Community College

Gemini Observatory
Mentor: Chris Stark

The Gemini Observatory has four distinct, interconnected, high-speed gigabit TCP/IP networks, and a constant need to transfer large amounts data. Some technology experts believe that adjusting default network settings on a network of this speed can have a substantial impact on network efficiency, resulting in faster data transfers and reduced CPU utilization. The most common of these optimizations is the use of jumbo packets. Jumbo packets are a result of a change to TCP/IP's Maximum Transfer Unit (MTU) setting from the standard 1500 bytes to something larger, like 4500 or even 9000 bytes. We started this project by researching the various jumbo packet standards and their potential risks and benefits. Armed with information, we then set up a testing lab using platforms that represent common hosts at Gemini, including Dell, Cisco, and Sun hardware running CentOS Linux, VMware ESXi, Windows 7, and Windows Server. We ran a battery of benchmark tests to establish CPU and network usage across a variety of MTU settings, then analyzed the results to see for ourselves whether this common industry recommendation would be a good fit for the Gemini network.

Doan Pham

Doan Pham has been a student at Honolulu Community College since 2011, and his goal is to earn a bachelor’s degree in Computing, Electronics, and Networking Technology (CENT) at UH West Oahu. Doan was born in the south of Vietnam and moved to Hawaii in 2006. As a young child, he loved to figure out how things work — he took apart many toys to discover their secrets, although he was rarely able to reassemble them into working condition. Now, Doan’s ultimate goal is to complete a PhD in computer-related field. During his free time, he enjoys playing computer games and solving puzzles.

Gemini SciOps Observations Web Portal

Jonathan DeCosta
Univ. of Hawai'i Maui College

Gemini Observatory
Mentor: Jason Kalawe
Advisor: Jared Eckersley

The Gemini Observatory uses website pages, Java applications, an external database, and email to provide their service. When observing, scientists must navigate through each medium to successfully gather their data. To simplify and personalize the experience, we first designed a Web portal. The portal contains important links and quick information for the P.I. to monitor how astronomical observations are proceeding. The portal will also merge other Gemini data sources such as schedules and forums. Research was done by interview and prototype-testing to identify whether these features of the observation process were worthy of this quick information hub. The webpage is decided to either be ideal or overlooked by the scientists when the user testing is completed. Ideal webpage design will be based on navigability, usefulness, amount of information, and how the users and staff members of Gemini react to its presence. A project charter will be made and submitted to Gemini management. The charter explains the Web portal's uses and the impact it will have within Gemini, to afford the management team a well-developed decision on whether or not to use this new method of observing.

Jonathan DeCosta

Jonathan DeCosta was born and raised on the island of Maui. He graduated from Maui High School in 2013, where he took college-level programming and mechanical physics courses, and was in the video club, wrestling, and choir. Following his goal of working in a technical field, Jonathan is currently attending the Electronic and Computer Engineering Technology (ECET) program at UH Maui College. He plans to go on to complete the bachelor's degree in Engineering Technology at UHMC, and to seek a career that allows him to design and maintain Hawaii's technology.

Gas in Luminous Infrared Galaxies

Derek Hand
Univ. of Hawai'i at Hilo

Gemini Observatory
Mentor: Andreea Petric

Luminous Infrared Galaxies (LIRGs) bridge the luminosity gap between star-forming galaxies and quasars, and so they may provide the link between the extreme objects we see at high redshift and typical nearby systems. Furthermore, LIRGs span the full range of galaxy interactions from non-merging spirals to late-stage mergers, so they are excellent laboratories in which to study the effect of mergers on the interstellar medium in galaxies as a function of interaction. The goal of this project is to assess if and how the molecular-gas properties of LIRGs change as a function of (1) merger stage, (2) IR luminosity and (3) AGN contribution to the IR emission. Our sample is drawn from the Great Observatories All-Sky LIRG Survey (GOALS) sources. We assess the molecular gas properties by combining published observations of the cold gas that we obtained from searching the Nasa/IPAC Extragalatic Database (NED) with Spitzer and Herschel measurements of the warm H_2 and CO gas. The merger stages were estimated by comparing the available MIR and NIR maps from Spitzer and Hubble with simulations of gas-rich major mergers. The IR luminosities were derived from the 8-1000 μm photometric data. The AGN contribution to the IR is estimated from the [O IV / Ne II] line ratios, which are based on empirical measurements of high to low ionization flux ratios in pure AGN and star-forming galaxies.

Derek Hand

Derek Hand is a senior at UH Hilo and is majoring in Astrophysics. He originally comes from Bemidji, Minnesota, but has been living on the Big Island for the last 2 years. He has interests ranging from outdoors sports to observational astronomy and computational physics. Derek hopes to attend graduate school at the Universitat de Barcelona or the University of Minnesota to study galaxy evolution or particle physics.

The Fault in Our System:
Improving Event-Handling Response at Gemini Observatory

Tuan Giang
Univ. of Hawai'i at Hilo

Gemini Observatory
Mentor: Tom Cumming

Gemini Observatory's telescope is controlled by many computers. These computers record all "events" as log messages into files: mechanism movement and positioning, temperature, and system errors, to name a few. There are a vast number of log messages being recorded, and not all log messages are important. Thus, a mechanism was needed to extract and handle only important messages. Our solution was implemented using a three-way communication between a Web application, server, and client log watchers. The web application provides users with a user-friendly interface that allows the user to identify an important log message by submitting a regular expression and its corresponding action. From the Web application, the server sends the regular expression and appropriate action to the proper log watcher. The log watcher reads each recorded log message. If the log message matches with an expression the log watcher triggers the corresponding action such as emailing the user that an expression was matched. This mechanism would reduce the difficulty of identifying and handling critical log messages. This overall solution, however, does not yet address the disk issue of Gemini Observatory's log file collections. The writing and reading of Gemini Observatory's log collections could be improved, as files are currently written and maintained without any concern toward finite disk storage capacity.

Tuan Giang

Tuan Giai Giang was born in 1995 in Vietnam. At the age of eight years old, he moved to O'ahu. #Tuan graduated from Kaiser High School in 2013. He is currently enrolled at UH Hilo, double majoring in Computer Science and Mathematics. Some of the most influential people in his life are his dad, Bill Gates, Friedrich Nietzsche, and Nikola Tesla. Tuan's hobbies include running, reading, and playing basketball.

Characterizing C IV and Mg II Absorption Systems Using a Median Stacking Analysis

Natalie Nagata
Univ. of Hawai'i at Manoa

University of Hawai'i at Hilo
Mentor: Kathy Cooksey

Studying the large-scale gaseous structure of the universe is vitally important in understanding the evolution of its metallicity and chemical abundance, ionization processes, and physical distribution. For this project, we use the large catalogs of triply-ionized carbon (C IV) and singly-ionized magnesium (Mg II), absorbers from the Sloan Digital Sky Survey Data-Release 7 (SDSS DR7). C IV and Mg II absorption-line systems have each been well studied due to their high relative abundance and characteristic doublet appearance. However, direct comparisons of C IV and Mg II-selected absorption line systems are difficult because C IV and Mg II doublets are predominately detected in different redshift ranges. My objective is to use a median stacking analysis on C IV and Mg II absorption system within a redshift range of $1.46 \leq z < 2.3$ (where they are both effectively detected) to better characterize what "typical" chemical and physical conditions may be associated with the presence of one or both types of absorption. This was achieved by creating three distinct samples from the C IV and Mg II catalogs and analyzing the strength of absorption lines, defined as the rest equivalent-widths.

Natalie Nagata

Natalie was born in Honolulu but raised in Hilo, where she developed a love for math and science at a young age. After graduating from Hilo High School as one of several valedictorians that year, she spent her freshman year at Harvey Mudd College in Claremont, California. Although she loved every moment of it and misses her friends dearly, she decided to return to Hawai'i for personal health reasons. Currently Natalie is a senior pursuing a B.S. in Physics and a minor in Mathematics at UH Manoa. After graduation, she is interested in studying applied mathematics in graduate school, with a keen interest in probability, statistics, and data science. Outside of school, Natalie loves reading Agatha Christie novels and listening to early American and British big band jazz.

A Website Prototype for Displaying Real-Time Data from the Adaptive Optics Real-Time Controller

Sean Carlos
Univ. of Hawai'i at Hilo

Thirty Meter Telescope
Mentor: Lianqi Wang

We are developing a prototype Web-based graphical user interface (GUI) that is able to display real-time telemetry data from the telescope's adaptive optics real-time controller. The sample telemetry data include deformable mirror actuator commands and laser guide-star wavefront sensor gradient measurements. The GUI will be composed of two components: the "back-end" will receive a data stream from an actual or simulated source, and send it through a Web socket in real time to the users' browser; the "front-end" will be running in the users' browser, and will display the real-time data at a speed of around 30 Hz. The end-users of the GUI include engineers at TMT who will monitor the adaptive optics real-time control process for optimal scientific data collection. They will be able to examine the data through zooming, panning, and pausing features, to quickly visualize any unusual behavior of the deformable mirrors in real time. This GUI can be expanded further by adding more features to the user interface, such as a database to access recently collected data.

Sean Carlos

Sean Carlos was born and raised on the Big Island of Hawai'i. He graduated from Kealakehe High School in 2010, and then continued his studies at UH Hilo. He is currently majoring in Computer Science and expects to graduate in Spring 2015. After earning his B.S. degree, he plans to pursue a career involving video game development. In his free time, Sean likes to lift weights, breakdance, play video games, and jam out on his ukulele.

Designing a Cushioning and Immobilization System for the TMT Mirror Shipping Container

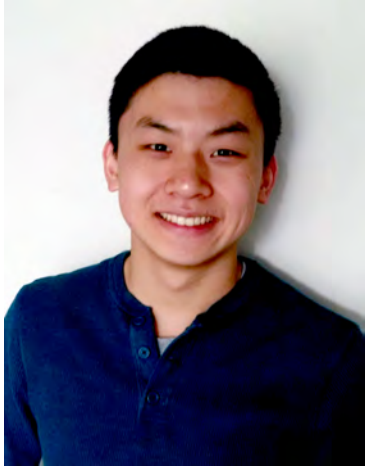
Patrick Peng
Northwestern University

Thirty Meter Telescope
Mentor: Eric Williams
Collaborator: Evan Akuna

The primary mirror of the Thirty Meter Telescope (TMT) is composed of individual 1.4-m hexagonal mirror assemblies, called Polished Mirror Assemblies (PMA). Each PMA consists of the mirror and a support structure called an SSA (Segment Support Assembly). 574 PMAs will be manufactured in several stages in various global locations before finally arriving on Mauna Kea. The main focus of this project was to design a specialized shipping container to protect both SSAs and PMAs from shock, vibration, and environmental factors during transport and storage. Several design weaknesses were identified in TMT's existing "box-in-a-box" concept for the PMA/SSA shipping container: it was excessively large, could not be stacked, and took several hours to unload. The new design achieves significant size and weight savings by abandoning the double-box design in favor of a single box with a more robust structure and improved cushioning system, resulting in a similar level of protection with lower production and shipping costs. The smaller, lighter, reinforced box structure allows safe stacking of up to three units. Measures were also taken to improve the adjustability and user-friendliness of the interior immobilization system, which prevents the PMA or SSA from shifting around in the container during transit. Furthermore, the immobilization system was made completely removable to minimize the risk of damage during PMA/SSA insertion. The reduced size and simplified interior restraints greatly expedite the unloading process. In addition to the design of the container, the project also involved finding potential manufacturers for these containers in India, where they will be mass-produced.

Patrick Peng

Patrick grew up in Hilo and graduated from Waiakea High School in 2012. He is currently studying Mechanical Engineering at Northwestern University in Evanston, Illinois, and will begin his junior year this fall. At Northwestern, he is involved in Formula Racing, Club Swimming, and Hawai'i Club. After graduating, Patrick plans to pursue graduate studies in mechanical engineering and then work in industry.



Developing Economical Protective Shipping Containers for TMT Polished Mirror Assemblies

Evan Akuna
Univ. of Hawai'i at Mānoa

Thirty Meter Telescope
Mentor: Eric Williams
Collaborator: Patrick Peng

The Thirty Meter Telescope (TMT) on the summit of Mauna Kea will be comprised of a segmented primary mirror (M1), a secondary mirror (M2), and a tertiary mirror (M3). M1 will consist of 492 mirror segments, plus 82 spare segments that can be exchanged for maintenance, for a total of 574 polished mirror assemblies (PMA). Each 220-kg PMA includes a 67-kg segment support assembly (SSA) that will hold the mirror segment in position during telescope operation. This project is focused on creating a shipping container design that will be able to safely and economically transport all SSAs and PMAs from their various points of manufacture to the observatory in Hawai'i. The container must isolate and protect its contents from vibrations, shocks, and environments that are associated with transportation, handling, and storage of the PMA and SSA, while allowing for ease of loading, unloading, and inspection of the assemblies. The container must also record any excess levels of mishandling to indicate carrier or shipper negligence, while allowing international customs officials to inspect the containers. Our developed design is based off of a prototype shipping container, military specifications, and international shipping standards. A final design review will be held before a panel of senior engineers at TMT to confirm preliminary designs and calculations, as well as qualification testing methods for prototypes of this design. Once approved, 600 shipping containers are to be built for the project in India, and will be transported to various producers of the SSA and PMA.

Evan Akuna

Evan Akuna is a 2010 graduate of James B. Castle High School on O'ahu, and is currently a senior at UH Manoa working toward his B.S. in Mechanical Engineering, with a minor in Business Administration. After obtaining his bachelor's degree, Evan plans to enter the field of structural design in an aerospace-related field, and later obtain his Professional Engineering license. In his spare time, Evan enjoys hiking, good food, and almost anything fitness-related.

Documentation and Mobility for the PISCES Rover

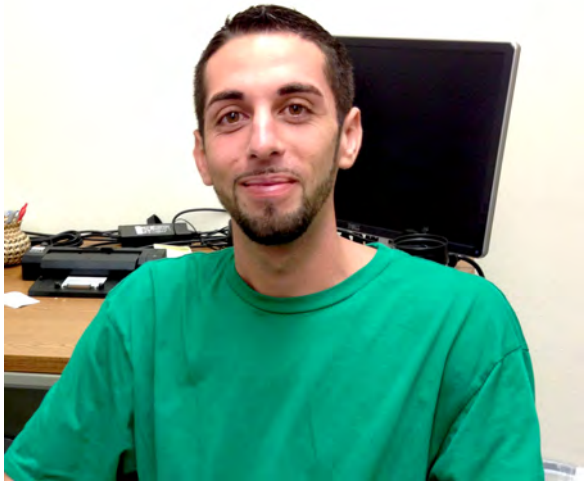
Nasre Manasrah
Univ. of Hawai'i Maui College

Pacific International Space Center for Exploration Systems (PISCES)
Mentor: Rodrigo Romo

PISCES develops tools and techniques for planetary exploration. When they received their Argo "Alpha" Rover for testing, it arrived with minimal documentation and functionality. For future operation and development, it was necessary to integrate command and control systems and create a comprehensive troubleshooting manual. In order to improve the rover remote control, the rover's existing CAMBUS radio-control system was hacked using an Arduino Yun (which has integrated wi-fi) and a CAMBUS shield. By adding GPS, a temperature sensor, lights, and navigation cameras, we greatly improved the rover's navigation and sensing capabilities. Finally a graphic user interface (GUI) was implemented for the rover. These improvements enabled us to control, locate, and obtain the status of the rover, all via the Internet. For future reference, all of these developments were documented in block and wiring diagrams for the troubleshooting manual. Although these improvements were made, there is still much room for potential future upgrades on the rover, including changing the type of tiers, integrating a fuel cell, adding solar panels, and weather-proofing the existing systems.

Nasre Manasrah

Nasre Manasrah was born in the Caribbean and raised in Palestine. He moved to Hawai'i in 2008 and graduated from Maui High School in 2010. He is currently enrolled in the Electronic and Computer Engineering Technology (ECET) at UH Maui College, and plans on earning his B.S. degree in Engineering Technology after he completes his A.S. degree from the ECET program. For fun, Nasre enjoys hiking, playing basketball, MMA training, and watching movies.



Characterizing Planetary Analogue Sites

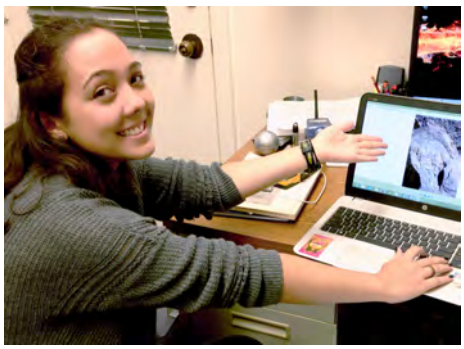
Leila Olivar
Univ. of Hawai'i at Mānoa

Pacific International Space Center for Exploration Systems (PISCES)
Mentor: Christian Anderson
Collaborators: Christina Cauley, Colin Milovsoroff, Kyla Defore & Tracee Fukunaga

The goal of having mankind returning to the Moon, then venturing toward Mars, will someday become a reality. Before setting out on this mission, sites here on Earth are being studied for use as analogues for other terrestrial planets and test-beds for planetary exploration. This summer, our team of interns at PISCES characterized planetary-analogue sites on the island of Hawai'i in order to better serve the diverse customers (NASA, CSA, the Japanese Space Agency, the Korean Space Agency, and other Pacific-nation space agencies) with various technology-testing needs. Such agencies seek to know more about the geological makeup and terrains that would be faced on Mars and the Moon; our team performed geological surveys of sites that were found to be the most similar to both of these bodies. A second goal is to reduce the cost of sending supplies to both the Mars and the Moon, and to identify resources that humans could rely on to survive. Utilization of in-situ planetary resources is the primary idea to reduce the cost of sending supplies. With the testing of various technologies, future explorers will be able to be self-sufficient, and it will make living on Mars and the Moon more efficient. By characterizing these sites, we can hope to further our understanding of the types resources to be found on both the Moon and Mars, as well as other planets, in order to utilize these materials for scientific and technology use.

Leila Olivar

Leila Olivar was raised in Kea'au on the island of Hawai'i and graduated from Kea'au High School in 2011. For her first year of college, she attended UH Hilo as a pre-engineering student, then transferred to UH Mānoa where she is now majoring in Civil and Environmental Engineering. She plans to further her education by attending graduate school. In her free time, she enjoys going to the beach, hiking and spending time with her family and friends.



Design and Security of the Wireless Network for the Subaru Telescope Base Facility

Devin L. Rasco
Honolulu Community College

Subaru Telescope
Mentor: Kiaina Schubert

Wireless maps are used to determine the strength of signals coming from various wireless access points around a building or other facility. These wireless maps also allow IT managers to see regions that have no connectivity or poor connectivity compared to other areas within in the same facility. These maps can be used to deploy new access points without disrupting the rest of the network with connection loss. When deployed correctly, the company or facility can benefit from better connections on their network and make plans for any sort of expansion to their facility. First, we created a wireless map for the Subaru Telescope Base Facility, then determined the best arrangement of access points to limit the range of their open-network signals to be within the boundaries of their facility. Second, we investigated ways to optimize the security protocol for the internal network at the Base Facility. We began the process of switching every staff member at Subaru over to a new network that uses WPA2-enterprise for its security protocol instead of WPA2-personal. After this transition is complete, the facility will have a backup network as well, in the event that the active network is breached. Three extensive documents were created as part of the output of this project, analyzing various factors of the wireless coverage of the Base Facility.

Devin L. Rasco

Devin Rasco was born in Texas, moved to Hawaii shortly after birth until age 4, then returned to Texas, where he was raised until graduating from Plano Senior High School in 2012. After graduation, he returned to Hawai‘i with his parents. He now attends Honolulu Community College, where he is enrolled in the Computing, Electronics, and Networking Technology (CENT) and Information Assurance programs. He plans to continue his studies at UH West Oahu to complete dual bachelor’s degrees: Bachelor of Applied Science in Computing, Electronics and Networking Technology (CENT) and Bachelor of Applied Science in Information Security and Assurance (ISSA). After graduation, Devin plans to explore his options for jobs and graduate school. His favorite pastimes include art, gaming, and further exploration of IT-related topics, such as creating games, designing websites, and building computers.

Chilling in Subaru:
Investigating and Upgrading the FMOS IRS2 Climate Control System

Marley Rutkowski
University of Portland

Subaru Telescope
Mentor: Lucio Ramos
Collaborators: Joshua Walawender & Brendan Hora

The FMOS instrument used on the Subaru telescope is a fiber multi-object infrared spectrograph with two separate modules that each utilize 200 fibers and are capable of observing 50 objects in parallel. The sensors of each module must be cooled to around –60˚C, however the cooling system of the second infrared spectrograph module (IRS2), designed by a collaborating university, often malfunctions. Since its installment, the system, which is centered on programmable logic controller (PLC), has not been well understood and has not had effective integrated debugging. Therefore, when problems arose, it was very difficult for Subaru technicians to diagnose them. In order to reduce instrument downtime in such a case, the system needed to be reverse engineered, documented, and retrofitted with an intelligent error-notification system, so that technicians can quickly diagnose and service faults. Understanding the system required analyzing the PLC ladder logic code, the physical "black box" wiring and component setup at the summit, and the minimal amount of available documentation. By combining and cross-referencing these resources, an understanding of the key functionality of the system was gained and documented for future reference, providing explanations for previously bewildering system behavior. Additionally, using this knowledge and working with Subaru's FMOS scientist, system-monitoring improvement and remote-control modifications for the climate control PLC code have been devised and implemented. Although great advancements have been made in understanding and documenting the IRS2 system, in order to fully understand it, future exploration is required, including a temporarily deconstruction of the module.

Marley Rutkowski

Drawing on his remote, off-the-grid upbringing on the North Shore of Maui, Charles Marley Rutkowski has used his many diverse opportunities to fuel his interests in science and engineering, and to establish a firm and broad STEM knowledgebase. After attending King Kekaulike High School, Marley recently completed his bachelor's degree in Electrical Engineering from the University of Portland, including minors in Computer Science and Physics and a study-abroad in Ireland. While taking advantage of the joys of life, Marley plans to continue expanding his knowledge, all the while applying it to invigorate his community and the lives of those he encounters.

Design and Optimization of PV Systems for the SMA Summit and Base Facilities

Tiffanee Pahia
Univ. of Hawai'i at Manoa

Smithsonian Submillimeter Array
Mentor: John Maute

Solar energy has become one of the leading renewable energy sources. The Smithsonian Submillimeter Array (SMA) facilities want to try to eliminate their energy use with the local electric utility company (HELCO). This project was to design and optimize a photovoltaic (PV) system for both the Hilo and Summit SMA facilities. Using public data, we were able to calculate the amount of sun hours, on average, Hilo and the summit obtain per day. Using that, and analyzing utility bills, we were able to estimate the size of a system needed to meet the needs of each facility. Then we compared different types of panels and inverters to find the ones that would best fit our needs. We selected SunPower 345 panels and Enphase M250 micro-inverters, and to meet our full demand, we would require approximately 962 panels in Hilo and 2112 panels at the summit. Due to rooftop area restrictions, the Hilo facility is limited to 916 panels and the summit facility is limited to 185 panels. The costs of both systems were also estimated: $872,000 for Hilo, and $160,000 for the summit. All that is needed now is funding to have the system installed.

Tiffanee Pahia

Tiffanee Pahia will be a junior this fall at UH Manoa, pursuing her bachelor's degree in Mechanical Engineering. Her ultimate goal is to earn a Ph.D. in Mechanical Engineering and return to teach at one of Oahu's community colleges. She is currently a Peer Mentor for Kapiolani Community College's STEM program and enjoys mentoring fellow students.

Repackaging of an RF Beam Scanner and Beam Pattern Analysis

Kepa Fernandes
Kaua‘i Community College

Smithsonian Submillimeter Array
Mentors: Rob Christensen & Ryan Chilson

The Smithsonian Sub-millimeter Array (SMA) utilizes eight antennas atop Mauna Kea to collect submillimeter waves from astronomical objects. Within each antenna, there are four RF receivers collecting these waves, however if the beams are out of alignment in dual-receiver observations, the efficiency of the receivers degrades. In order to correct the misalignments, SMA has developed an RF Beam Scanner to install within the antennas for aligning the individual receivers. The RF Beam Scanner can scan a square raster up to 25 mm in the plane of the beam waveguide system where images of the sub-reflector and the receiver feed horns are formed. Post processing the analog data can generate a digital amplitude and phase map. Using the amplitude and phase maps, the SMA can assess the optimal centration of illumination over the RF receivers, and achieve co-alignment by adjusting the optical mirrors. Currently the RF beam scanner is an assortment of electronic components, along with disordered cables and connectors, causing assembly within the antenna array to be a time consuming hassle. Having roughly a six-hour window for beam scanning and RF receiver adjustments per day, it is very important to maximize the efficiency of assembly time for the RF beam scanner. We accomplished this by repackaging all current hardware into a single chassis and consolidating power supplies, cables, wires, and connectors into a clean simplified form, creating a substantially more user-friendly RF beam scanner for assembly, and increasing mobility within the antenna array atop the Mauna Kea summit. The simplified final form of the RF beam scanner will also greatly decrease assembly time and generate a more efficient window for RF beam scanning and RF receiver co-alignment throughout the array.

Kepa Fernandes

Kepa grew up on Kaua‘i and graduated from Kapa‘a High School. He is currently attending Kaua‘i Community College, and will be graduating with an A.S. degree in Electronics Technology. After graduation, Kepa plans to pursue a bachelor's degree at UH Manoa. In his free time, he enjoys surfing and spending time with his family.

Greenland Antennae Retrofit Database

Alexander Self
Univ. of Hawai'i at Hilo

Smithsonian Submillimeter Array
Mentor: Ranjani Srinivasan

The Smithsonian Astrophysical Observatory (SAO), along with collaborators around the globe, is in the process of designing and ultimately constructing a telescope in Greenland. This process requires massive amounts of documentation, from bills-of material, engineering schematics, and work-flow diagrams, to any other relevant documents associated in the development of such a project. As a result of the scale of the documentation required for this project, a database is needed to store and access all files associated with construction of the telescope. The database itself was engineered using the Python programming language for server-side logic, and Hypertext Markup Language (HTML5), Cascading Style Sheets (CSS), Jquery and Javascript for the Web-based client-side interface and stylistic framework. As a result, users are able to upload any file by selecting radio buttons, which act as a key for the associated file. After a file is uploaded into the database, each file can then be queried based on the key, and can be downloaded directly to the user's computer. This Web-based database is run on SMA's server and is accessible around the globe through Plone, a content-management site, which also provides authentication for access. Further improvements can be added for additional documentation regarding the key definitions that are associated with the files, as well as more specialized query options.

Alexander Self

Alexander Self was born and raised in southern California, and is currently a junior at UH Hilo, pursuing a Bachelor of Science in Computer Science. Prior to enrolling in the Computer Science program, Alex initially earned his Bachelor of Arts degree in Political Science in 2007. Afterward, he started an agricultural business where he owned and operated a small coffee orchard and fruit-tree nursery. Alex now hopes to enter a career in software development with one the observatories on the Big Island. His hobbies include horticulture, programming, and sports.

Modeling Star Formation: Simulating the Magnetic-Field Structure of Collapsing Molecular Clouds

Andrew McNichols
Univ. of Hawai'i at Hilo

Smithsonian Submillimeter Array
Mentor: Ramprasad Rao

Astronomers are still trying to construct a model that demonstrates complete understanding of the processes by which protostars and their subsequent evolution occurs from the gaseous interstellar medium (ISM). The observed collapse time-scales of dust-enriched molecular-hydrogen clouds have led astrophysicists to conclude that there is some mechanism providing external support in these regions; one potentially responsible mechanism is the presence of magnetic fields in the clouds' cores. The Smithsonian Astrophysical Observatory's Submillimeter Array has conducted polarimetric observations that provide insight into the structure of the magnetic field in several regions where the ISM is condensing and star formation is beginning. These observations provided the first conclusive evidence for an hourglass-shaped magnetic field in a pre-stellar dust cloud: young stellar object (Class 0) NGC 1333 IRAS 4A. Over the course of this project, I have developed a series of programs that plot with increasing sophistication the most recent mathematical models of hourglass magnetic fields and their Stokes parameters. My mentor and I used the numerical data produced by my software as input for the Dust Polarization Module of the ARTIST software project, with the goal of producing a publication-quality object model simulation that can easily be compared to the most recent, highest-resolution polarimetry data of NGC 1333 IRAS 4A. Overall, this project will provide some clarification as to how accurately the analytic magnetic-field model matches the hourglass structures that are widely observed in molecular cloud cores, potentially corroborating existing theories and providing new insight into processes that are influential to the early stages of stellar evolution.

Andrew McNichols

Andrew McNichols was born and raised in Connecticut. During his first year of college, he decided to study astronomy, so he transferred to UH Hilo to be close to the observatories on Mauna Kea. Andrew graduated in May 2014 with bachelor's degrees in Astronomy and Physics, having spent time developing and implementing data-reduction pipelines for Gemini Observatory, and researching the flux and energy of cosmic-ray muons with UH Hilo's Department of Physics & Astronomy as a Fellow of the NASA Hawai'i Space Grant Consortium. Andrew's primary academic and career goal is to do as much as possible to help facilitate extra-planetary exploration and, eventually, habitation. In his free time, Andrew likes reading and is a PADI-certified rescue diver.

Presentation Schedule

Waimea

August 11, 2014

W.M. Keck Observatory Headquarters

Hualalai Public Conference Room

Host Organizations

Cellana, Inc.

NELHA

W.M. Keck Observatory

Opening Remarks

Lisa Hunter
Director, Akamai Workforce Initiative
Univ. of California, Santa Cruz – Institute for Scientist & Engineer Educators
UH Institute for Astronomy

Internship Project Presentations

Cellana, Inc.

Designing and Implementing a Stability Program for Micro-algae Biomass and Crude Oil
Kelli Yamane — *UH Hilo*

NELHA

Seawater Distribution Water Flow Model
Michelle Chu — *UH Mānoa*

Mapping out the Miles: Seawater Distribution System Topography
Daniel Gregg — *Brown University*

W.M. Keck Observatory

Establishing High-Speed Communication to the Keck 1 Dome
Kully Kekaula-Basque — *Columbia University*

Thermal Stabilization of the Keck Observatory Artificial-Guide-Star Laser
Andrew Zeitler — *UH Maui College*

Closing Remarks & Reception

Designing and Implementing a Stability Program for Micro-algae Biomass and Crude Oil

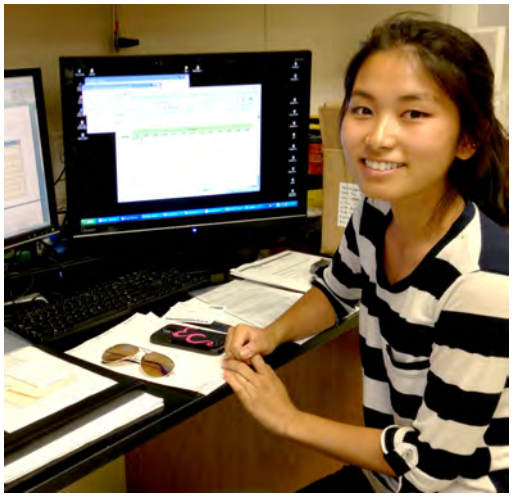
Kelli Yamane
Univ. of Hawai'i at Hilo

Cellana, Inc.
Mentor: Valerie Harmon

Cellana is a private corporation that grows and develops different strains of micro-algae possessing high contents of fatty acids and protein. The company plans to sell algae biomass globally to manufacturers to make nutraceuticals, animal feed, and fuel, but currently the shelf-life, recommended storage conditions, and proper packaging are not known. A stability program was set up to test the quality of the whole algae biomass, defatted algae biomass, and crude oil of two strains of *Nannochloropsis* over 3 years for real-time testing and 6 months for accelerated testing. These bioproducts have been stored at either 5°C, 25°C, or 40°C, and stored either in dark or bright conditions. To determine the quality of the bioproducts, the fatty acid content, protein content, microbial content, moisture, and ash have been measured for the biomasses, and the fatty acid content has been measured for the crude oil. As long as the results of the tests demonstrate that a bioproduct has not changed more than 10% during its shelf-life, it is still of good quality. Analyses from the accelerated tests have shown that degradation of the defatted algae biomass occurs more rapidly when it is exposed to light and stored at 25°C than when it is not exposed to light, or stored in the refrigerator. Analyses on the other bioproducts have shown little degradation after 3 weeks. Since the results from the accelerated tests can only predict the results for the real-time tests, real-time tests are ultimately necessary to truly measure the shelf-life of the bioproducts. This stability program will continue until the program is completed, or until results from analyses show that the biomass and crude oil are no longer of good quality.

Kelli Yamane

Kelli Yamane graduated from Mililani High School in 2010, and will be graduating from UH Hilo in Fall 2014 with a Bachelor of Arts degree in Chemistry–Health Sciences, with minors in Biology and Computer Science. She plans to pursue a master's degree in either Chemistry, with emphasis in Analytical Chemistry, or Computer Science. Kelli has always had an interest for science and technology, but she also enjoys traveling and doing a variety of community service. She is currently an active member in the Rotaract Club of East Hawaii, Colleges Against Cancer at UH Hilo, and Big Brothers Big Sisters of Hawai'i Island.



Seawater Distribution Water Flow Model

Michelle Chu
Univ. of Hawai'i at Mānoa

Natural Energy Laboratory of Hawai`i Authority (NELHA)
Mentor: Laurence Sombardier
Advisor: Keith Olson
Collaborator: Daniel Gregg

Hawai'i Ocean Science & Technology (HOST) Park, administered by the Natural Energy Laboratory of Hawai'i Authority (NELHA), is an 870-acre facility providing opportunities in energy and ocean-related fields to their tenants. NELHA pumps and distributes cold deep seawater (DSW) from 2,000 and 3,000-ft depths and warm surface sea water (SSW) from an 80-ft depth, using five pump and booster stations. The stations collectively pump on the order of 35 million gallons per day to over 40 users. A model of the flow system of the seawater distribution pipelines was created using Microsoft Excel. The model uses monthly data from meter recordings. This user-friendly model makes the distribution system easier to understand, and it presents checks and balances to reconcile flow-meter measurements and alert the user to any discrepancy. The model also validates flow measurements with respect to past 6 month flow data.

Michelle Chu

Michelle Chu is from Kailua, O'ahu. She will be a senior this fall at UH Mānoa, pursuing a bachelor of science in Civil and Environmental Engineering. After graduating, she plans to pursue a master's degree in Environmental Engineering, allowing her to work with coral reefs, the water environment, and the land environment. Michelle is particularly interested in wastewater treatment, and in using her strengths in math and science to help Hawaii's environment.

Mapping out the Miles: Seawater Distribution System Topography

Daniel Gregg
Brown University

Natural Energy Laboratory of Hawai‘i Authority (NELHA)
Mentor: Alex Leonard & Laurence Sombardier
Advisor: Keith Olson
Collaborator: Michelle Chu

The Natural Energy Lab of Hawaii Authority (NELHA) provides a large variety of services to its clients, one of the most important of which is acting as a surface-seawater and deep-seawater utility. Over the course of the past 35 years, NELHA has installed one of the largest seawater distribution systems in the world, so that today it serves 41 clients and pumps 30 million gallons per day. Since the first days of installation, however, certain elements of the system have been poorly catalogued, and many of the modifications since have experienced the same lack of documentation. In order to better understand the distribution system, the topology of the system has been mapped by means of GPS survey equipment from Trimble Construction, historic documentation, and professional narrative from the people who had seen the system grow. For project products, AutoCAD mapping software was used to integrate the survey data with past documentation and site maps of NELHA’s facilities, as well as those of its clients, to create a map of the distribution system and site in which it exists. A tabulated and descriptive list of all pipeline features was also created for additional analysis and as a tool for future system upkeep and modification. Together, the two items should enable more efficient and less costly use of the system, and allow for better-documented system changes.

Daniel Gregg

Daniel Gregg is a 2011 graduate of Parker School, and will be a senior this fall at Brown University, where he is studying to be an environmental engineer. He is primarily interested in renewable energy production, especially solar, and integrated “green” building. When he is not studying, Daniel enjoys running, kicking a soccer ball around, singing, playing and listening to music, acting, reading, soaking up some sun, and, when he is home, swashbuckling around the Big Island. He is glad for the opportunity to work at NELHA, where he can both be at home and work on a project with real-life applications.

Establishing High-Speed Communication to the Keck 1 Dome

Kully Kekaula-Basque
Columbia University

W. M. Keck Observatory
Mentor: Andrew Cooper

The W.M. Keck Observatory's domes lack high-speed communication, inhibiting the installation of essential instruments and preventing access to the Internet. Simple solutions to the problem, such as directly installing Ethernet or using Wi-Fi, cannot be employed as a result of engineering restrictions. The rotation of either Keck dome would sever any wires entering the dome, and the Mauna Kea summit prohibition on the use of radio waves prevents Wi-Fi. The goal of this project is to circumvent these restrictions and establish high-speed communication into the domes. An alternative method—utilizing power-line adapters—can be used to transmit Ethernet over the 120-volt slip rings into the dome, thereby bypassing any engineering obstacles. Furthermore, a Raspberry Pi can be used to monitor the network communication and analyze ping time, packet loss, and network jitter to determine the viability of the Ethernet connection. It was found that a critical amount of data is lost when the dome shutters are moved—for several minutes at evening and dawn—indicating that magnetic flux is disrupting communication. While such interruptions may be acceptable for data from anemometers and other weather instruments, many prospective applications may require steady communication. Future endeavors to install a noise filter will be undertaken to mitigate disturbances and provide continuous data.

Kully Kekaula-Basque

Kully Kekaula-Basque was born and raised in Kona. Having graduated from Kealakehe High School, he now attends Columbia Univ. in New York City, where he will be a sophomore this fall. Kully intends to major in Computer Science with a prospective track in artificial intelligence, as well as pursue computer science in graduate school. In his spare time, he participates in robotics organizations, and enjoys both video games and exploration.

Thermal Stabilization of the Keck Observatory Artificial-Guide-Star Laser

Andrew Zeitler
Univ. of Hawai'i Maui College

W.M. Keck Observatory
Mentor: Pete Tucker
Collaborators: Andrew Cooper & Kully Kekaula-Basque

The Keck Observatory lasers are an integral part of the adaptive optics system. In order to use adaptive optics while imaging a section of the sky where there is not a sufficiently bright natural guide-star, a laser can be used to illuminate a point at the sodium layer of the atmosphere, creating an artificial laser guide-star (LGS). The Keck-1 laser that is used to create the artificial guide-star takes approximately seven hours to warm up and stabilize. Under normal operation, the extensive amount of time required to make the laser operational is not a problem because its use is always scheduled well in advance, sometimes as far ahead as two years. However, there are occasionally special circumstances, such as an unexpected supernova, where immediate use of the laser guide star system is greatly desired. The goal of this thermal stabilization project is to use sensors, heaters, and microcontrollers to maintain the thermal stabilization of the laser bench in order to reduce the warm-up time, allowing for nearly immediate use of the laser during those unexpected astronomical occurrences. An ideal setup would allow the laser heads and power amplifiers to remain at the operational temperature indefinitely, allowing the LGS system to be operational within tens of minutes of being switched on.

Andrew Zeitler

Andrew Zeitler is a senior in the Engineering Technology bachelor's program at UH Maui College. He holds an Associate of Arts degree from Green River Community College, an Associate of Science in Electronic and Computer Engineering Technology (ECET) from UH Maui College, and an Associate of Applied Science in Electronic Systems Technology from the Community College of the Air Force. Andrew is working toward a career in optoelectronics, with the intention of working with the various observatories on Haleakala and Mauna Kea. He is a member of IEEE, and his interests include neuroscience, hiking, scuba diving, sailing, and volunteering for Read Aloud America. In his spare time, he enjoys traveling and has been to more than 30 countries across all seven continents.

Akamai Workforce Initiative

University of California, Santa Cruz Institute for Scientist & Engineer Educators (ISEE)
University of Hawai‘i Institute for Astronomy (IfA)
Thirty Meter Telescope International Observatory
University of Hawai‘i at Hilo

The AWI advances Akamai (smart, clever) students into the Hawai‘i technical and scientific workforce. AWI partners industry, observatories, government, educational institutions, and community to meet workforce needs in astronomy, remote sensing, and other science and technology industries in Hawai‘i. The Akamai Internship Program is one of the major programs of the Akamai Workforce Initiative.

The 2014 Akamai Internship Program placed college students from Hawai‘i at the following organizations to complete a seven-week project:

- Akimeka LLC
- Cellana, Inc.
- Gemini Observatory
- HNu Photonics
- W.M. Keck Observatory
- UH Institute for Astronomy (*Maui facility*)
- Makani Kai Tech
- Natural Energy Laboratory of Hawai‘i Authority (NELHA)
- Pacific International Space Center for Exploration Systems (PISCES)
- Pacific Joint Information Technology Center (JITC)
- Smithsonian Submillimeter Array (SMA)
- Subaru Telescope
- Thirty Meter Telescope International Observatory (*Pasadena facility*)
- University of Hawai‘i at Hilo

The AWI currently receives funding from:

Air Force Office of Scientific Research (FA9550-10-1-044)

University of Hawai‘i

Thirty Meter Telescope International Observatory

For more information please contact:

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For more information on the Akamai Internship Program please contact:

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