Photo: Scott Nishi, UH Foundation

UNIVERSITY OF HAWAI'I
MĀLAMALAMA
1907
UA MAU KE EA O KA 'ĀINA I KA PONO

2019
SURE

**Summer
Undergraduate
Research
Experience**

SYMPOSIUM

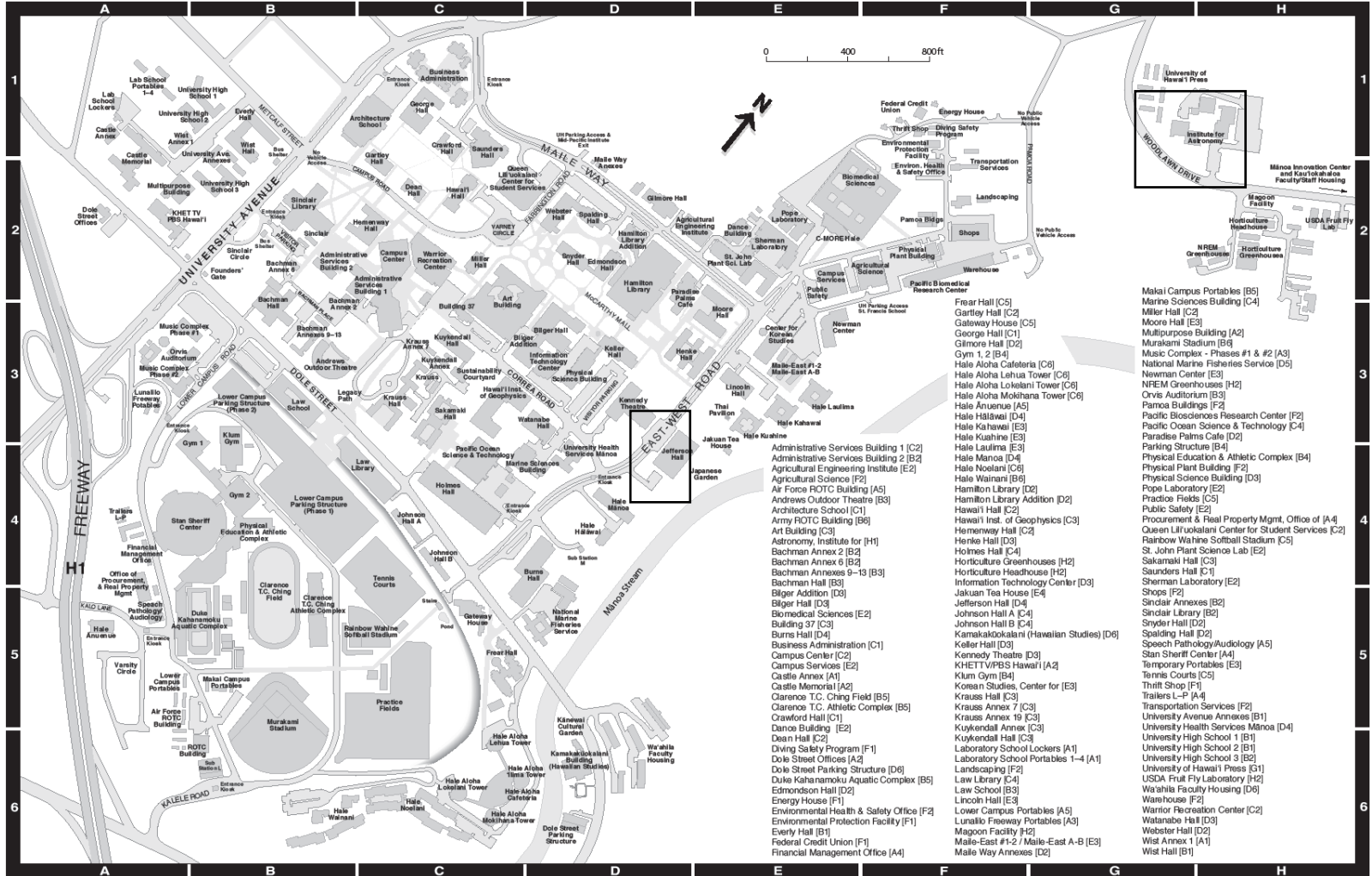## August 1 - 2

**Undergraduate Research
Opportunities Program**

Office of the Vice Chancellor for Research
University of Hawai'i at Mānoa

UHM Campus Map

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1

Imin International Conference Center; 2nd Floor Map

Imin International Conference Center; Keoni Auditorium Poster Map

LANAI
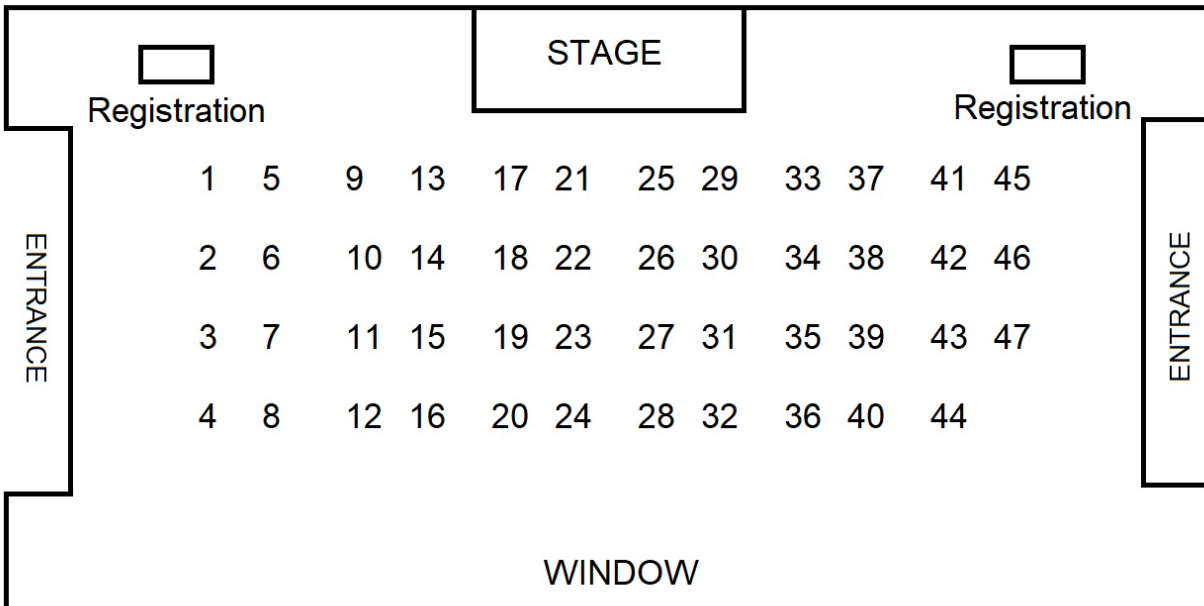
2019 Summer Undergraduate Research Experience (SURE) Symposium

August 1-2, 2019

2-DAY PROGRAM SCHEDULE

August 1, 2019

Institute for Astronomy (IfA) REU Symposium*

9:00 am – 12:00 pm; Institute for Astronomy Auditorium

August 2, 2019

2019 SURE Symposium

9:00 am – 2:00 pm; Imin International Conference Center at Jefferson Hall, East-West Center

Special session for Institute for Astronomy REU students; no abstracts available

IfA REU Symposium

August 1, 2019

9:00 – 9:05   Welcome
Dr. Nader Haghighipour (Director of the IfA REU program)

9:05 – 9:15   Opening Remarks: Undergraduate Research at the UH
Dr. Creighton Litton (Director of Undergraduate Research Opportunities Program)

9:15 – 9:30   REU program at the UH Institute for Astronomy: History, Current State, Future
Direction *Dr. Nader Haghighipour (Director of the IfA REU program)*

Scientific Session
Chair: Aaron Do

9:30 – 9:45   Spectral Energy Distributions of Morphologically Classified X-ray Luminous Sources
Kaitlynn Lilly (University of Maryland, Baltimore County)

9:45 – 10:00   The ASAS-SN Catalog of Variable Stars VI: Dippers in the Lupus Region
John Bredall (Ohio State University)

10:00 – 10:15   Hunting the Source of Optical Aberrations due to Dome-Seeing
Jacob Young (San Jose State University)

10:15 – 10:30   Where's the Action? Galaxy Evolution and Environment at Redshift 1
April Horton (Bluffton University)

10:30 – 10:45   Investigating the Relationship Between Bulge Growth and X-ray Emission
in Luminous AGN
Justin Johnson (University of Maryland, Baltimore County)

10:45 – 11:00   **Coffee Break**

11:00 – 11:15   Molecular Gas Heating in Active Galaxies: Tidal Shocks, New Stars, or Growing
Black Holes
Rebecca Minsley (Bates College)

11:15 – 11:30   Development of a Telemetry Pipeline for Use on the Keck II Pyramid Wavefront Sensor
Alexander Witte (University of Notre Dame)

11:30 – 11:45   Spatially Resolved Kinematics of Ionized Gas with CFHT's SITELLE in the Merging
Luminous Infrared Galaxy: Mrk 266 - Host of Double AGN
Maya Merhi (Lycoming College)

11:45 – 12:00   Quenching the Main Sequence: The Role of Luminous AGN and Galaxy Mergers
Christopher Bain (University of Maryland, Baltimore County)

2019 SURE Symposium

AUGUST 2

9:00 am – 2:00 pm

Imin International Conference Center

Time	Activity	Location
9:00 am – 9:30 am	Registration and presenter setup	Keoni Auditorium
9:30 am – 9:50 am	**Opening remarks** Dr. Creighton Litton, Director, UROP Dr. Michael Bruno, Provost, UHM Terrence "Terry" George, President & CEO, Harold K. L. Castle Foundation	Keoni Auditorium
9:50 am – 10:00 am	**Breakfast snacks**	Keoni Lanai
10:00 am – 11:00 am	**Oral Presentation Session 1** Natural Science I Engineering & Computer Science and Natural Science	 Sarimanok Kaniela
11:00 am – 11:10 am	**Break**	
11:10 am – 12:10 pm	**Oral Presentation Session 2** Natural Science II Arts & Humanities and Social Science	 Sarimanok Kaniela
12:10 pm – 1:00 pm	**Lunch**	Wailana, Makana, Ohana
1:00 pm – 2:00 pm	**Poster Session****	Keoni Auditorium

Room guide:

Basement level rooms: Wailana, Makana, and Ohana

Ground floor rooms: Keoni Auditorium and Keoni Lanai

2nd floor rooms: Sarimanok and Kaniela

**Posters viewable throughout event; presenters arrive 1:00 pm

Oral Presentation Session 1

Natural Science (I)
10:00 am – 11:00 am
Sarimanok Room

No.	Start	Title, Student Presenters* and Institution, Mentor(s)°, Summary

1   10:00

Characterization of the phenotype of mice with Zfy knocked out (Zfy KO) and Wild-Type. *Emmaelle Carrot*, Monika Ward°*.
The Zfy genes, encoded on the short arm of the mouse Y chromosome are thought to be important in sperm formation, but this observation was obtained by characterizing the phenotype of mice with severe Y chromosome deficiencies. It therefore cannot be excluded that at least some aspects of the phenotype resulted from the deficiency of Y chromosome genes other than Zfy. To address this, the lab generated mutant mice lacking just Zfy genes (Zfy DKO). The loss of Zfy was confirmed by quantifying Zfy1, Zfy2, and Zfy1/2 global transcript levels in testes, no Zfy1 and Zfy2 was detected in Zfy DKO mice. Light microscopy analysis demonstrated that sperm from Zfy DKO males display severe headshape defects. TEM revealed that sperm from Zfy DKO males had disrupted cell membrane, poorly condensed chromatin, and defects in acrosome, a structural component essential for sperm ability to fertilize. These findings support that Zfy genes are essential for normal sperm development in the mouse.

2   10:15

The seedling skirmish: the effect *of metrosideros polymorpha* & *psidium cattleyanum* plant neighbors in Hawaiʻi. *Amanda Wong*, UHM, Kasey Barton°*.
Invasive species are a major global threat to native biodiversity, especially on islands, yet it remains unclear whether invasive plants displace native plants via competition. We investigated neighbor effects between the most abundant tree species in Hawaii using a greenhouse experiment with the native *Metrosideros polymorpha* (ʻōhiʻa) and invasive *Psidium cattleyanum* (strawberry guava). Growth and survival were assayed in seedlings grown in pots alone, with a conspecific, or heterospecific neighbor. We found that *P. cattleyanum* is a stronger performer than *M. polymorpha* with a lower mortality rate and higher growth rate, but that it is sensitive to intraspecific competition. Surprisingly, *M. polymorpha* had greater shoot biomass when grown with neighbors than alone. These results suggest that intraspecific competition may be more important than interspecific competition, and that *P. cattleyanum* is can likely outcompete *M. polymorpha*.

3   10:30

Seed Drought Tolerance of *Leucaena leucocephela*, *Dodonaea viscosa*, & *Sophora chrysophylla*. *Malakhi Reynolds*, UHM, Kasey Barton°*.
Due to climate change, drought is projected to increase in frequency and duration globally. Vegetation stability will depend on continued seedling recruitment under increasing drought. To investigate seedling drought tolerance in Hawaiian plants, we used an experimental approach with 2 native (*Sophora chrysophylla* and *Dodonaea viscosa*) and 1 invasive (*Leucaena leucocephela*) species. Seedlings were grown from field-collected seeds and initially watered daily. At the 5-leaf stage, seedlings are randomly assigned to a control group with continued daily watering or a drought group with no water for 4 weeks. Following the drought, all seedlings are watered daily for 4 weeks, at which time, half of both groups are harvested. The remaining half are subjected to a final terminal drought to determine how many days they can survive without water. Seedling drought tolerance is measured as the capacity for drought-stressed plants to survive and grow compared to control plants.

4 10:45 **Fuel properties of *Pongamia pinnata***. *Sabrina Summers*, UHM, Scott Turn°.*
Pongamia pinnata, or pongamia, a leguminous, oil seed-bearing tree, has been identified as a potential biofuel source due to its robust nature. Native to humid and tropical environments, Hawai'i is an ideal location for production. Furthermore, byproducts of the conversion preparation, such as seed pods and seed cakes, have potentials as solid fuel. The goal of this research is to investigate the fuel properties of *Pongamia pinnata* and its torrefied products. Pongamia trees from Oahu were harvested to determine the oil, pod, and seed cake characteristics to provide data to assess the usefulness of pongamia as a biofuel. The high heating value (HHV) of pongamia seed, oil, cake, and pod was determined along with x-ray fluorescence (XRF) and ultimate analysis. The oil was also analyzed for free fatty acid, density, viscosity, iodine value, and flash point. Proximate analysis and chlorine content was performed for all solid samples, including torrefaction products.

Engineering & Computer Science and Natural Science
10:00 am – 11:00 am
Kaniela Room

No.	Start	Title, Student Presenters* and Institution, Mentor(s)°, Summary

5   10:00   **The Subadditivity of Analytic Capacity**. *Irvin Chang*, UHM, Malik Younsi*°.
Various mathematical notions can be used to describe the size of a set in the two-dimensional plane, area being one metric. One of the geometric properties of area is that it is subadditive, where the union of two sets will have less area than the sum of the area of the sets when considered independently. However, the notion of area is not sufficiently refined to differentiate certain sets.
For instance, both a line segment and a single point have area zero, though these two sets are quite different in many aspects. Because of this and for other reasons, other notions of size can be taken into consideration. Analytic capacity is a mathematical notion introduced in the 1940's and is one of the objects of study in the branch of complex analysis. It measures the size of a set from the point of view of analytic functions, functions that can be represented by power series at a point.
In this talk, I will discuss the question of whether analytic capacity is subadditive or not.

6   10:15   **Lower VC-dimensions of finite automata**. *Davin Takahashi*, UHM, Ethan Lamb*, UHM, Bjoern Kjos-Hanssen*°.
Ishigami and Tani studied VC-dimensions of finite automata. We show that their results apply to a new notion, lower VC-dimension, where all sets (instead of some set) of a given cardinality must be shattered. We also relate the VC-dimension to the Separating Words problem.

7   10:30   **Word powers and automatic complexity**. *Sun Young Kim*, UHM, Clyde Felix*, UHM, Bjoern Kjos-Hanssen*°.
The automatic complexity of a word was introduced by Shallit and Wang in 2001 and studied further by Kjos-Hanssen since 2013. In this work we develop an implementation of a lower bound on the complexity involving occurrences of powers of words, such as the occurrence of "humu" twice in "humuhumunukunukuapua'a".

8   10:45   **Integer Factorization**. *Taylor Markham*, University of Calgary, Annie Carter*°.
The security of many modern day cryptosystems are based on the fact that it is computationally difficult to factor large numbers. This talk will give a brief introduction to the general number field sieve, which is currently the most efficient algorithm for factoring large integers.

Oral Presentation Session 2

Natural Science (II)
11:10 am – 12:10 pm
Sarimanok Room

No.	Start	Title, Student Presenters* and Institution, Mentor(s)°, Summary

9   **11:10**   **Impact of Physical Reef Characteristics on Calcification Rates of the Kāneʻohe Bay Barrier Reef**. *Noah Howins*, UHM, Eric De Carlo°*.
Coral reef-wide calcification rates are often determined using data obtained over sub-sections that may not be representative of the entire reef system. This study aims to elucidate the challenge of quantifying environmental controls of calcification by providing an in-situ analysis of the effects of coral cover on calcification rates while also comparing calculated calcification rates with those previously published on both the same reef and of mesocosm experiments. This study allows for quantitative evaluation of the degree to which variations in calcification rates across an entire reef system can be explained by localized phenomena such as variations in coral cover and other physical characteristics. To achieve this goal, we compared previously published literature on reef-wide calcification rates for both Kāneʻohe Bay and mesocosm experiments, to a mid-scale equivalent reef as a means to more accurately compared determined calcification rates.

10   **11:25**   **Effects of Future Ocean Conditions on the Microbiome of Crustose Coralline Algae with Implications for Coral Settlement and Growth**. *Brenna Carroll*, UHM, Craig Nelson°*.
Environmental stressors are known to disrupt the microbiome of reef dwelling organisms, leading to more extensive habitat damage through species loss or alteration of reef relationships. Crustose Coralline Algae (CCA) are vital calcifiers for reef ecosystems that are known to induce the settlement and metamorphosis of many reef inhabitants. However, there is limited research on the differentiation of microbes between CCA species, and how these variances may cause contrast in reef interactions, especially when stressed. The objective of this study was to investigate how the relationship between two species of CCA with differing microbiomes and the microbial communities in coral reefs may change with the combined stressors of ocean acidification and sea surface temperature rise. CCA were placed into ambient and high temperature, low pH conditions in a full factorial cross. Effects of "future ocean conditions" on CCA-associated microbial communities will be discussed.

11   **11:40**   **Culturing Marine Malassezia.** *Megan Gonsalves*, UHM, Anthony Amend°*.
Malassezia are yeast-like fungi that are the dominant component of the human skin mycobiome. Recent metagenomic studies suggest that Malassezia are ecologically hyper-diverse and can also be associated with corals, sponges, and even sea sediment and deep sea vents. Malassezia are fastidious microorganisms that require unusual fatty-acid rich media for growth. While axenic cultures of terrestrial species have been successful, marine Malassezia have never been cultured. Using different media compositions and varying physicochemical parameters, this experiment attempted to culture marine Malassezia. While I have not yet been successful in isolating marine Malassezia, several marine fungi morphospecies, including yeasts, were isolated. This study suggests that Malassezia isolation may require control of other parameters- such as pH and salinity.

Arts & Humanities and Social Science
11:10 am – 12:10 pm
Kaniela Room

No.   Start   Title, Student Presenters* and Institution, Mentor(s)°, Summary

12   11:10   **Development of a Mixed Reality-based Platform to Enhance Patient Interaction**.
Noah Emil Domingo, UHM, Piers O'harrow*, UHM, Brittany Biggs°.*
Pediatric feeding disorders is difficult for families for various reasons. Children need to consume nutritionally balanced diet for their long-term physical health. Children who don't eat with family or peers can miss opportunities to develop social skills and friendship. This project may potentially decrease challenging behaviors associated with mealtime by incorporating preferred/positive items to possibly ameliorate a stressful mealtime environment. It will combine the expertise of animators with clinical expertise of various disciplines to address a socially significant problem. This project may potentially decrease hospitalizations and be more cost efficient for families.

13   11:25   **Democracy, Islam and Compatibility: Arguably Compatible, with a Question that Deserves Re-Examining**. *Daniel Ouansafi*, UHM, David Falgout°.*
There are many debates and studies centered around Islam and compatibility with democracy. In the study, a large portion of the research will seek to establish that there is potential for compatibility. From there, the focus will shift.
The paper posits that compatibility is possible, yet it is almost certain that the question will be raised when conflict erupts anew in the Middle East. If religion, by being thoroughly analyzed, is not the central reason for the lack of Middle Eastern democracy, then something else must be the cause. The culture that the media presents of a violent Middle East, is a far cry from the culture that Islamic texts present about the early Islamic community. Perhaps after reading these arguments, future inquiry can use the findings to argue
against bringing religion into the inquiry as to why there is a lack of Middle Eastern democracy. The why, when it comes to a lack of democratic compatibility, might be culture and not religion.

Poster Presentations

Social Science

Alphabetical by last name (of primary presenter)

No.   Title, Student Presenters* and Institution, Mentor(s)°, Summary

3   **An Exploration of Information Processing and Recall.** *Alian Anjum*, UHM, Scott Sinnett°.*
State-dependent learning suggests that memory can be enhanced if a state can be matched at encoding and retrieval. The current research extends this effect to conditions involving food; we tested whether eating a snack while studying and when being tested would lead to increased performance on a test covering the studied material. We further examined this notion by varying whether participants received food or not at both encoding and retrieval, and whether the same food was consumed, or not. Participants were presented with an article to read and asked to memorize as much information as possible. They were then subsequently tested on this material after a short delay. The participants were randomly divided into three groups, Same Food, Different Food, and No Food. The results show that the group that received the same food at both encoding and retrieval stages performed statistically better in the memory test than either of the other two groups.

17   **Sound induced modulations of motion perception**. *Victor Kilonzo*, UHM, Scott Sinnett°.*
It is common for the human brain to combine signals arriving at more than one sensory modality in order to form balanced and intelligible perceptual representations. Under specific conditions, one sensory modality can integrate with another, leading to multisensory integration. To understand the differences in perception the audiovisual bounce-inducing effect (ABE) was used. This motion bounce illusion displays two identical disks moving towards each other, diagonally, on a screen. At the point of coincidence, a sound is played in one condition, while no sound is played in another. The introduction of the sound induced a higher proclivity to observe the otherwise identical visual percept as bouncing off each other, rather than streaming through each other. In addition to reproducing these findings, we evaluated how the ABE was perceived under conditions when stimuli either followed gravitational expectations (i.e., accelerating), or did not follow gravitational expectations (dec/con).

32   **Self-Reported Instances of Discrimination: Focusing on Race Differences**. *Hyunsok (Holland) Lee*, Sejong University, Hyun-kee (Harry) Lee (translator),Yeonjung (Jane) Lee°.*
According to the cumulative inequality theory, racial and ethnic minorities experience cumulative disadvantages throughout the life-course that can affect their health and well-being. Yet, less is known about how instances of discrimination experiences differ by specific race. To fill a gap in the literature, this descriptive study explores the race differences for discrimination experiences among adults in the United States. Using the 2016 Post-Election National Asian American Survey, adults aged 35 and older were selected. Our study confirms that instances of discrimination vary by one's race. Thus, policies and practices to reduce the negative consequences of discrimination and micro-aggression need to be developed. The present study contributes to the greater literature by focusing attention on racial minorities to understand their discrimination experiences, and also by including discrimination that is specific to living in the U.S.

46   **Methods Must Match Study Questions: State of Hawai'i Youth Substance Use Prevention and Treatment Needs Assessment**. *Taira Masuda*, Mount Holyoke College, Susana Helm°.*
Purpose: Youth Substance Use
The Hawai`i State Department of Health Alcohol and Drug Abuse Division administers youth substance use prevention and treatment services in Hawai'i. This process begins with

conducting a needs assessment. The purpose of this poster is to outline best practices in needs assessment, to highlight the approaches selected for the current 2019-2020 assessment, and feature implications for future research, policy, and practice.
Methods: Best Practices
Needs assessments must be tailored to the population of focus. Best practices in needs assessments are indicated and evaluated for strengths and weaknesses related to the task.
Results: Approach Selected
Our 3-pronged approach maximizes population-relevant data: 1)survey public school students 2) open-ended survey of professionals working with youth 3) in-person interviews with affected youth.
Discussion: Research, Policy and Practice
Our approach will allow us to provide a clear image of what services are needed.

Engineering & Computer Science

Alphabetical by last name (of primary presenter)

No.   Title, Student Presenters* and Institution, Mentor(s)°, Summary

1   **Enabling Sensory Data Storage on The Iron Giant, a Parallax Elev-8 v3 Quadcopter, through Serial Connection**. *Lindsey Agustin*, Honolulu Community College, Mevan Ranasinghe°, Shidong Kan°*.
Over the summer, the Parallax ELEV-8 v3 Quadcopter was built under Honolulu Community College's Pre-Engineering Education Collaborative (PEEC) II program. The purpose of the project is to research and design innovative ways to modify unmanned aerial vehicles. The improvement proposal was to implement sensory data storage for the inertial measurement unit (IMU) sensors onboard the quadcopter during flight. Throughout the research period, hardware and software analysis was done to collect data for improvement ideas. With the information gathered about the specifications of storage hardware available, a Decision-Making Matrix (DMM) was developed to ensure the storage unit chosen was the most effective for sensory data. The OpenLog component was chosen for its ease of data retrieval and large storage capacity. At the end of the four weeks, the Iron Giant was able to interface with the OpenLog storage unit. Work is currently being done to store sensory data logs via serial connection.

16   **Strain Estimation of Metallic Structures Using a 3D Scanner**. *Joshua Dyogi*, UHM, Chunhee Cho°*.
Strain estimation of metallic structures may offer an opportunity to slow down progressive failures and thus to prevent catastrophic collapses. Researchers have developed several methods to identify deformation using several sensors such as metal foil gages and fiber-optic sensors. To remove the need for these sensors, we propose a 3D scanning technique (a sensor-free and non-contact method) in tandem with algorithm development. A high-resolution 3D scanner enables to measure full strain/displacements by scanning a structure before and after loading applied. Through analyzing full strain/displacement fields, the developed algorithm will estimate areas of stress and strain levels of a target structure. Furthermore, if the proposed project is successful, the research will significantly advance a non-contact (sensor-free) method of strain measurement in metallic structures.

22 **Development of Non-destructive Structural Condition Assessment With Multi-Fusion Technique**. *Xiaolin Mai*, UHM, DoSoo Moon°*.
Many civil structures are in a condition of serious deterioration caused by physical or chemical events. The non-destructive testing methods for examining structure performance today exist numerous unstable factors that could potentially provide inaccurate information. This research proposes a new structural performance assessment incorporating sensor fusion technique, cameras readings, as well as different sensors: accelerometer, strain gauges, and Linear Variable Differential Transformer to estimate the equivalent neutral axis (ENA). The intended proposal has shown efficiency through numerical simulations but will be further validated through performing experiments with the reinforced concrete beams. The fundamental in ENA is to determine the flexural bending stresses and deflections in the beam after being subject to a heavy force. Through combining information obtained from different sensors and the cameras, the proposal can be satisfied.

39 **Material Process Development for Advanced Material Synthesis.** *Ryan Sokolowski*, UHM, Joseph Brown°*.
This project focuses on the design, construction, and testing of apparatus for high temperature material processing, including ceramic pressing die and compressed gas instrumentation. The project stems from the Vertically Integrated Project in spring semester as an effort explore pathways to hypersonic materials and oxide ceramic synthesis. The synthesis of yttrium barium copper oxide (YBCO) served as a stepping stone to pursue processing of transition metal alloys, graphene, and other materials. The importance of superconductors lies in its potential for very fast computing and making electricity generation more efficient. A discussion will be included on the challenges of the fabrication process. A plexiglass enclosure and gas instrumentation will be used to enable flow of gases such as nitrogen, hydrogen, and argon into a tube furnace.

Natural Science

Alphabetical by last name (of primary presenter)

No.   Title, Student Presenters* and Institution, Mentor(s)°, Summary

34 **Quenching the Main Sequence: the Role of Luminous AGN and Galaxy Mergers**.
Christopher Bain*, University of Maryland Baltimore County, David Sanders°.
Local galaxies from the Chandra-COSMOS survey are used to format information in the evolutionary aging of galaxies in the universe in which AGN are associated with Star-formation rate. Using data obtained from the Laigle et al. 2016 catalog at $0.5 < z < 3.5$, our analysis shows that several AGN, especially Type 1 do not follow the main sequence of galaxies, however it is not clear as to whether AGN have a direct correlation to the quenching of star-formation in galaxies. AGN-detected galaxies with stellar mass ~ $8.5 – 9.0$, exhibit the qualities of LINER galaxies especially in lower redshift bins while higher mass AGN Type 2 galaxies exhibit the qualities more similar to SEYFERT 2 galaxies.

44 **Using in-situ collections of reef algae to examine land-based sources of pollution in Kāneʻohe and Waialua Bay**. *Nerissa Barling*, Colorado College, Celia Smith°.*
In near-shore waters of Hawaiʻi, nutrient pollution poses a risk to the health of the coastal reefs. Land-based sources of pollution (LBSP) such as on-site sewage disposal systems (OSDS) can go into groundwater, bringing pollution to the coast via submarine groundwater discharge (SGD). $\delta^{15}N$ data have been used to examine potential LBSP; %N data can reveal nutrient loading. In-situ algae samples of *Ulva lactuca*, *Acanthophora spicifera*, and *Dictyosphaeria cavernosa* were

collected for tissue-based assays of δ^{15}N and %N from sites in Waialua and Kāneʻohe Bay, regions identified by the Department of Health as having high densities of OSDS. Comparing 2018 data from Kāneʻohe Bay, δ^{15}N values will be similar while %N in Waialua bay will be lower due to more mixing with the ocean. Algae are useful tools to examine nutrient pollution as they provide robust assessments of the water quality as opposed to single point water samples.

40 **The continuum approach for modeling flow and transport in fractured-porous media systems**. *Gerardo Barrera Giron*, University at Buffalo, Aly El-Kadi°*.
Modeling is an essential tool for understanding and accurately predicting the transport of contaminants through subsurface media. Fracture media systems are difficult to model without prior knowledge of fracture sizes, locations, and transmittal properties. Applying a continuum or a porous media approach is an alternative method that assumes that properties of the fractured system can be averaged out over a representative elementary volume (REV). This REV should also be small enough to be considered as a point in the mathematical formulation of flow and transport processes. In this study, results from detailed fracture flow and transport models are used to calibrate porous media models for random and basalt fractured systems. The latter systems are relevant to Hawaii aquifers where fracture flow is dominant. Calibration is used to quantify errors towards assessing validity and limitations of the porous media approach that depends on the nature of both the fractured system and the flow.

23 **Inter-calibration of common bio-assay species: testing *Ulva lactuca, Acanthophora spicifera*, and *Gracilaria salicornia* tissue parameters δ^{15}N and %N from select sites on Oʻahu**. *Jiana Blaha*, American University, Celia Smith°*.
Nutrient pollution is a key driver of ecological impairment in coastal waters, particularly through land-based sources of pollution (LBSP) entering via submarine groundwater discharge. Algae are useful indicators of LBSP via analysis of their plant tissues for δ^{15}N and %N. Because no one alga occurs across at all sites, we ran an inter-calibration exercise of common bio-assay species by deploying replicates across six sites to examine the range in tissues δ^{15}N and %N for *Ulva lactuca, Acanthophora spicifera*, and *Gracilaria salicornia*. Prior to deployment, wild plants were collected and grown for 7 days in nutrient poor water. The day of the deployment, plants size, weight and photosynthesis were recorded. After 7 days, algae were collected, re-analyzed and dried for δ^{15}N and % N. It is expected that the algae δ^{15}N will be similar and %N will vary. This research will help fill in important gaps in understanding and our ability to compare species in different locations.

8 **Coliphage Diversity in Hawaiʻi**. *Christian Bolacito*, Kirs Marek°*.
There is little research on the types of Coliphage in our environment. The avg. percentage of human/ animal waste is not recorded regularly. The DNA and RNA sequencing of Coliphage yields tests that allow us to identify where the phage comes from. There are four subgroups of this virus 1 and 4 belong to animals, 2 and 3 belong to humans. By testing the Coliphage in our rivers and streams we can detect how much human waste is being leaked into our ecosystem. The current test for water quality have some percentage errors that are overlooked. Current tests include markers for *Enterococci* and *Clostridium Perfringens*. The error is that these are naturally found in soils around the island. The result of this is false positive readings. The Coliphage testing can be a more accurate indicator of water quality if adopted by the State of Hawaiʻi.

12 **Do we have a future together?: Exploring the interaction between non-native sponges and corals of Kāneʻohe Bay**. *Ciara Bongolan-Aquino*, Leeward Community College, Brendan Wong*, Arizona State University, Jan Vicente°*.
Two sponge species, *Mycale grandis* and *Monanchora clathrata*, are considered recent introductions to Kāneʻohe Bay. Previous studies have shown that *M. grandis*, while palatable to predators, grows quickly and can decrease percent cover of both coral species. Unlike *M. grandis, M. clathrata* appears to be less abundant in the bay and is chemically defended. These drastic ecological differences provide opportunities to explore how corals will react to sponges with contrasting lifestyles. In this study we monitored rates of attachment of sponges to corals, sponge growth, and photosynthetic efficiency of corals in pairs of *P. compressa* and *M. capitata*

with both species of sponges. *M. grandis* presented greater attachment rates to *P. compressa* than to *M. capitata*, possibly explaining its high co-occurrence with *P. compressa* throughout the bay. Our results show that *M. grandis* has a more neutral relationship with corals, while *M. clathrata* has devastating consequences in either coral species.

5   **Baby Boomers: An ASAS-SN Investigation of Variable YSOs in Lupus**. *John Bredall*, UHM, Benjamin Shappee°*.
Examining variable Young Stellar Objects (YSOs), especially "dipper" stars, gives us unique insight into stellar and planetary formation. While there have been several recent high-precision surveys of YSOs in specific star-forming regions, variability can be missed as a result of their short baselines and limited coverage. Here we present a YSO survey of the Lupus star forming region using the All-Sky Automated Survey for Supernovae (ASAS-SN). Despite being home to several well-studied variable YSOs, the Lupus clouds have currently no published cases of dipper stars. In this search, we have found multiple new dippers in Lupus and present our findings along with classifications of other variable YSOs in the region.

33   **Proteomic Analysis of Nonconforming Conopeptide Profiles in *Conus striatus* to Uncover Novel Classification**. *Amihan Camson*, UHM, Jon-Paul Bingham°*.
Predatory cone snails paralyze fish and other marine mollusks by injecting venom composed of a diverse array of conotoxins/conopeptides. These conopeptides are characterized by disulfide bonding frameworks which selectively target ion channels in the human nervous system, thus making them potential candidates for novel drugs, pharmacological probes, and pesticide leads. In this study, milked venom samples from *Conus striatus* were analyzed to isolate low abundant peptides in the uncharacterized RP-HPLC regions. A proteomic approach using HPLC and mass spectrometry could identify unique novel peptides that are pharmacologically diverse from established conotoxin/conopeptide superfamilies.

18   **Feasibility of skin carotene as a biomarker for health via iphone app**. *Nahian Chowdhury*, UHM, Gemady Langfelder*, UHM, Jinan Banna°*.
We investigated the feasibility of an mHealth app by analyzing α-Carotene images and comparing them with measurements from Minolta spectrophotometer. McGill University researchers investigated effects of carrot juice supplementation on skin carotenoid levels over a 6 week period. Participants were supplemented carrot juice for the first 2 weeks, and were followed up on week 4 and week 6. Skin carotenoid levels were expected to increase after supplementation. Images of the cheek, palms and top of hand and their pictures were taken during every 2 weeks. We analyzed data from the palm. JASP software was used to conduct data analysis. Our data showed that there was an increase in a* values from week 2 to week 4 and a slight decrease between week 4 to week 6. The a* value gathered with Minolta showed that skin redness increased after supplementation. iPhone photos showed a similar trend but did not correlate with Minolta values.

4   **Analyzing infrasound, geodetic, and seismic data from Kīlauea 2018 caldera collapse**. *Meritxell Colet*, Carleton College, Rhett Butler°*.
In 2018, the Kīlauea volcano experienced the largest eruption and caldera collapse of the last century. Between May and August 2018, we examine infrasound data from the Infrasound Laboratory (ISLA) of the University of Hawaiʻi and geodetic data from the USGS Hawaiʻi Volcanos Observatory (HVO). We focus on the Halemaʻumaʻu crater at the summit to understand the relative timing of events contemporaneous with the beginning of Kīlauea's intense seismic activity period. Analysis of infrasound data for the most explosive events in May yielded mixed results as the infrasound and seismic signals do not always correlate well with Halemaʻumaʻu plumes ejected kilometers into the atmosphere. Geodetic data is still being processed and it is expected to provide further insight into the timing of events. Although still in process, this study aims to compare and contrast the timing of events at the summit of Kīlauea volcano last year and provide an outline chronology for context in future eruptions.

42   **The Enigmatic Seamounts: Using Lead Isotopes to Investigate Arch Volcanism**. *Molly Cunningham*, Rensselaer Polytechnic Institute, Jasper Konter°.*
Hawaiian volcanoes end their lifetimes with a phase of geochemically distinct rejuvenated volcanism. Manifestations of this phase occur as lava flows and craters on the Hawaiian islands, as well as submarine lavas along the surrounding flexural arches. This arch volcanism is caused by the loading of the Hawaiian volcanic complex, which creates up-flexed arches of weakened lithosphere to the north and south. Resulting shallow decompression melts exploit and erupt in these deformed areas, but the mechanisms and materials of these eruptions are poorly understood. This study characterizes the radiogenic lead isotopic composition of two seamount clusters adjacent one of the largest Hawaiian structures. On the small scale, this isotopic analysis will constrain the mantle source(s) and volcanic mechanism responsible for these seamounts; on the large scale, it will deepen scientific understanding of rejuvenated volcanism and the evolution of Hawaiian volcanoes.

47   **Word powers and automatic complexity**. *Clyde Felix*, UHM, Sun Young Kim*, UHM, Bjoern Kjos-Hanssen°.*
The automatic complexity of a word was introduced by Shallit and Wang in 2001 and studied further by Kjos-Hanssen since 2013. In this work we develop an implementation of a lower bound on the complexity involving occurrences of powers of words, such as the occurrence of "humu" twice in "humuhumunukunukuapua'a".

2   **Allelopathic Effects of Native and Non-Native Hawaiian Plants on Monocots and Dicots**. *Sherry-Ann Hara*, UHM, Daniel Owens°.*
Due to the unique climate, Hawaiian plants have developed an array of phytochemicals that are hypothesized to increase their competitiveness for resources. Each of these compounds is a potential source for development to address agricultural and medicinal problems facing humanity. One useful attribute many of these plants convey is allelopathy, the ability to inhibit the germination of other plants due to their chemical complement. As evolving herbicide resistance continues to be an issue searching for new weed killing compounds, hopefully representing new modes of action, becomes even more critical. We are identifying Hawaiian plants with potential for allelopathic activity using a phylogenetic approach and directly quantifying their allelopathic activity. A long-term goal is to develop new herbicidal compounds to address reductions in crop yields due to weeds. By increasing the amount of food that can be produced on crop lands, this work will improve sustainable agriculture.

13   **Examining Nutrient Contaminate Inputs from Wastewaters and Other Land Uses with the Ocean Waters of Waialua Bay, Oʻahu**. *Daniel Harrington*, The University of South Carolina, Craig Glenn°.*
Release of effluent from onsite sewage disposal systems (OSDS) to coastal waters can pose significant human health risks and cause nutrient imbalances that harm native ecosystems, and this contamination may enter the coast via streams and/or submarine groundwater discharge (SGD). Exceptionally high concentrations of ~1700 OSDS occur within close proximity to the coastline of Waialua Bay, Hawaiʻi, a region historically plagued by overgrowth by opportunistic invasive algae. To understand relative nutrient inputs in this area we combined unmanned aerial vehicle thermal infrared imaging with in situ coastal salinity to differentiate locations of stream flow versus high SGD, and analyzed surface and pore-water nutrient concentrations of these sources. Preliminary results demonstrate that nutrient concentrations in beach pore-waters exceed those of rivers in the area, and that of the two rivers sampled, higher nutrient concentrations were found in the river that drains agriculture and OSDS.

45   **Where's the Action? Galaxy Evolution and Environment at Redshift 1**. *April Horton*, Bluffton University, Roy Gal°.*
Cluster samples, across a redshift range of 0.6 < z <1.3, taken from research conducted on the Observations of Redshift Evolution in Large Scale Environments survey (ORELSE) were analyzed to explore the role of dense environments in galaxy evolution. Using the spectroscopic and photometric data coverage, this research project studied the evolutionary states and

luminosity properties of the cluster sample. Galaxy membership was determined by comparing three methods to make luminosity and mass functions: using the spectroscopic data, using spectroscopic and photometric data, and using photometric data. Results showed a 1:1 correlation between the spectroscopic and photometric data. Additionally, the survey has more spectroscopic coverage at lower virial radii multiples. The research paper further describes the study's details and demonstrates the scientific significance of the results.

35 **Role of mechanical properties of sediments in the formation of landward versus seaward verging thrust faults at accretionary prisms**. *Madeline Hunt*, The University of North Carolina at Chapel Hill, Garrett Ito°*.
In most accretionary wedges at subduction zones, thrust faults are oriented, or verge, seaward, away from the overriding continental plate. However, in a few regions like Cascadia and Sumatra — the site of the destructive 2004 tsunami — thrust faults verge landward. To understand why this occurs, numerical tests were run using a finite differencing code, simulating thrusting in accretionary prisms by solving for conservation of mass and momentum in a visco-elastic-plastic medium. Results show that landward-verging faults occur when the prism has a weak basal layer, with a thickness of at least 25% of the entire sediment package. Landward vergence is also promoted by weaker ductile or brittle strengths in the basal layer, indicating lower shear stresses, or by weaker elastic deformation of the sediment as a whole, due to lower shear moduli. To understand the implications of these results, they will be compared with rock properties observed in the field for different accretionary wedges.

30 **Oxidative Stress in *Yarrowia lipolytica***. *Rex Imanaka*, UHM, Michael Kesler*, UHM, Wei Wen (Winston) Su°*.
This project is to study potential oxidative stress in an industrially important yeast *Yarrowia lipolytica* using plant oil as a carbon source. Lipids, when heated or oxidized, may generate reactive oxygen species (ROS). The ROS produced from oils are dangerous because they can react with cells (including yeast) causing them to mutate or die. ROS has also been linked to cancer. Here yeast cells were grown in different plant oils and tested using a dye called CellRox to detect ROS. If the yeast was under oxidative stress they would glow green fluorescence. After counting the cells it was found that grape seed oil stressed the cells the most (than safflower and waste cooking oil) with about 9.32% of the cells being under oxidative stress. This is likely due to grape seed oil's high content of polyunsaturated linoleic acid which is prone to oxidation. The finding offers guidelines for selecting plant oils based on fatty acid composition to grow *Y. lipolytica* for producing useful compounds.

24 **Investigating the Relationship Between Bulge Growth and X-ray Emission in Luminous AGN**. *Justin Johnson*, University of Miami, David Sanders°*.
To investigate the influence of AGN on host galaxy bulge growth as well and if AGN are responsible for the quenching star formation, we look at bulge to total (B/T) fractions of galaxies and their dependence on X-ray luminosity. We use GALFIT to model X-ray selected galaxies in COSMOS and with a single Sersic profile and find a large number of sources with a Sersic index of 20 due to prominent point nuclei. Due to the skewing from point sources, we find no clear correlation between the Sersic index and X-ray luminosity. However, using a multicomponent galaxy model to accommodate for the point sources, we expect find a positive linear correlation between B/T and X-ray luminosity.

21 **Integrating STEM and Culture: The Molecular Taxonomy of *Gibsmithia* (Rhodophyta)**. *G'voni Kalaiwaa*, Kapiolani Community College, Alison Sherwood°*.
The genus *Gibsmithia*, a red alga (Rhodophyta) appears throughout the Indo-Pacific reef systems. The Hawaiian Islands house 2 known species, *G. dotyi* and *G. hawaiiensis*, known by their cluster of gelatinous lobes borne from a perennial cartilaginous stalk. Advanced technologies in deep-sea exploration opened doors for scientists to discover and educate communities about the importance of saving native algal communities impacted by invasive species. Molecular analysis reveals a new species of *Gibsmithia* collected at depths of between 45-85 m in the mesophotic zone. Molecular analysis was performed using three molecular

markers: the 23S rRNA universal plastid amplicon (UPA), Rubisco large subunit gene (rbcL) for plastid markers, the 28S rRNA nuclear LSU and the mitochondrial cytochrome oxidase subunit 1 (CO1). Future steps include incorporating morphological analysis of the specimens, determine whether they represent an undescribed species and formally describe this taxon.

25 **Low-Cost Inductive Conductivity Sensor Design**. *Grant Kirchhoff*, University of California, Berkeley, Brian Glazer°*.
The high costs of oceanography sensors have remained a significant barrier for low-budget professional and citizen scientists. As a part of the SMART Ala Wai Project, which aims to reduce this barrier, my project endeavors to develop a low-cost, long-term deployment conductivity sensor. Current inexpensive methods utilize electrodes in their designs, but exposure to water results in undesired polarity and biofouling. This design's solution involves a pair of epoxied toroids instead of electrodes to induce a current in the water, which is proportional to its conductivity. The mechanical design is compact and the sensor makes use of single-board computers, which provides easier access for individuals monitoring conductivity. To determine the sensor's effectiveness, it is tested against the conductive electrode design and research-grade inductive design in saline solutions that range from fresh to saltwater. The sensor will be compared to the existing designs in both cost and accuracy.

26 **Lower VC-dimensions of finite automata**. *Ethan Lamb*, UHM, Davin Takahashi*, UHM, Bjoern Kjos-Hanssen°*.
Ishigami and Tani studied VC-dimensions of finite automata. We show that their results apply to a new notion, lower VC-dimension, where all sets (instead of some set) of a given cardinality must be shattered. We also relate the VC-dimension to the Separating Words problem.

38 **Spectral Energy Distributions of Morphologically Classified X-ray Luminous Sources**. *Kaitlynn Lilly*, University of Maryland, Baltimore County, David Sanders°*.
1342 galaxies from the COSMOS survey are analyzed through visual classification, focusing on their morphology to determine how the shape of the spectral energy distributions (SEDs) depend on the morphology of the source for X-ray selected active galactic nuclei (AGN). The extensive photometric coverage within the 2- COSMOS field allows for detailed SEDs to be made. Sources were separated into morphological groups determined through visual classification, providing a breakdown of the morphology of X-ray luminous sources within the COSMOS field. 80.1% and 52.5% of the sources were classified as spheroid and point nucleus respectively and it was these classifications with over 53% 64% of their sources having X-ray luminosities above. It was found that type 1 AGN show significantly more UV excess than type 2 AGN and in general, there is not a significant difference in the shape of the SEDs between the different morphological classes.

19 **Genome sequence of a new Cyanobacterium from a Hawaiian lava cave**. *Alphina Liusamoa*, UHM, Jimmy H. Saw°, Rebecca D. Prescott°, Jennifer Saito°, Shaobin Hou°, Stuart Donachie°*.
Novel cyanobacteria were cultivated during an investigation of microbial diversity in lava caves in Kīlauea Caldera, Hawai'i. Strain JS2 produces branching filaments of spherical and cylindrical cells typical of the genus *Fischerella*. The JS2 16S rRNA gene nucleotide sequence shares 97.99% identity with the 16S rRNA gene in its nearest formally described neighbor, *Fischerella muscicola* PCC 7414T, suggesting JS2 is a new species. Formal description of JS2 requires genome data: 2,028,954 paired-end reads assembled into 448 contigs, providing a genome of 6,918,595 bp. An EDGE analysis identified two rRNAs, 64 tRNA, and 5,850 coding sequences. The latter include for CRISPR-associated RNA-binding proteins involved in bacterial immunity against virus infection, and genes typically found in cyanobacteria, e.g., for heterocyst formation and circadian rhythm. An antiSMASH analysis predicted coding regions for secondary metabolites including lasso peptides and terpenes. Average Nucleotide Identity between the JS2 and *F. muscicola* PCC 7414T genomes of 92% supports JS2 being the type strain of a new *Fischerella* species. The genome's G+C content is 40.78%.

6   **Changes to Chromatin in Hypoxic Cardiomyocytes**. *Elliott Markell*, UHM, Andrew Knutson°*.
An appropriate response to changes in oxygen levels is critical for many biological processes. This is of particular importance in the heart, where coronary obstruction, with resulting hypoxia, is the most common cause of death in the world. The best-characterized oxygen-response pathway involves the transcription factor HIF-1. In hypoxia, HIF-1 is stabilized and directs expression of genes that promote various tissue adaptations. To determine if hypoxia induces changes to chromatin in the mammalian heart, we will examine hypoxic and normoxic mouse neonatal cardiomyocytes using immunofluorescence. We have determined conditions for antibodies that recognize histone modifications H3K4me3 and H3K27me3. If we detect changes, we will explore whether this effect is HIF-1-dependent by comparing these histone marks in wild-type cardiomyocytes to cardiomyocytes lacking HIF-1. These experiments will provide insight into molecular changes to cardiomyocyte chromatin under low-oxygen conditions.

36   **Sediment Analysis of Land Based Pollutants.** *Alex Mathers*, UHM, Morgan Pugh*, UHM, Eileen Nalley°*.
Land based pollutants, such as heavy metals, can be found in harbors, estuaries, runoff, and canals around Oʻahu and Kauaʻi, and human consumption of marine life from heavily polluted areas can lead to health problems. The type of sediment present on a reef may be an indicator of its source and potential pollutant load. Sediment samples from seven reef sites adjacent to areas of varying pollutant sources were analyzed to determine the grain size and percent organic matter. The percent size fraction of each location was determined using seven mesh sieves ranging from 4mm to <53um, and percent organic matter will be determined using combustion. t When compared with known metal concentrations in these locations, our preliminary results suggest that sites with finer sediment, such as Kāneʻohe Bay and Hanapepe, also had higher concentrations of several metals. Understanding the relationship between sediment type and metal concentration will help to identify the source of pollution.

37   **Spatially Resolved Kinematics of Ionized Gas with CFHT's SITELLE in the Merging Luminous Infrared Galaxy: Mrk 266 - Host of Double AGN**. *Maya Merhi*, Lycoming College, Andreea Petric°*.
We have spatially resolved the kinematics of Mrk 266 (NGC 5256). Mrk 266 is a gas-rich luminous infrared galaxy (LIRG) merger hosting dual AGN: Mrk 266 SW – a Seyfert, and Mrk 266 NE – a LINER. Using the Canada France Hawaii Telescope's (CFHT's) SITELLE instrument we studied the effect of dual-AGN on Mrk 266 and the surrounding medium. We obtained rich spectral data of Mrk 266 and resolved the kinematics using the SITELLE data cubes specific software package called ORCS written by Dr. Thomas Martin. We fit the spectra the spectra of the galaxy. We then produced maps of the galaxy's flux, velocity, velocity dispersion, line ratios, and extinction corrected star formation. We then made a BPT diagram of the entire system. We found 10% of the Hα gas comes from new stars in HII regions, while 20% to 40% is of composite (LINER + HII) origin. We also found that most of the ionizing radiation comes from shocked gas either associated with the AGNs or with the tidal disruption.

28   **Molecular Gas Heating in Active Galaxies: Tidal Shocks, New Stars, or Growing Black Holes**. *Rebecca Minsley*, Bates College, Andreea Petric°*.
We visually classified the merger status of 630 nearby galaxies. We looked at the warm molecular gas and dust features of interstellar medium (ISM) effected by active galactic nuclei (AGN) to determine if these effects are solely caused by AGN or if they could be a result of merger status. We compared the impact of AGN to mergers using non-parametric two sample survival tests. We used line-emission measurements from the Spitzer Infrared-spectrograph (IRS) from Lambrides et al. 2019 to compare ISM features: for gas temperature we used the mid-infrared molecular emission lines H2 S(3) and the S(1) line, for dust grain size we used PAH 6.2 μm and PAH 7.7 μm luminosity emission, for ionization rate PAH 11.3 μm and PAH 7.7 μm luminosity emission, and for dust extinction we used the strength of the 9.7 μm silicate feature. We found AGN to have a larger bearing on the ISM, however we also found merger status to significantly complicate AGN effects by also having an impact on the ISM.

41   **The Effect of Umu Kai on Diversity and Abundance of Fish Communities**. *Chase Sawyer*, UHM, Shor Williams*, Leeward Community College, Frederick Reppun°*.
Umu kai are a type of fish trap that was widely used until the mid-20th century in the Hawaiian islands. This submarine structure is typically a stack of rocks that act as shelter for small fish which in turn attract larger fish. Since the mid-1900s, use of umu kai has declined, due to coastline development along with agricultural runoff affecting the ocean. This experiment investigated the effect of umu kai on fish abundance and species diversity in two differing environments, with the goal of examining this traditional method of fish aggregation as a method to enhance fish survey techniques. We constructed six umu in total: three in Heʻeia stream near the muliwai, or stream mouth, and another three along the eastern, makai side of Heʻeia Fishpond. We utilized three methods to collect fish abundance and diversity data, including seining, throw net, and visual surveys. We characterized the water quality parameters of the stream and ocean sites using a YSI multiparameter sonde.

9   **Crystallization of Hawaiian Submarine Basaltic Glasses Under High P-T Conditions in Multi-Anvil Press**. *Jacob Switek*, Colorado State University, Murli Manghnani°*.
The nature of melting and crystallization of basaltic glasses is important for understanding the properties and composition of melts erupting on the Hawaiian islands. The subject has not been researched with samples at high temperature and pressure, so this study was conducted to observe the degree of crystallization and hydroxyl group concentration of samples after they were remelted at pressures appropriate to those of the deep crust. Samples of known composition from the Loʻihi, Kilauea, and Mauna Loa volcanoes were obtained and a 2000-ton multi-anvil press using an 18/12 assembly was used for experiments at 4 GPa and 1000o, 1200o, and 1400o C in separate runs. An optical microscope and scanning electron microscope (SEM) will be used to identify the mineralogy and degree of crystallization of the samples; Raman spectroscopy will be used to determine hydroxyl group concentrations.

20   **Identifying Plant Root Communities in Hawaiian Caves**. *Fuamai Tago*, UH Hilo, Megan Porter°*.
Hawaii hosts many diverse and endemic species within its caves. Caves are an important habitat for rare communities of troglobitic arthropods. Caves may lack the essential resources such as nutrients and light, nevertheless the species all share the plant roots for survival. Plant roots collected from within the caves can be identified by using methods similar to previous research by Howarth. There were 21 samples of roots collected from 11 cave sites on Hawaii representing 6 lava tube systems. The samples were processed using molecular techniques such as DNA extractions and barcoding. To aid in the identification of the collected root species we used the ITS region. Out of 21 samples extracted only 12 samples have successful PCR reactions. After assembling sequences in the program Geneious, we then used NCBI BLAST searches to identify that 6 of the sequences from 4 sites were fungi. The other 6 samples matched sequences from the *Metrosideros* genus and were from 4 lava tube systems.

7   **Cloning and Characterization of Hairy Sheath Frayed2 (Hsf2) - A New Leaf Patterning Mutant in Maize**. *Chelsea Tanaka*, UHM, Michael Muszynski°*.
In multicellular organisms, molecular networks mediate the spatial organization of tissues in developing organs (patterning). To understand how this occurs, we use the maize leaf as a model because it has 4 distinct sections—the sheath, auricle, ligule, and blade—organized in the proximal-distal (P-D) pattern. We study mutations that alter this P-D pattern to identify key molecular components. In maize, the Hairy Sheath Frayed1 (Hsf1) and Hairy Sheath Frayed2 (Hsf2) mutations alter this P-D pattern by causing ectopic proximal tissue outgrowths (prongs) in the distal blade. The gene underlying Hsf1 was cloned and we know that Hsf1 is caused by altered cytokinin (CK) signaling. For Hsf2, we identified a candidate gene and my project is to validate it, and also perform expression analysis to determine if Hsf1 and Hsf2 share the same misexpressed genes. Current progress on these projects will be presented.

15 **Exploring the Dynamics of *Symbiodinium* and *Cassiopea andromeda* Interaction During Environmental Stress and Recovery**. *Mikala Thomas*, Hawaii Pacific University, Courtney Yoshiyama*, Western Washington University, Jeremy Soriano°.*
The symbiosis between *Symbiodinium* and various hosts is vital for reef ecosystem resiliency, but highly susceptible to various environmental stressors which can lead to the break down of this relationship. One relationship of interest is that between *Symbiodinium* sp. *and Cassiopea andromeda*. Previous studies have shown that some cnidarian species are capable of recovering from bleaching; however, host-symbiont and symbiont-symbiont interactions are not well-described. Here, we investigated the reestablishment of the symbiosis between the *Symbiodinium* and *C. andromeda* after bleaching. Changes in spatial distribution, abundance, and community structure of the symbiotic algae were measured to better understand the process of recovery. Results from this study will help elucidate whether *C. andromeda* can serve as a model organism to understand *Symbiodinium* dynamics, providing insight into conservation efforts as reef ecosystems are affected largely by the impacts of climate change.

43 **Ultrasound-mediated Gene Therapy**. *Giorgio Tran*, UHM, Cynthia Anderson°.*
We are developing an approach that uses ultrasound and microbubbles to deliver plasmid DNA to mouse liver for the treatment of the blood coagulation disease, Hemophilia B. Hemophilia B results from mutations in factor IX (FIX), which is normally produced and secreted by the liver. Gene therapy of this disease is particularly attractive because modest levels of FIX activity (>1%) can have substantial therapeutic benefits.
A human FIX plasmid was modified into a more active form known as hFIX Padua. hFIX Padua was delivered to Hemophilia B mice (FIX-/-) with microbubbles that were targeted for destruction via high intensity focused ultrasound. Exogenous hFIX expression in the plasma was detected in the treated mice 7 days after treatment assessed via western blotting. Coagulation in the treated plasma samples was assessed by performing a FIX-specific APTT assay. Reductions in APTTs were observed one week after treatment (n=3) compared to plasma from untreated FIX-/- mice (P=0.02).

14 **Exploring settlement and survival patterns of *Pocillopora acuta* larvae on a spectrum of natural and synthetic substrates**. *Taelyn Uyehara*, Oregon State University, Ciara Ratum*, Hawaii Pacific University, Mackenzie Manning°, Malia Rivera°.*
The global decline of coral reef ecosystem health has intensified reef restoration efforts and research on coral larvae settlement cues. In this study we tested settlement success of *Pocillopora acuta* larvae on conditioned (fouled) or unconditioned (clean) substrates. We then tested whether *P. acuta* would show substrate preference when presented with natural and synthetic substrate types. Results suggest no significant difference in settlement success between conditioned and unconditioned substrates regardless of substrate type. Natural substrates promoted significantly higher settlement compared to synthetic substrates, with aragonite tile and coral rubble being the most successful. For the substrate preference experiment, larvae showed no significant preferences for a particular substrate. These results can help inform future coral research endeavors that contribute to the process of restoring reefs that are being lost to bleaching and other human impacts.

29 **Nitrogen & Benthic Recruitment at Maunalua Bay**. *Julia Vu*, UHM, Patrick Nichols°.*
Over time, population growth has led to increased inorganic nutrient wastewater discharge into Hawaii's intertidal zone. This submarine groundwater discharge (SGD) causes eutrophication in the surrounding water, prompting large phase shift of coral-dominated to macro-algae dominated reefs. Wailupe Bay is a prime example of a reef ecosystem that has become dominated by algal blooms. As a widespread concern for Hawaii's biodiversity, this research analyzes how the change in nutrient supply, caused by chemical factors in the SGD, affects the surrounding species diversity of the macro algae versus coral population. Specifically, the study focuses on how the presence of dissolved inorganic nitrogen influences the species composition of the surrounding area for algae and coral recruits in Wailupe. Benefits from this study include potential to understanding broader impacts of dissolved nitrogen in tidal zones beyond Hawaii, especially in similar coastal environments facing urban development.

10 **Design, construction and testing of proteinaceous nanoparticles for DNA and enzyme packaging**. *Gina Watanabe*, UHM, Gernot Presting°*.
Protein nanoparticles offer protected delivery of enzymes and DNA to plant chromosomes with potential applications in gene therapy and transgenesis. Virus-like particles (VLPs) are protein shells composed of self-assembling subunits expressed by the gag gene in retroviral and retrotransposon systems. Engineering the ability to sequester molecules and transport them to regions of a cell introduces challenges in manufacturing VLPs. The centromeric retrotransposon (CR) elements of Zea mays provides a natural system capable of packaging and inserting DNA into the functional centromeres of grass chromosomes. In this study, the feasibility of packaging DNA and the centromere-specific integrase (IN) into CR VLPs in vitro will be investigated through VLP formation from combinatorial assembly of wild type and Gag-IN fusion or E/K-coil associated proteins. The results of this study may offer new methods of packaging DNA for potential transport to a region present on every eukaryotic chromosome.

31 **Physical factors that impact the nature of faulting and stability of ocean island volcano flanks**. *MJ Wilner*, Garrett Apuzen-Ito°*.
Volcanoes are known to expand laterally when their flanks slip outward along faults or, on rare-occasions, when they catastrophically collapse. Kīlauea's south flank, for example, slips seaward along both its base as well as the potentially shallower Hilina normal fault. Our goal is to explore the physical conditions that promote flank stability versus basal slipping or shallow faulting. With 2-D finite-difference models we characterize fault behavior in response to various physical parameters, including volcanic slope, presence and location of a shoreline, frictional strength, pore fluid pressure, and magmatic intrusions. Models successfully produce stable versus unstable flanks consistent with the angle of repose for either subaerial or submarine flanks. Models also indicate that the presence of a shoreline—a dual subaerial-submarine case—as well as high pore-fluid pressure tend to destabilize the flank. Further work will examine the impact of magmatic intrusion on flank faulting.

11 **Development of Telemetry Pipeline for Pyramid Wavefront Sensor on Keck II**. *Alex Witte*, University of Notre Dame, Charlotte Bond°*.
A new Adaptive Optics (AO) system utilizing a Pyramid Wavefront Sensor (WFS) is currently being commissioned on the Keck II Telescope. A new telemetry pipeline must be developed to analyze data produced by the WFS and AO system and to determine important parameters present in the observing process. The following project focuses on laying the groundwork for such a pipeline and providing measurements of two parameters useful in the characterization of the atmosphere in real time. These parameters are the root mean square of the deformable mirror commands and the value of the Fried parameter, from which a value of the seeing angle can be derived. To confirm the results of these measurements, simulated data was implemented. As a result, the functionality of the analysis methods was confirmed, and the results considered accurate. Further comparisons between the analysis of on sky data and measurements made on Mauna Kea further confirm the results.

27 **Measure of Local Optical Turbulence Using a Non-Redundant Mask Imaging Interferometer**. *Jacob Young*, San Jose State University, Mark Chun°*.
AIRFLOW is a device which measures local optical turbulence through analyzing interference patterns created by a non-redundant pinhole mask. The device's purpose is to determine the location where optical turbulence is most prevalent within the telescope domes. The purpose of this paper is to establish that data taken by the device is credible, reliable, and useful. This project tests the validity and precision of data provided by AIRFLOW and iterates upon the instrument's design to increase the instrument's overall performance. These design iterations include a new pinhole mask, a removable instrument cover and code which autonomously runs the instrument and processes data received. Precision tests indicate the instrument's measurement floor of C_n^2 to be two orders of magnitude lower than that seen at previous tests in turbulent environments. In this paper we will present the details of the design iterations as well as the procedure for tests that prove the instrument's data validity.

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VIP Opening Speakers

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UROP Staff

Jessie Chen, Program Coordinator

Seung Yang, Program Coordinator

Dr. Creighton Litton, Director

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Nicole Lowe, Communications Assistant

Mentors

The research and creative work that students conduct with faculty mentors is often the students' first opportunity to do work in their field of interest. Faculty provide crucial access to resources, works spaces, and information that students may otherwise not be able to attain. Mahalo to all of the mentors, for enriching students' academic experiences.

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Contact us
urop@hawaii.edu
(808) 956-7492
Hawaii Hall –127
manoa.hawaii.edu/undergrad/urop/

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Office of the Vice Chancellor for Research
University of Hawai'i at Mānoa