

Makaola: A Possible Detection of Life

By: *Dr. Jessica Dempsey - Deputy Director, EAO/JCMT*

Above: Venus, the closest planet to Earth, is characterized by a caustic environment of sulfuric acid and infernal temperatures. But could some form of life have found a way to survive in these harsh conditions? Credit: Akatsuki satellite, JAXA.

I vividly remember an email professor Jane Greaves sent me last December containing a draft paper with data from the James Clerk Maxwell Telescope in Hawai'i that she "thought I'd be interested in." I had forgotten that a year and a half before, she had reached out asking for some discretionary time on the telescope "to try something crazy" after multiple telescopes (including our own) had rejected the project for being too outlandish. But having worked and lived in Hawai'i in the very early years of creating the JCMT observatory, Jane was 'ohana. I said yes, and had entirely forgotten her project until now. I stared at the spectrum presented in the paper. And stared. For about a half hour I sat at my computer, blinking stupidly. Then I called Jane. "Is this what I think it is?" I asked. She said yes. "You've just exploded my brain."

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Letter from the Director



Rodrigo Romo

Aloha kākou,

We are excited to be hosting our first Women in Space Exploration (WiSE) Talks series with support from Microsoft and the Hawai'i Science and Technology Museum this month, Oct. 5 to 10. This free virtual event will highlight seven extraordinary women who are scientists and engineers involved in fascinating space exploration projects. The talks will explore the Cassini mission to Saturn, NASA's Mars rovers including Curiosity and Perseverance, the Ingenuity Mars helicopter, life support systems for spacecraft including the International Space Station and more. We also have MIT grad and Emmy-nominated TV host Emily Calandrelli, who will share her career as a science communicator for young women. Though the WiSE Talks are intended to inspire young women, the event is open to the public and all are welcome to attend. Visit our website for details and to register.

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@PISCES_HAWAII

Culture Meets Space in new Artemis Patch



Above: The Artemis CubeSat mission patch created by UH student Katlynn Vicuna represents elements of a UH Mānoa project developing small satellites kits that can be replicated and assembled by undergraduate students.

University of Hawai'i at Mānoa's cubesat kit project now has an official mission patch integrating elements of culture, science and inclusivity with space exploration.

The patch was created by Kapiolani Community College and UH Mānoa student Katlynn Vicuna with help from UH Mānoa SOEST illustrator Brooks Bays Jr. Dr. Frankie Zhu, principal investigator for the project, helped guide the general aesthetic.

The central figure in the patch is Artemis—twin sister of Apollo in Greek mythology and namesake of NASA's new lunar program. The Artemis program aims to put astronauts back on the moon by 2024, including the first women.

Hawai'i's rich culture is represented by several elements in the design including the plumeria flower behind Artemis' ear, symbolizing hope and new beginnings. Worn behind her right ear, the flower also

signifies that she is single. Two birds swoop above Artemis' head, representing long journeys. To the left of the moon, a sprinkle of constellations are a nod to the Native Hawaiian star compass used for maritime wayfinding. The illuminated yellow arc of the moon forms Artemis' bow, the head of her arrow a cubesat.

"This patch makes me feel really proud of my project right now, even though it's been going for almost five months now," said Principal Investigator Dr. Frankie Zhu in a social media post. "It's incredible how inspiring art can be."

The project, which was awarded \$500,000 by NASA's Artemis Student Challenges program earlier this year, is developing hardware and software for a 1U cubesat kit together with a spacecraft design course for undergraduate students. The course includes lectures, labs and hardware/software development. The project will offer cubesat workshops to colleges throughout Hawai'i that emphasize Native Hawaiians and other underserved groups.

Women in Space Exploration (WiSE) Talks



Scientists & Engineers share their stories!

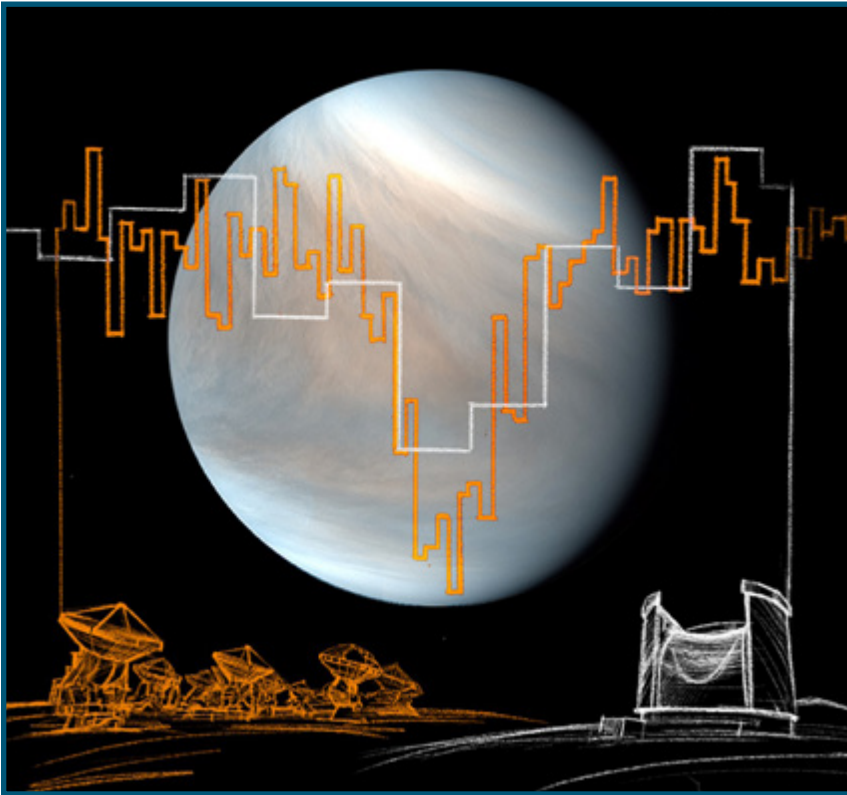


- Dates: Oct. 5 - 10
- Daily talks, Q&As
- Free virtual event



Register now at: bit.ly/wisetalks

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Above: Data spectra of Venus' atmosphere captured by the JCMT observatory in Hawaii was confirmed in greater detail by the ALMA telescope array in Chile. Credit: Joanna Pętkowska, PhD.

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Jane's data indicated the presence of phosphine on Venus. Phosphine is a volatile, unstable and noxious gas—and until that day, I knew nearly nothing about it. It is a gas that, on Earth, is only found in the life-cycles of living creatures—in decaying processes and the guts of many animals. It gives penguin poop a distinct and unforgettable smell. In its largest volume, phosphine is an excretion product of anaerobic microbes found in the upper atmospheric clouds floating above our planet.

And now we have detected it on Venus. Jane's data from JCMT had been confirmed with an even more authoritative survey by the huge ALMA array of telescopes in Chile. To explain their findings, the studies' authors

then began a deep-dive analysis, modeling the atmospheric conditions of Venus' mid-latitude clouds. Was it caused by volcanoes? No. Abiotic (non-living) chemistry? Not in these abundances. UV light? Not at these depths. The authors were exhaustive in ruling out all the known production methods of phosphine. Now, here we are with a tantalizing possibility.

Is it life? Could there be some type of microbe in these churning clouds producing phosphine—a gas that some astrobiologists have already noted as a “bio-marker”—a potential sign to look for on exoplanets orbiting other stars? The short answer is: Unlikely, but maybe. If this is a lifeform, it is unlike anything we know on Earth.

Venus' clouds are 90% or more acid—environments that even the most acid-loving bacteria on Earth would dissolve in. But co-authors of the study have proposed potential life-cycles for Venusian life, and ways they could possibly protect themselves from a harsh environment. Or, it could be some strange, unknown chemistry.

The exciting thing is that, while we don't yet know for sure what the discovery means, Venus is just next door (unlike exoplanets that are light years away). We can go and find out for certain. Within the next few years, the American aerospace company Rocket Lab is planning to send a probe to our neighboring sister planet. NASA is reviving plans for similar missions. Perhaps, just perhaps, in our search to know if we are truly alone in the universe, we have been looking in the wrong direction. Until now.

Lunar Rover Design Contest Offers S\$10K to Winning Students

Singapore Space & Technology Ltd. is offering a S\$10,000 (\$7.3K USD) prize for the most creative design of a lunar rover capable of excavation and/or In-Situ Resource Utilization activities on the moon. The contest, which is part of the 2020 Singapore Space Challenge (SSC), is for youth ages 15 to 25 living anywhere in the world. Teams of up to four students from any background or discipline may register to compete.

During the development phase of the contest, participating students will receive guidance from technical experts to help them hone their design. Teams will be tasked with a final mission report, presentation to judges and computer simulation video showing their proposed design in action. The deadline to register for SSC is Oct. 30, 2020.

SSC is an international technical design competition held annually since 2007. Participants are challenged to creatively design complex space-related and advanced-technology projects for science and engineering solutions across many fields. Working in teams to solve problems developed with industry professionals, students derive theoretical models, design prototypes and create simulations of their work. Learn more and registration at: www.space.org.sg/ssc.



Above: Artist rendering of a lunar rover equipped with a leveling blade for excavating the surface of the moon. Credit:

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Last month, the team at Hawaii Space Flight Laboratory (HSFL), along with members of UH Mānoa, Kauai Community College, Windward Community College, Honolulu Community College and Kapiolani Community College delivered their Neutron-1 CubeSat for launch early this month. Their launch window is quickly approaching and we wish them a successful liftoff into orbit!

Finally, PISCES bill HB1912 was signed into law by Gov. David Ige late last month. This legislation will make some administrative modifications and corrections to PISCES and its board.

A hui hou,
Rodrigo Romo
Program Director