

Hi'ohia iā JCMT nā 'āwe'awe'a o ke ola ma Hōkūloa

Maunakea Hawai'i - Ua kūkala aku i kēia lā kekahi kime kilohōkū kau'āina i alaka'i 'ia e Jane Greaves o ke Kulanui 'o Cardiff, UK, i ka hi'ohia o kekahi lātoma laha 'ole - posapihine- i loko o nā ao o Hōkūloa. Ma ka Honua nei, i ka 'oi'enehana wale nō e puka ai kēia 'ano ea, a i 'ole ma muli o nā mū 'ike 'ole 'ia e ka maka e ahuhua ola ana i ke kaiapuni 'okikene 'ole e puka ai. 'O ua hi'ohia *posapihine* nei ke kuhi no ka mana'o ho'i 'o ke ola "eaea" i ka lewa papa lani. "I ka hi'ohia iā mākou kēia mau 'āwe'awe'a *posapihine ma ko Hōkūloa pō'ai 'auina kala, he hikilele ho'i kau!"* wahi a Jane, ka mea iā ia nā 'āwe'awe'a *posapihine* i hi'ohia mua ma ke kilo aku mai ko James Clerk Maxwell Telescope (JCMT) ma Hawai'i.

Ua kuhi mua nā kilohōkū no kekahi mau kekeke makahiki he wahi home paha nā ao ki'eki'e o Hōkūloa no nā lātoma - he lana pakele wale i ka papa wewela, me ka lako i ka wai a mahana lā, me ka 'alo ho'omanawanui na'e i ka 'akika ikaika. **'O ka hi'ohia *posapihine*, nona ka haikokene me ka posoporusa, ke kuhi nui e hō'oi'a ai i kēia ola eaea o ka papa lani.** Ho'ākāka 'ia kēia hi'ohia hou ma kekahi pepa i pa'i 'ia i kēia lā ma *Nature Astronomy*.

'O ka ho'ohana 'ia 'o **JCMT ma Hawai'i** kai hi'ohia mua i ka *posapihine* i ko Hōkūloa mau ao. A laila ua 'ae 'ia ke kime he wā e hō'oi'a'i'o ai i ia hi'ohia a lākou me 45 'ohenānā o ko Atacama Large Millimeter/submillimeter Array (ALMA) ma Kile. Kilo like 'ia 'o Hōkūloa e nā kahua 'elua ma kekahi kōā hāwewe ma kahi o ka 1 milimika, i 'oi a'e ho'i ka loa i hiki i ka maka kanaka ke 'ike - hiki wale nō i nā 'ohenānā ma kahi ki'eki'e loa no kēia 'ike hō'oi'a 'ana. "'O ka hopena, 'o ia ka like a like o ka 'ikena o nā hale kilohōkū 'elua - he omo 'āwe'awe'a ma ke kōā hāwewe pono he ea *posapihine* nō ia, kahi o nā lātoma i hō'a'ai 'ia ai i ke kā'ei kua lamalama o nā ao mahana o lalo mai'" wahi a Jane.

Mālama nā kilohōkū i nā ho'omākalakala 'ana e ho'oi'a ai inā ua kumu mai ka *posapihine* i ka hana kūlohelohe ma Hōkūloa. Alaka'i ke kanaka 'epekema 'o Dr William Bains o ka Massachusetts Institute of Technology i ka loiloi i nā hana e ho'opuka kūlohelohe ai i ka *posapihine*. No ke kukuna lā kekahi mana'o, no ka ho'opuehu minelala 'ia a'e mai kekahi papa aku, no ka luapele, a no kekahi mā'ama'ama, akā he hiki 'ole i kekahi o kēia mau hana ke ho'ohua like lihi aku. 'Ike 'ia ma ka nui loa e hiki aia ma ka hapa 'umi kaukani ka nui o ka *posapihine* i ko ka mea i hi'ohia i ka 'ohenānā. Ma ka 'ēko'a ua ho'omaopopo 'ia e ke kime 'ē no ke kumu 'ana i ka nui o ka *posapihine* i hi'ohia ma Hōkūloa, ua pono wale nō nā meaola papa lani e ho'ohua 10% wale iho nō o ko lākou ho'ohua palena nui. 'O nā lātoma na'e ma Hōkūloa he kū paha i ka 'oko'a i ko ka Honua mau hoa lātoma. Hiki i ko ka Honua mūhune ke omo minelala *posapahate*, hui 'ia me ka haikokena mai ka wai, a ho'oku'u 'ia akula ke ea *posapihine*.

Ma mua o ua noi'i nei, ua komo ka mana'o iā Dr Clara Sousa Silva, kekahi lālā kime a he mea noi'i MIT, e huli a loa'a ka *posapihine* ma ke 'ano he ea lauana meaola o ka pō'ai ola 'okikene 'ole ma nā hōkūhele pili pū me kekahi mau hōkū a'e, no ka mea 'a'ole i lawa ka 'ike o ke kemika kūmau. Wahi āna, "'O ka

loa'a o ka posapihine ma Hōkūloa he pōmaika'i ho'opū'iwa! Kū nā nīnau i kēia kaunānā e la'a me ka nīnau pehea ho'i e hiki ai i kekahi wahi meaola ke ola. Ma ka Honua, hiki i kekahi mau lātoma ke ola a i ka palena 5% 'akika o ko lākou kaiapuni - akā ua 'ane piha'ū nā ao o Hōkūloa i ka 'akika."

Hilina'i ke kime he hi'ohia kupanaha kēia i loko o ka pahu'a o nā 'ano 'imi hou a'e e hana ai i ka posapihine, koe ho'i ua 'ike nō lākou no ka 'imi hou i kekahi kūmaka 'ana o kekahi mea he "ola" he nui nā hana i koe. 'Oiai hiki 'olu'olu aku nā ana wela o ko Hōkūloa mau ao i ke 30 kekelē kelekia, ua piha 'akika loa - ma kahi o ke 90% 'akika sulufuriku - e kū ai ka nīnau pehea e o ai nō nā meaola māiki ma laila. Ke noi'i nei 'o Polopeka Sara Seager me Kauka Janusz Petkowski, no MIT i ke 'ano e hiki ai i nā meaola māiki ke kūpale iā lākou iho ma loko o nā huna kulu wai laha 'ole.

Ke ho'omanawanui pīhoihoi nei ke kime no kekahi manawa hou e hō'ōia ai i ko ka posapihine loa'a ma kekahi māhele 'ano kemepale o ke ao, a e huli i kekahi mau ea hou a'e e pili pū ana me ke ola. He mau mana'o ho'olale ko kēia hopena no ka huli i ke ola o waho a'e o ko kākou 'onaehana Poe Lā.

I ka lohe 'ana i nā hopena o kā JCMT noi'i, pane maila ka Hope Luna Ho'okele 'o Dr Jessica Dempsey, "*Kupaianaha kēia mau hopena*" a ho'omau aku "*'o kēia hi'ohia 'ana ma Hawai'i, na ka JCMT, ua ho'okō 'ia i ka maomeka nona ho'okahi kikoki'i. 'O kēia ka maomeka ho'okahi nō nāna i ho'opa'a i ke ki'i mua loa o ka Lolelipo, 'o Pōwehi. Ho'okau 'ia ka inoa 'o JCMT i ka hano ma muli o kēia hi'ohia posapihine i ka lewapuni o Hōkūloa, no ka noi'i 'oi kelakela i lawelawe 'ia e nā kilohōkū ma ka ho'ohana iā JCMT. Ua piha au i ka hau'oli i nā ho'oikaika 'ana o ko mākou po'e limahana o ne'i nei ma Hawai'i."*

Ho'ulu'ulu 'ia kahi mana'o o E'Lisa Lee, he haumāna kilohōkū ma mua ma UH Hilo nāna i hana me kekahi 'ikepili JCMT i kona wā JCMT e hana hapa manawa ana he kele 'ōhenānā, a penei kona mana'o, "*'O ka 'ōnaehana kilo ka'ina kemikala meaola e 'ōmaka ana ma kekahi mea ma waho o ka Honua, he 'i'o kona i ke kuhi maoli 'ana no kekahi ho'omaopopo i ke ola ma ka Honua, a me ke ola ma kona mana'o'i'o iho nō*" Me ka ho'omau aku "*No ko'u wā i komo ai i ke kālai ka'ina 'epekema ma ke 'ano he kele 'ohenānā ma JCMT he pā pilikino ho'oha'aha'a no'u. 'O ko'u mana'olana 'oia'i'o na ia ho'omau kilo 'ana e wehe a'e i kekahi noelo nui hou a'e i nā ao Hōkūloa a i nā mea i ka mamao hou aku.*" Aia 'o E'Lisa ma kona 'imi Laeo'o Kālaikūlohea ma ke Kulanui 'o Fresno State.

'O ia maomeka JCMT nāna i ho'ohi'ohia i kēia posapihine, ua ho'omaha 'ia kona ho'ohana a pani 'ia me kekahi maomeka hou a 'oi mio maka'ala i 'ike 'ia ma ka inoa 'o Nāmakanui. No ke āhua a'e o kēia maomeka hou, 'ōlelo maila 'o Jessica, "*E la'a me kona inoa iho, 'o ka i'a maka nui e huli mea'ai ana i ka wai kai pōuliuli, pēlā e ho'okuene ai mākou iā Nāmakanui ka mea i 'oi a'e kona āhua iā Hōkūloa i ka 'imi i kēia mea he ola ma ko kākou 'ōnaeao. 'O ka ho'omaka wale nō kēia, a 'o ka 'oi launa 'ole kēia o ko'u pīhoihoi i ke komo me ke kime na'i palena JCMT"*

Supplemental Information

This research was presented in the paper "Phosphine Gas in the Cloud Decks of Venus" to appear in Nature Astronomy.

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JCMT – The James Clerk Maxwell Telescope

With a diameter of 15m (50 feet) the James Clerk Maxwell Telescope (JCMT) is the largest single dish astronomical telescope in the world designed specifically to operate in the submillimetre wavelength region of the electromagnetic spectrum. The JCMT is used to study our Solar System, interstellar and circumstellar dust and gas, evolved stars, and distant galaxies. It is situated in the science reserve of Maunakea, Hawai'i, at an altitude of 4092m (13,425 feet).

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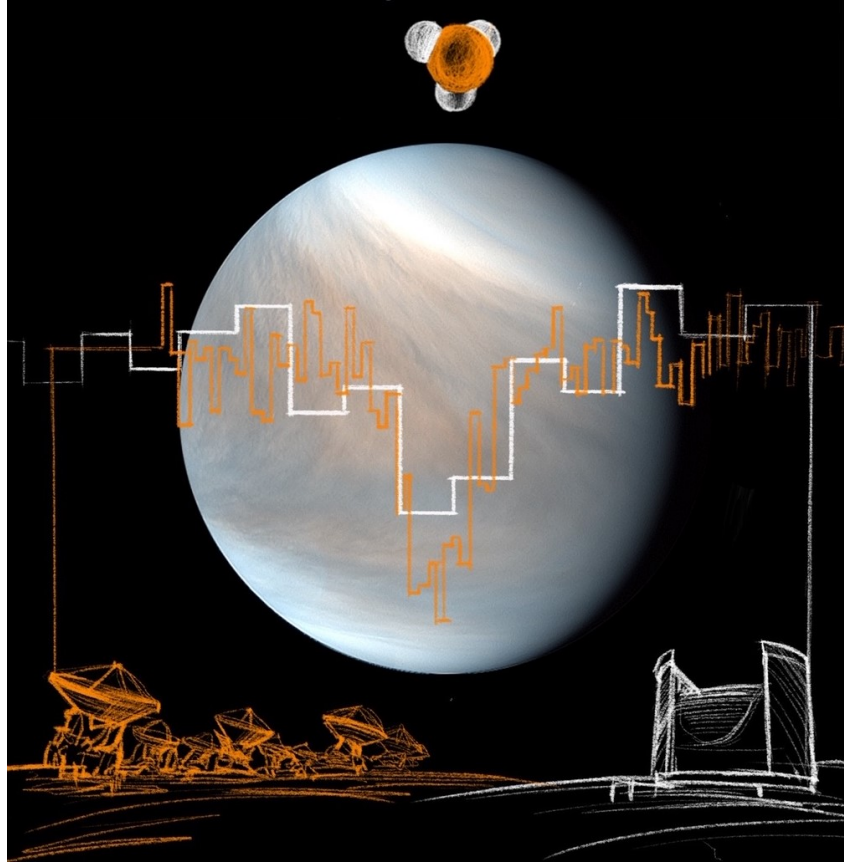
ALMA – The Atacama Large Millimeter/submillimeter Array

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of the European Southern Observatory (ESO), the U.S. National Science Foundation (NSF) and the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Republic of Chile. ALMA is funded by ESO on behalf of its Member States, by NSF in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and by NINS in cooperation with the Academia Sinica (AS) in Taiwan and the Korea Astronomy and Space Science Institute (KASI). ALMA construction and operations are led by ESO on behalf of its Member States; by the National Radio Astronomy Observatory (NRAO), managed by Associated Universities, Inc. (AUI), on behalf of North America; and by the National Astronomical Observatory of Japan (NAOJ) on behalf of East Asia. The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.

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Ki'i 1: 'O Hōkūloa ka lātoma posapihine a me ka hi'ohia posapihine iā JCMT (ke'oke'o) a me ALMA ('alani). Mea pa'i ki'i Joanna Petkowska, PhD.



Ki'i 2: Mākaukau 'o JCMT i ke kakahiaka no ke kilo 'ana me ko Maunakea aka e 'ō'ili pi'i ana i hope a luna a'e o Hualalai. Mea pa'i ki'i: Tom Kerr.