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## Historical Views on Mauna Kea: From the Vantage Points of Hawaiian Culture and Astronomical Research

### INTRODUCTION

Hawai'i currently faces unresolved sovereignty issues and their resulting polarizing effects. One such case of continuing discord involves a sacred and strategically important mountain named Mauna Kea—the highest peak in the Pacific. Traditionalists regard this mountain as the altar of Wākea, the Polynesian sky god and father of all indigenous Hawaiians, while astronomers extol its lofty summit as a premier platform for astronomical observations.

To address this conflict, the University of Hawai'i at Hilo together with congressional support established the 'Imiloa Astronomy Center, a cultural science museum and planetarium, whose mission includes bringing the Hawaiian community and astronomers together to discuss and mitigate their differences. Explored here are the background behind these issues and the unique attempt of informal education to resolve them.

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'Imiloa Astronomy Center at UH Hilo, February 23, 2010. Photo by Joseph Ciotti.

#### MAUNA KEA—A SACRED MOUNTAIN

Towering 13,796 feet above sea level, Mauna Kea is the highest peak in the Pacific basin. Measured from its base at the ocean floor, this massive shield volcano is actually the tallest mountain on earth. According to Hawaiian tradition, Mauna Kea is the mountain altar of Wākea, the celestial father—sire of the indigenous Hawaiian race. This mountain is said to protect burials of the highest chiefs, the descendants of Wākea and Papahānaumoku, who gave birth to the islands. Mauna Kea is often eulogized as Hawai'i's *piko*—the umbilical cord connecting earth and sky. In recent years, some Hawaiians have traveled to Lake Wai'au, an alpine lake 750 feet below the mountain's summit, to offer the umbilical cords of their newborns.<sup>1</sup>

In wintertime, the summit is often covered with snow—giving the mountain its name Mauna Kea, White Mountain. Reaching above 40 percent of the earth's atmosphere, its dry conditions have attracted thirteen astronomical observatories, more than on any other mountain peak on earth.

Volcanically dormant for over 4,000 years, this mountain has become the epicenter of recent social upheaval arising from disputes between those who worship its sacred altar to their sky father and those awed by its pristine views into the heavens.

## NECESSITY—THE MOTHER OF INTERVENTION

The recognition of Mauna Kea as a premier site for astronomical observations stemmed from unrelated happenstances and the necessity that followed. As is often the case, the road leading to its development and the consequential collision of cultures was paved with good intentions.

Surprisingly, prior to the early 1960s, Mauna Kea was never seriously considered a potential site for a major observatory. In fact, since the 1940s, the summit of Haleakalā on the neighboring island of Maui had been receiving the undivided attention of observational astronomers.<sup>2</sup> Haleakalā already held claim on a major solar observatory. Haleakalā's allure had even enticed world-renowned astronomer Gerard Kuiper, Director of the University of Arizona's Lunar and Planetary Laboratory, to Maui in 1963 to survey potential sites for a major observatory. So, with all of Maui's successful pioneering work in observational astronomy, why were sights eventually turned to Mauna Kea?

The answer rests with a combination of unrelated circumstances occurring soon after Hawai'i became a state in August 1959. At that time, one out of every twelve people employed in Hawai'i was in the sugarcane cultivation and processing industry. Statehood, however, brought with it the prospects of significantly increasing labor costs, which sharply contrasted with the cheaper labor found elsewhere in the Caribbean. Although sugar would continue to dominate the Hawai'i economy for another decade, leaders already sensed the impending demise of this once staple industry.

Just past one a.m. on May 23, 1960 and not quite one year into statehood, the Big Island of Hawai'i was dealt a devastating blow. Triggered by a major earthquake in Chile, the third and largest swell of a tsunami estimated at 35 feet high inundated the island's major city of Hilo—killing 61 people in its wake and destroying the waterfront businesses along the city's expansive bay. Necessity prompted the Hawai'i Island Chamber of Commerce to intervene, searching for ways to pump up the island's failing economy.<sup>3</sup>

Mitsuo Akiya, the Chamber's executive secretary, coincidentally learned of Kuiper's interest in Haleakalā and successfully persuaded him to consider Mauna Kea instead. Soon afterwards, then-Governor

John Burns released funds to bulldoze an access road to its summit. Test observations verified that Mauna Kea was a superb site for an astronomical observatory. In Kuiper's own words, the mountaintop was "a jewel . . . probably the best site in the world."<sup>4</sup> His enthusiastic pronouncement has since stood the test of time.

#### LOCATION-LOCATION-LOCATION

Energized by the race to the moon in the early 1960s, astronomy and space exploration enjoyed favored status throughout the United States. Despite its as-yet unproven record in astronomical research, the University of Hawai'i (UH) was awarded funds from the National Aeronautics and Space Administration (NASA) to build a world-class observatory to be coupled with an expanded graduate program in astronomy and a research branch, called the Institute for Astronomy (IfA).

When this author arrived at the University of Hawai'i in 1967 to begin graduate studies in astronomy, construction of this observatory was newly underway. Severe weather conditions and technical problems, however, delayed its dedication until 1970. Once in operation, the UH's 88-inch (2.2-m) telescope became the eighth largest in the world and the first to be fully computer-controlled. Word of the outstanding seeing conditions at this tropical peak spread quickly throughout the astronomical community.

By 1979, three larger internationally managed telescopes, along with two smaller 0.6-meter instruments, were operating at the summit. These included the 3.8-m United Kingdom Infra-Red Telescope, the 3.6-m Canada-France-Hawai'i Telescope, and the 3.0-m NASA Infrared Telescope Facility. Mauna Kea was on the fast track to becoming the world's finest location for astronomical observations.

During the 1980s, there existed little vocal opposition to these modern sentinels on the mountain. The directors of Hilo's Joint Astronomy Centre were well-respected and viewed as community-oriented.<sup>5</sup> The most derogatory comments at that time were references to visual eyesores: "pimples on the mountain." These were only vague hints of the impending controversy that was still to come.

By 1999, the tally of observatories had soared to thirteen, including the then-largest telescopes on earth—the two 10-meter telescopes

at the Keck Observatories. With the turn of the millennium, astronomers were poised for more even greater projects. But intervening events had already broken the trust of the Hawaiian community and created a rift between these two cultures.

By 2001 the growing dissension had reached national attention, when *Los Angeles Times* science writer Usha McFarling wrote:

The emotionally charged debate over modern and ancient uses of this rocky pinnacle is much more, though, than a fight over a telescope or a mountaintop. To many Hawaiians, nothing less than the future of their homeland is at stake. And it is a perfect example of the often-fumbling progress of science in a multicultural world.

Once prized for the clean industry and jobs they brought to this economically challenged island, astronomers are now lumped in with the missionaries, whalers, plantation owners and golf-course developers who have taken turns carving up this island.<sup>6</sup>

Vocal opposition to the development of Mauna Kea had erupted with a fury that both stunned and frustrated the astronomy community. In order to understand the undermining causes of this turmoil,



Gemini Observatory (left) and Canada-France-Hawaii Observatory (right) February 11, 2006. Photo by Joseph Ciotti.

one needs to examine the beliefs and behaviors of these two cultures in light of the volatile political situation that was concurrently surfacing in Hawai'i.

#### PERFECT STORM—THE MAKING OF A CULTURE RIFT

During the 1990s, a series of events converged to create a perfect storm that stirred up this heated dispute over Mauna Kea.

With the centennial of the Hawaiian Kingdom's overthrow approaching in 1993, vocal activism on sovereignty issues was beginning to emerge within various Hawaiian factions. When Hawai'i was annexed in 1898, the crown lands of the Hawaiian monarchy were ceded to the U. S. Federal government. These 1.8 million acres of ceded lands constitute about 25 percent of the total land area of Hawai'i. Upon gaining statehood, these ceded lands were transferred to Hawai'i and placed in trust to support among other things public education and the betterment of native Hawaiians. Disputes over the distribution of these revenues have resulted in various legal battles and social uproar.

The summit of Mauna Kea, along with its entire complex of observatories, falls within the boundaries of these ceded lands. In 1968, the UH was granted a 65-year lease on a section known as the Mauna Kea Science Reserve (MKSR), an area 2.5 miles in radius that is centered on the UH 2.2 m telescope. This includes an Astronomy Precinct of 525 acres upon which the observatories sit.<sup>7</sup> The UH leases this land for \$1 a year and subleases portions of the MKSR to all other non-UH observatories.

In an attempt to impress others over their cutting-edge instruments, astronomers often cited the exorbitant cost for observing time at these telescopes—estimated at \$1 per second. This unwittingly gave the impression that the UH had found a golden goose—which was, however, to become more of a golden noose. In contrast to the dollar-a-year lease the UH was paying, some began wondering where all the sublease funds were going. It didn't placate matters to point out that these subleases were in-kind compensations to UH consisting of 10 percent of the observing time and that non-UH facilities were also responsible for road maintenance and other support. The perception was that the UH was benefiting handsomely from these ceded lands.

It was difficult to see how this research bonanza was benefiting native Hawaiian students at UH or elsewhere.

In part, this resentment had sparked from the backfire of overstating a case. The damage had already begun. And still more was ahead. In 1993, President Bill Clinton signed the United States Public Law 103–15 (aka Apology Resolution), which formally apologized for the overthrow of the Hawaiian monarchy 100 years before.<sup>8</sup> As the *LA Times* succinctly put it:

A once fledgling Hawaiian movement has grown into a vocal political power in the islands. There are calls for secession from the United States, a return of native Hawaiian lands and, on Mauna Kea, a moratorium on telescopes and even their removal. . . . The battle over telescopes has become a chance to reclaim, symbolically and practically, ground that their people lost long ago.<sup>9</sup>

Soon after, other events conspired to widen the rift between the astronomers and the Hawaiian community and other groups, including culturalists, environmentalists and recreationalists:

- In 1994, when construction trash blew down from the observatories and was left unretrieved, the Sierra Club's complaint was reportedly met with indifference by the astronomy staff. The trash was only removed several months later after local newspaper support was enlisted. This publicity started people wondering if other environmental laws were being circumvented or decisions being made without full public hearings.<sup>10</sup>
- Studies in 1996 revealed that the habitat of an endemic alpine insect, called the *wēkiu* bug, was being destroyed by the construction of the observatories. Measuring a quarter-inch long, this recently discovered insect is found only at the summit of Mauna Kea, where it can endure extreme cold due to an antifreeze-like substance in its body.<sup>11</sup>
- Others voiced bitterness from personal experience. Kealoha Piscotta, a native Hawaiian, once worked as a telescope technician at the summit's two sub-millimeter facilities. Honoring her Hawaiian tradition, she routinely brought offerings to the family's stone shrine that she had erected on the mountainside. Several times her altar was removed—on at least one occasion reportedly by an astronomy colleague. The ultimate desecration occurred when the ashes of her aunt were strewn across the cinder landscape when the shrine was

vandalized again. While the astronomy community was not responsible for this act, it was an easy target for the understandable hurt feelings and anger.<sup>12</sup>

- Perhaps most damaging was a scathing 1998 legislative audit on the summit's management. That report essentially supported many of the claims levied by the Hawaiian and environmental communities and concluded that the IfA had "failed to develop and implement adequate controls to balance the environmental concerns with astronomy development." In response, the IfA proposed to limit access to the summit road. The community, however, saw this as a veiled attempt at self-protection rather than environmental control.<sup>13</sup>

#### BROKEN TRUST—WIDENING THE CULTURAL DIVIDE

As a result of this audit, the university initiated the development of a new Mauna Kea Science Reserve Master Plan. This time, however, the university actively sought out community input. And, unlike before, the community spoke out in numbers with uninhibited "rancor about desecration of traditional sites, blocked access to gathering and spiritual sites, and about what was widely perceived to be general disregard for the care of the mountain."<sup>14</sup>

An impartial examination of the circumstances leading to this cultural divide suggests that both parties shared the blame, albeit in different ways. It wasn't so much the different beliefs that both cultures professed, but the behavior they exhibited when confronting those differences.

The astronomers' clinical view of the summit's use was pragmatic and altruistic. It was couched in academic idealism. Surely, such a pure, intellectually-minded endeavor was evidence enough to persuade all of the summit's strategic value. Besides, the summit's astronomical discoveries mirrored the explorations of ancient Polynesian navigators. From the vantage point of the astronomers, the horizon is a barrier to be pushed back—beyond which new frontiers lie. Certainly, all people share astronomy's noble quest—to discover our origins and place in the universe.

In contrast, the community's cultural view of the mountain was steeped in heritage and spirituality. It was charged with the latent resentment of a disputed overthrow. Surely, such long-held, culturally-minded beliefs were enough to exhort all of the mountain's sacred-



ness. Besides, the summit's pristine majesty reflected the unspoiled, untouched wonders of outer space. From the viewpoint of the Hawaiian culturalists, the horizon is an embracing shelter within which heritage is safeguarded. Certainly, all people are mindful of traditions—to preserve our origins and genealogical connections with the sky.

These were certainly different philosophies, different beliefs, different mindsets—potential reasons for disagreeing, but not justification for being disagreeable. Lost in the dispute was honest dialog. Both cultures felt misunderstood, or worse, ignored. There was lack of candor for fear of offending others and overstating cases to advance one's position. Public hearings often took on an adversarial atmosphere. What was sorely needed was a non-threatening venue where these two cultures could speak frankly and without accusation of bias. That venue wasn't to appear for several more years.

The broken trust between these cultures was instigated by real and perceived causes. Among those were the following:

- *Semantic Arguments.* One of the hotly debated issues at that time was how to count the number of telescopes at the summit. The 1983 Master Plan for Mauna Kea stipulated a maximum of thirteen. By 1999, when the new Master Plan was being crafted, there already were thirteen observatories, including the soon-to-be constructed Submillimeter Array (SMA), managed by the Smithsonian Astrophysical Observatory and Taiwan. Unlike the other twelve observatories that housed one telescope each, the SMA consisted of eight movable antenna dishes, each measuring 6 meters (20 feet) across. These dishes could be positioned in different configurations to take advantage of a resolution-improving technique called interferometry. The question was whether these eight dishes counted as one telescope or eight separate instruments? Compounding the issue was the newly proposed plan to install four to six small 1.8-m telescopes, called “outriggers,” around the Keck Observatories. These were to work in concert with the two large 10-m telescopes, much like the interferometric technique used by the SMA. Astronomers claimed that these telescopes worked in tandem, so should count only as one telescope. While technically true, it was understandably viewed as the semantics of deception by the opposing side—a loophole to bypass the limit set by the initial Master Plan.
- *Overstating Cases.* As mentioned earlier, astronomers unintentionally created the illusion of being wealthy landlords by repeatedly cit-

ing the staggering \$1-a-second cost for observing time at the summit. While payment was actually made in-kind rather than cash, the overstatement was more damaging than helpful. Overstatements are rarely persuasive and frequently appear self-serving. Unfortunately, neither did the Hawaiian community escape this pitfall. In an effort to emphasize their disapproval of observatories or any other structure being placed at the summit, they often recited the claim that the summit was too sacred for even Hawaiian altars. Although none were ever found at the very peak, archaeologists had identified hundreds of shrines, burials, and culturally significant sites within the summit area. From the earliest days when Kuiper conducted his test studies, astronomers had avoided building on the summit's highest peak, called Pu'u Wēkiu. Nevertheless, the observatories were within the summit proper, and so drew constant admonition for encroaching upon land too sacred for any man-made structure. Then, in 1997 the Hawaiian community erected a spiritual altar, called an *āhu lele*, at the very peak of Pu'u Wēkiu. Had the rules changed? Or was overstatement to blame again?

- *Honoring vs. Patronizing.* The controversy already surrounding the aforementioned proposal to add several smaller telescopes around



*Ahu lele* altar at the summit of Mauna Kea (Pu'u Wēkiu), February 11, 2006. Photo by Joseph Ciotti.

the Keck facility became more inflamed when astronomers suggested naming these add-on telescopes “outriggers.” The metaphor was an innocent attempt to compare the spacefaring exploration conducted by the Keck telescope with the seafaring exploration of Hawaiians on canoes fitted with similar supporting outriggers. This reference, however, was viewed by some as condescending. A similar situation occurred at another sacred mountain in Arizona. Mount Graham (known as *dzil nchaa si’an* to the Apaches) has long faced the same controversy as Mauna Kea. In 1992, the innovative Large Binocular Telescope stirred up international protest over its originally proposed name, the Columbus Project.<sup>15</sup>

- *Self-Imposed Silence.* When community dissent escalated in the early 1990s, astronomers probably felt blindsided. Prior to then, little objection had been voiced on the development of astronomy facilities on Mauna Kea. Why didn’t the community speak up before? And why now? After all, astronomy was partly responsible for rescuing the failing economy of the Big Island. By 1996, the last sugarcane plantation had closed. Topped only by tourism, the Big Island’s astronomy industry today pumps over \$150 million into the local economy and employs over 600 workers, many from the island itself.

The Hawaiian community claimed in their defense that their voices had been silenced with the overthrow of the monarchy and their language suppressed. Indeed, from 1896 until 1986, Hawaii law (Act 57, sec. 30) mandated English as the basis of instruction in all public and private schools. Courses in Hawaiian or any other language required special authorization.<sup>16</sup> The end result significantly limited the use of Hawaiian in schools for nearly a century. In 1987, one year after the State Legislature amended section 298-2 (the successor to this English-only law), the Board of Education approved the first Hawaiian immersion classes. But was this claim a legitimate excuse or merely a rationalization? Did this self-acknowledged low self-esteem excuse the silence of the Hawaiian community or only explain it? Certainly, on this count astronomers were blameless.

At least now, the community was speaking up. The vocal dissension that arose in the 1990s had the positive effect of galvanizing the Hawaiian community into articulating the underlying causes of its resentments and demands to set them right. There were still some who vocally demanded the removal of the observatories, but public forums suggested those were in the minority.

Community input during the crafting of the new Master Plan included criticism “that native Hawaiian voices were not part of the advisory or decision making agencies. At the same time, some native Hawaiians mentioned that the voices that were loudest did not necessarily represent the majority of the community.”<sup>17</sup>

Other, more practical concerns had surfaced in the community’s overall testimony. What was in it for the Hawaiian community? How would their children benefit from these telescopes? While the majority felt that a limit had already been reached for building on the summit, the consensus was to use what you have and give back to the community. These sentiments are best summed up by several testimonies presented when the new Master Plan was being formulated<sup>18</sup>:

*“The mountain is very sacred. Some of us feel that you need to remove these structures, but I must accept them. I know that our children need the education. They are gone because there are no jobs here. Just maintain what you have now.”*

—mk, local resident

*“... this represents a crossroads of two important Hawaiian values: preserving the ‘āina [land] or protecting my ‘ohana [family]. Nothing can be found in the past that can compensate for failure in the present.”*

—sa, Keck Observatory employee

#### BRIDGING THE GAP: ‘IMILOA ASTRONOMY CENTER

The new Mauna Kea Science Reserve Master Plan was finally adopted in 2000 after more than a year of discussions and meetings. This document established a new management board that included Hawaiian representation. It allowed for the building of three additional observatories and the redevelopment of five current facilities. Perhaps, more importantly, the new Master Plan explicitly included an educational outreach component for native Hawaiians and others. The plan essentially adopted the UH-Hilo’s independently developed proposal calling for the establishment of the ‘Imiloa Astronomy Center (then called the Mauna Kea Astronomy Education Center). *Imiloa* in Hawaiian fittingly means *to explore*. The Master Plan stated:

Education, with an emphasis on outreach to indigenous community members, is a central feature of the Master Plan. Much of the philosophical framework for this finds expression in the proposed Mauna

Kea Astronomy Education Center at the University of Hawai'i at Hilo. The Center will serve to facilitate formal astronomy education and the integration of science into indigenous cultures at all levels. It also will serve as the principal center in the world demonstrating how the latest science can be integrated with indigenous cultures of great antiquity to maintain unique cultural identity and knowledge while participating at the scientific forefront of the international global society.<sup>19</sup>

The 'Imiloa Astronomy Center was conceived in late 1993 by Marlene Hapai, who would eventually become its director during most of its construction phase. Like the driving force behind the observatories, the initial motivation for establishing this science center and planetarium sprang from employment concerns on the Big Island.<sup>20</sup>

As dissension over Mauna Kea escalated during the 1990s, 'Imiloa's mission expanded to include the improvement of relations between astronomers and the community by showcasing the connections between the rich traditions of Hawaiian culture and the groundbreaking astronomical research conducted at the summit.

The University of Hawai'i at Hilo assembled a team of educators, scientists and community leaders to draw up the plans for the facility. Since 'Imiloa was intended as a bilingual (Hawaiian and English) educational center, assistance from UH-Hilo's College of Hawaiian Language Studies was enlisted from the start. One of the driving forces behind this project was U. S. Senator Daniel K. Inouye, who was instrumental in securing \$26 million of federal funds and NASA grants to design and construct the Center. The actual design phase began in 1999 with construction commencing in 2002. The facility officially opened in February 2006.<sup>21</sup>

The three large titanium-clad cones that are the centerpiece of its unique architectural design symbolize the island's three largest volcanoes—Mauna Kea, Mauna Loa and Hualālai. 'Imiloa features a 16-m dome planetarium and a 12,000 square-foot exhibition hall with over 300 displays.

All exhibits have bilingual captions. Although this doubles the amount of signage and departs from standard museum practice of minimizing text, bilingual labeling was seen as capitalizing on the revitalization of the Hawaiian language. By creating a fluent Hawaiian language setting, this approach is intended to engage Hawaiian youth in sciences while maintaining pride in their cultural identity.

The exhibits are divided into two main topics that link Hawaiian and scientific beliefs, theories and practices as they relate to Mauna Kea and the cosmos. The two themes are:

- **Origins**, which focuses on the birth of the cosmos and the beginnings of life on earth. One exhibit is a multi-media amphitheater dedicated to performing portions of the Kumulipo, a 2,000-line chant celebrating the Hawaiian creation story and genealogy. Paralleling this theme from the astronomy side is a second small amphitheater-style room that continually runs a 3D video of the Big Bang theory.
- **Explorations**, which features the tools and methods of discovery. Several exhibits are devoted to the Hawaiian canoe, wayfinding (non-instrument navigation) and the voyages of discovery made by the Polynesians. Complementing this are interactive astronomy displays where visitors engage in hands-on activities with astronomical instruments (such as telescopes and infrared cameras) and become acquainted with the pioneering discoveries being made at the Mauna Kea observatories.

By setting the cultural and scientific exhibits side-by-side in this fashion, a learning environment is created in which Hawaiian cultural contributions are cherished and validated, and astronomical research endeavors are promoted and humanized.

A major component of the 'Imiloa experience is its state-of-the-art planetarium. Designed with unidirectional seating for 120 visitors, this 16-m dome theater utilizes a fulldome projector with 3D stereoscopic capability. This digital projection system creates an immersive 360-degree viewing environment that allows audiences to vicariously experience voyaging aboard long-distance canoes, observing at the Mauna Kea observatories, and journeying into outer space.

The planetarium's signature show, *Maunakea: Between Earth and Sky*, uses parallels to compare Hawaiian culture and astronomy research as related to Mauna Kea, while also touching on the controversy over its use. Audiences are aided in visualizing the creation stories of the Kumulipo and the Big Bang. The show also covers the geological formation of the Hawaiian Islands and recounts the legend of volcano goddess Pele's flight across them towards her eventual encounter with the snow goddess Poli'ahu atop Mauna Kea. The projector's immersive, fulldome capability allows audiences to fly through the Gemini

Observatory and sail along with Hawai‘iloa on his epic discovery of Hawai‘i.<sup>22</sup>

Like other science centers and planetariums, ‘Imiloa Astronomy Center takes full advantage of the power of informal learning. Given that individuals generally spend four times as many years out of school as in, it’s no wonder that much of what we know comes from experiences outside of formal schooling. Unrestricted by the regulations of formal institutions, informal education can respond more quickly, flexibly and innovatively to the needs of a rapidly changing society.

Even the landscaping surrounding ‘Imiloa offers visitors a learning experience into Hawai‘i’s native ecosystem. The garden consists of over 50 native plants, including the “canoe” plants brought to the islands by the early Polynesian explorers. These species illustrate the variety of flora found at the different elevations on the Big Island.

‘Imiloa also collaborates with the observatories on Mauna Kea to spotlight their astronomical discoveries and make them both accessible and interesting to the public.

According to Senator Inouye:

The future of astronomy in Hawai‘i—the upgrading of equipment and a skilled local staffing pool—will in large measure depend on good relations with the community, especially those leading the efforts to advance Hawaiian language and culture. The future work opportunities for many young people growing up in Hawai‘i will require even greater preparation in astronomy and related fields. ‘Imiloa serves to unite efforts to advance knowledge of culture and astronomy, deepen understanding and respect for both, and thereby create opportunities for new generations of young people.<sup>23</sup>

The ‘Imiloa Astronomy Center attempts to leverage its mission of inspiring and encouraging Hawaiian and other students to seek careers in science and technology, while remaining grounded in their traditions of family and culture. Its partnerships with the Mauna Kea observatories, the Hawai‘i Volcanoes National Park and the National Oceanic and Atmospheric Administration (NOAA) serve to increase opportunities for informal science learning in ways relevant to the local culture—thereby bringing these two groups together as equal partners.

## 'IMILOA—ASSESSING THE IMPACT

Ka'iu Kimura, 'Imiloa's newly appointed Executive Director, was involved with the Center since its formative years as exhibits coordinator. Although no formal evaluation has been conducted yet to assess the success of 'Imiloa, Kimura is still able to cite anecdotal evidence supporting the positive impact already made by this facility five years after its opening.

She already senses a growth in the community's trust level. Suspicion over hidden agendas and backroom decisions is diminishing. People are even willing to broach the issues with her at supermarkets and other local shops. Kimura feels that 'Imiloa provides a safe, informal, non-confrontational venue for people to gather and air their differences; and this is proving more fruitful than the contentious atmosphere felt at adversarial public meetings.<sup>24</sup>

Kimura believes that the community sees the new Master Plan as providing concessions to protecting the mountain, the culture and the environment. With the plan's explicit support of 'Imiloa, the community now appears more reassured of receiving direct benefits. Having been included in 'Imiloa's construction and staffing, the community also views itself to be a genuine stakeholder and integrally involved in 'Imiloa's operation. Kimura believes that by specializing in informal educational opportunities 'Imiloa is better positioned to create ties to the community than the observatories can.

Kimura notes that 'Imiloa is playing a major role in facilitating dialog over the proposed Thirty Meter Telescope (TMT), slated as the world's most advanced optical/infrared observatory. At one of the TMT's presentations to the Hawaiian community, a resident remarked that "the (Hawaiian) culture was here before, and the culture will be here after. We need to look at today," underscoring in her comments the need for jobs and economic development for the island.<sup>25</sup>

The proposed site for the TMT observatory and its 18,000-square-foot support facility is approximately a half-mile from the summit and 500 feet below the existing base of the existing telescopes. This location was selected for its reduced impact on the surrounding natural habitats and archaeological sites as well as its outstanding observing conditions. Coupled with an advanced adaptive optics system, the



TMT's 30-meter (98-foot) diameter mirror will yield a resolution 12 times sharper than that of the Hubble Space Telescope. The TMT Observatory Corporation is a non-profit entity operated in partnership by Caltech, the University of California, the Association of Canadian Universities for Research in Astronomy, and the National Astronomical Observatories of Japan, China and India.

In February 2011, the Board of Land and Natural Resources (BLNR) of Hawai'i's Department of Land and Natural Resources (DLNR) unanimously approved a Conservation District Use Permit to the University of Hawai'i to build and operate the TMT on Mauna Kea. Over 30 native Hawaiians, teachers and students had testified at the public hearing prior to the vote, with testimonies divided equally between those for and against this observatory. The BLNR also granted the opponents' request for a contested case hearing, providing one final opportunity to make their case before a hearing officer. This hearing is expected to be concluded within six months.<sup>26</sup>

Some argue that the TMT would constitute the fourteenth observatory on the summit, in violation of the limit of 13 set in the 1983 Mauna Kea Complex Development Plan. However, in its staff report to the DLNR on the TMT's Conservation District Use Application, the DLNR Office of Conservation and Coast Lands (OCCL) stated:

... the BLNR has never established a limit on telescope development and OCCL is not aware of any carrying capacity study that would support this claim. UH-internal planning documents such as the 1983 Mauna Kea Complex Development Plan did limit the number of observatories to 13 under that plan, but we have not necessarily viewed that figure as a maximum limit or a carrying capacity.<sup>27</sup>

The OCCL also noted that the Caltech Submillimeter Observatory is expected to be decommissioned before the TMT would become operational, keeping the total number of telescopes on Mauna Kea at thirteen. Furthermore, projections over the next decade forecast that this total may actually decrease to ten.

Several labor union representatives also testified in favor of this project. At a projected cost of \$1.3 billion, the TMT is anticipated to contribute substantially to the island's languishing construction industry and create 140 permanent jobs upon completion. The TMT has also

committed itself to donating \$1 million annually to the community to be used for locally chosen education programs and scholarships.

According to Sandra Dawson, TMT's Manager of Hawai'i Community Affairs, the TMT is continuing to working closely with the 'Imiloa Astronomy Center. Besides developing cultural awareness training for TMT personnel and contractors, they are also discussing collaborations on projects that will strengthen the links between culture and science, particularly astronomy.<sup>27</sup>

If the final contested hearing finds in favor of the TMT, officials at TMT indicate that, pending funds, construction could start in early 2012 and be completed by 2020.

## CONCLUSION

Informal venues hold the potential to serve as conduits for mitigating cultural differences. At least in this one particular instance, by bringing astronomers and the Hawaiian community together in the safety of an informal environment, the 'Imiloa Astronomy Center has demonstrated initial success in mitigating the controversy over Mauna Kea. If the current success of 'Imiloa Astronomy Center is any indication, other communities experiencing similar disputes—such as, in Arizona over telescopes on Mount Graham or on Maui over Haleakalā's choice for the Advanced Technology Solar Telescope—may consider adopting this facility's approach as a model for overcoming their own differences.

## NOTES

A version of this article appeared in the on-line journal *Forum on Public Policy: A Journal of the Oxford Round Table*, Vol. 2010, No. 2. *Art and Science* (posted September 2010).

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