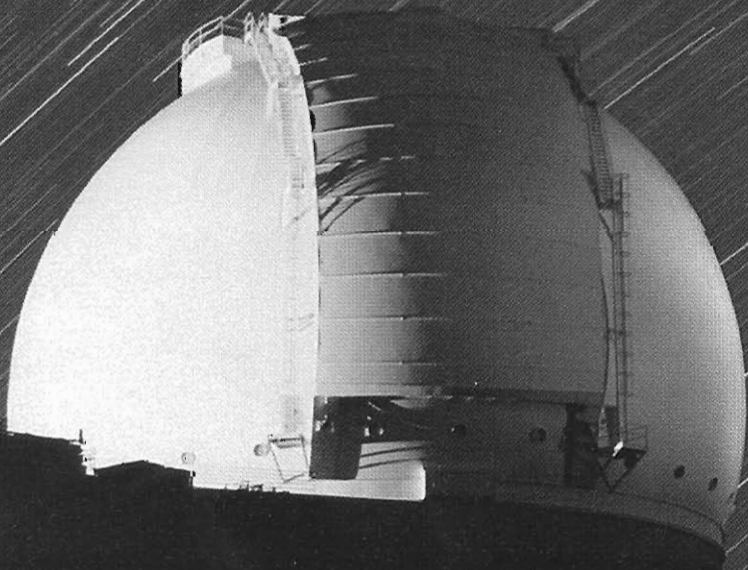


# On Top of the World

*Hawai'i's tallest mount is a  
monument to discovery*

*By Anton Zuiker*



Breathe slowly and deeply, or your head will begin to spin. The air here is thin and cold, with an average daily temperature of 37 F. Altitude sickness can double you over with nausea and fatigue. But when the retreating sunset finally gives way to darkness, the silence and star-lit snow of Mauna Kea's summit will leave you breathless more from wonder than lack of oxygen.

Atop Mauna Kea ("White Mountain"), you stand on the planet's tallest peak, 33,476 feet from the ocean floor. Though the crests of the Himalayas, Andes and European Alps reach higher into the atmosphere, Mauna Kea at 13,796 feet above sea level is a pinnacle unique in other ways.

Kids play "King of the Hill" because the top is where the best belong. Even gods once fought to reside on the remote reaches of Mauna Kea: snow goddess Poli'ahu, with ice-age glaciers, banished fiery Pele to nearby Mauna Loa and Kīlauea. Ancient Hawaiian stone masons found the island chain's best basalt for tools here, and contemporary astronomers now conduct their searches from this perch.

On Mauna Kea's lower slopes, camouflaged infantrymen crisscross the Army's Pōhakuoa Training Area, their gunfire echoing among the cabins of nearby Mauna Kea State Park. Farther down the mountain, 'io (Hawaiian hawks), and wild quail trespass on Parker Ranch land, the largest privately owned cattle ranch in the world. You can four-wheel drive around vast Mauna Kea on Keanakolu Road, which girdles the mountain and ends in the upcountry town of Waimea. The state Keanakolu cabin is off this road among pastureland and giant old *koa* trees.

In a former Army communications command post at 5,500 feet, the Girl Scouts have their own cabins, Camp Kilohana. As if to honor the summit 8,000 feet above, they loosely translate *kilohana* as "superior vantage point where the stargazer will obtain the breath of life."

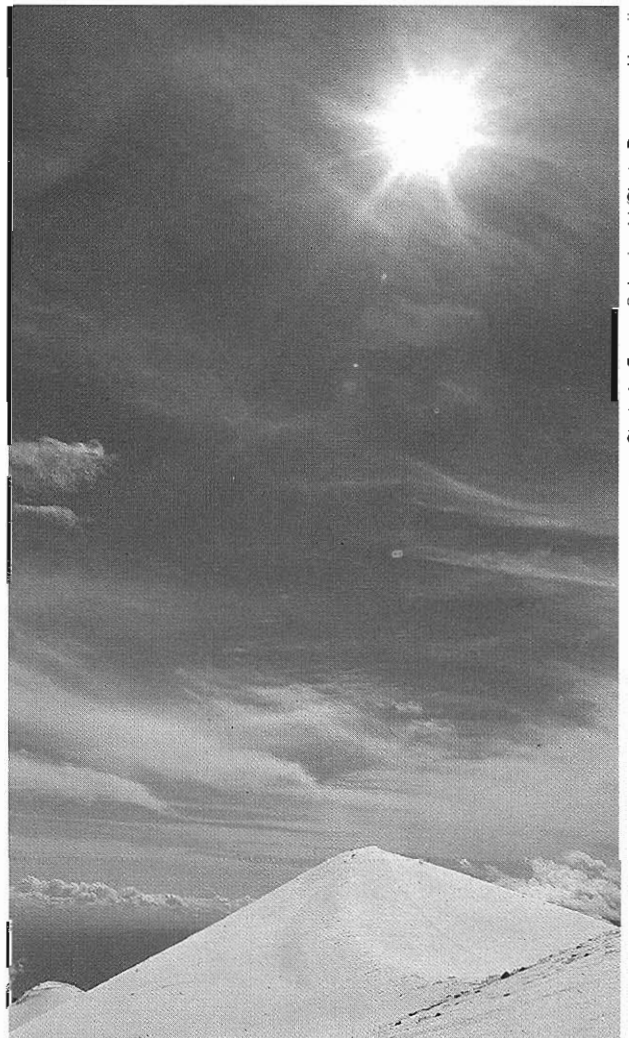
### *Far and above*

They're correct about the advantages of the summit. Dry, dark and cold, it is perfect for observing the heavens. Since 1964, the international astronomy community has ascended Mauna Kea to build precision telescopes. Each evening as sunlight fades and stars blink awake, a cluster of the world's biggest and most advanced telescopes open their eyes and allow astronomers glimpses into the distant universe.

"It's certainly the largest collection of mirror surface," says Walter Steiger, a University of Hawai'i physics professor and pioneer of astronomy on Mauna Kea and Haleakalā. Ten working telescopes—optical, infrared and radio—make up that collection, scouring the night sky for evidence of the Big Bang, an expanding universe or new, unimagined discoveries.

In astronomy, the larger the diameter of the mirror, the farther you can see; with its

10-meter mirror, the W.M. Keck Observatory is the largest optical telescope on Earth. "I think it's going to work up to expectations," says University of California, Berkeley scientist Jerry Nelson of the \$94 million telescope he designed. Its engineering tests almost complete, the telescope will soon offer astonishing pictures of what the universe was like as far back as 10 billion years ago, when light from very distant stars began to journey toward Earth. Those very faint light beams are reaching Earth only now, giving us images of stars that may no longer exist.



The Earth's closest star shines on the snow-capped summit of the Big Island's Mauna Kea.

Photo by Franco Salmoiraghi/Photo Resource Hawaii



Even the best observatories can be blinded, though, by atmospheric dust or city lights. Surrounded by water, Mauna Kea has little dust, but sometimes vog—volcanic gases from Kīlauea—can tint the sky and obscure the elusive stars. “We can’t do anything about that,” says Nelson, who is also concerned that the proposed Ka’ū spaceport would introduce chemical air pollution. To prevent light pollution, in 1988 Hawai’i County passed an ordinance restricting all new lighting on the Big Island to shielded low-pressure sodium lamps.

Steiger and his fellow UH physics and astronomy professors realized in the early ’60s that Mauna Kea could become a premier astronomical site, and the state rewarded them with the right to manage the summit and its development. (State plans restrict the summit to 13 telescopes, a limit to be reached by the year 2000 with the addition of Keck II and telescopes for Japan and the Smithsonian Institute.) The university’s Institute for Astronomy oversees the summit, its telescopes, and Hale Pohaku, a dormitory-style base camp at 9,300 feet for visiting scientists.

“The University of Hawai’i is unique in the world; it has more access to more telescopes than any other school,” says Steiger. “Any institution wishing to build on Mauna Kea must agree to 10 to 15 percent of the viewing time for UH.” With this precious time, and four telescopes of its own, the UH graduate program is one of the leading schools of astronomy in the world.

In the near future, fiber optic cables will connect schools statewide to the observatories, allowing students to see on televisions what the telescopes see at night.

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Amateur star searchers can visit the Onizuka Center for International Astronomy, just below Hale Pohaku. Here, Don Burciaga operates a visitor information station, where each Saturday and Sunday at 2:30 p.m. he begins a free guided tour of the summit and the UH telescopes.

Visitors must get themselves to the summit in four-wheel-drive vehicles, since the steeply graded road is difficult for regular cars. (Rental cars are prohibited from driving on Saddle Road, the only public access to Mauna Kea Summit Road.) The way up is bumpy at first, until you reach the \$13 million paved road that rings the summit. Warm clothes and plenty of liquids help to stave off the cold and altitude sickness.

After the summit tour, Burciaga and the group return to the visitor center, where they warm up with coffee and look at wall displays that explain some of Mauna Kea’s intriguing features: Lake Waiau, at 13,020 feet, the third highest lake in the U.S.; the tiny *wēkiu* bug, a scavenger that feeds on dead and dying insects blown up to the top; endangered birds, including the rare *palila*, which nests and feeds on the seed pods of the recovering *māmāne* trees; and feral goats and sheep that eat the *māmāne* seedlings, but provide targets for local hunters.

Later in the evening, Burciaga presents the mountain’s story, and then lets everyone stargaze through an 11-inch telescope.

continued...

## Mining the mountain

Long before Galileo used the first telescope, Hawaiian craftsmen were braving the vicious winds of the white mountain to extract black basalt for adzes, stone tools used for cutting and chopping. While each of the Hawaiian Islands had at least one adze quarry, most were on the Big Island, where Mauna Kea's *Keanakāko'i*—"cave of the adze makers"—yielded the finest rock.

"The mountain of Mauna Kea is unique in the Pacific because it has seen periods of glaciation," says Paul Cleghorn, who served as research assistant on the 1975-76 Bishop Museum archeological excavation of Mauna Kea. "When the volcano erupted underneath the ice cap, the magma cooled very rapidly and produced a very dense basalt."

When the last ice-age glacier retreated and melted about 10,000

years ago, a path of this basalt littered the mountainside, directing craftsmen to the quarry locations between 9,200 and 13,000 feet. Here, in a 7½-square-mile zone that is the only known evidence of Polynesian presence above a snow line, they lived in rock shelters, built religious shrines and mined the quarries to produce the finest adzes in all Hawai'i.


"There were literally thousands of adzes manufactured up there," says Cleghorn. The Mauna Kea *Keanakāko'i*, in use from A.D. 1100, was abandoned around 1700, nearly a century before European contact.

Part of Burciaga's presentation at the Onizuka visitor center tells the history of adze-making on Mauna Kea, and artifacts of that stone-age period are on display at the center. Today, the quarries are protected archaeological sites off-limits to visitors.

## Cold fun

Some visitors come to Mauna Kea not for history or heaven, but to frolic in the snow. Here, snowstorms blanket 100 square miles of skiable terrain between late November and early July.

"It's not a beginner's mountain," warns Chris Langan, who operates the only ski guide service authorized by the state. With no ski lifts snaking up the mountain, Ski Guides Hawai'i shuttles skiers to the summit in four-wheel-drive vehicles and retrieves them at the bottom of the snowfields.

"People from all over the world find us," says Langan of those who come to paradise to ski. The seeming paradox of snow skiing within sight of Hawai'i's famous beaches is exactly what makes Mauna Kea so peerless. To be at the top, to breathe deeply the cold, pure, thin air and to watch the sun set on the world below, can make anyone feel like king of the hill. 

*Snow conditions on Mauna Kea are usually what skiers call "corn snow"—less than ideal, but still good enough to enjoy the novelty of skiing in Hawai'i.*



Photo by G. Brad Lewis



# Reaching for the Stars

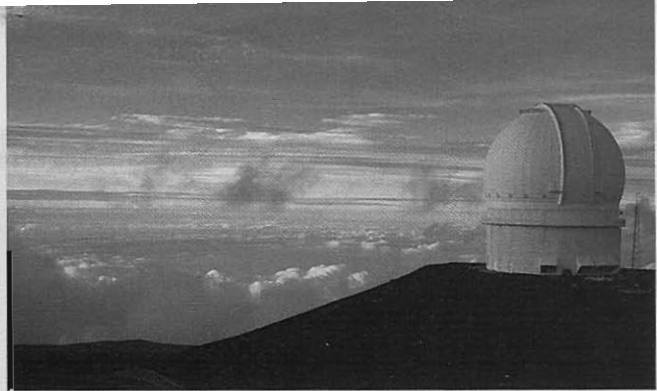


Photo by Anton Zuiker

"I've got to hold on," I think, in the thin, cold air. Wrapped in a winter parka, I'm shivering on the catwalk high inside the W.M. Keck Observatory, trying to comprehend what the guide is saying about the telescope mirror 25 feet below us. Consisting of 36 separate segments arranged in a hexagon, this is the largest mirror yet for optical astronomy. It's to be tested this night to make sure the pioneering design can be controlled with computers. So far, all the tests have proven that it will produce the clearest images of our universe ever collected.

Seven hundred metric tons of steel and concrete separate the universe and this \$94 million telescope. Outside the dome, the summit of Mauna Kea is just about freezing, and inside the observatory it isn't much warmer. Even here the air is automatically cooled to keep the mirror from fogging up. Being in the observatory is a chilling experience.

In the artificial cold, the mirror hangs silently in its scaffolding, patiently awaiting Jerry Nelson to open, pivot and aim the telescope at some distant galaxy. Nelson, the astrophysicist from the University of California, Berkeley who designed the daring Keck telescope, is downstairs preparing for the night's test. "It's faint stars we're after that nobody else can pursue," he says,

moving lithely about in his red checkered wool shirt, warmly confident that his gamble will pay off.

Inside the control room, Nelson phones the other observatories on Mauna Kea to ask for their readings of the outside humidity, since both of the Keck's devices for measuring moisture in the air have recently broken. The dome won't open tonight until the humidity level outside drops, so we sit patiently before the 20 dark computers that operate the observatory. The telescope is not visible from the control room.

While we wait, I practice mountain climbers' breathing techniques to get sufficient oxygen into my body. A song by the group Breathe comes on the radio, which picks up Honolulu stations clearer than I can from my Makiki apartment. Being high has its advantages.

Later, we sit in the kitchen drinking fruit juice, and Nelson talks about his creation. "We're going to discover things we have no ideas about."

The chance for new discoveries will be even greater when the telescope now under construction next to the Keck begins searching the skies. The Keck II, identical to Keck I, will be ready in 1996. Astronomers will then be able to experiment with optical interferometry: light from both telescopes will be focused together—like looking through binoculars—to produce an image ten times clearer than with a lone telescope.

Outside, the Keck Observatory glows beneath the stars. Nelson's words echo in the icy air: "Sometimes I actually say, 'Wow, this is neat. I'm looking at stars no one's ever seen before!'"

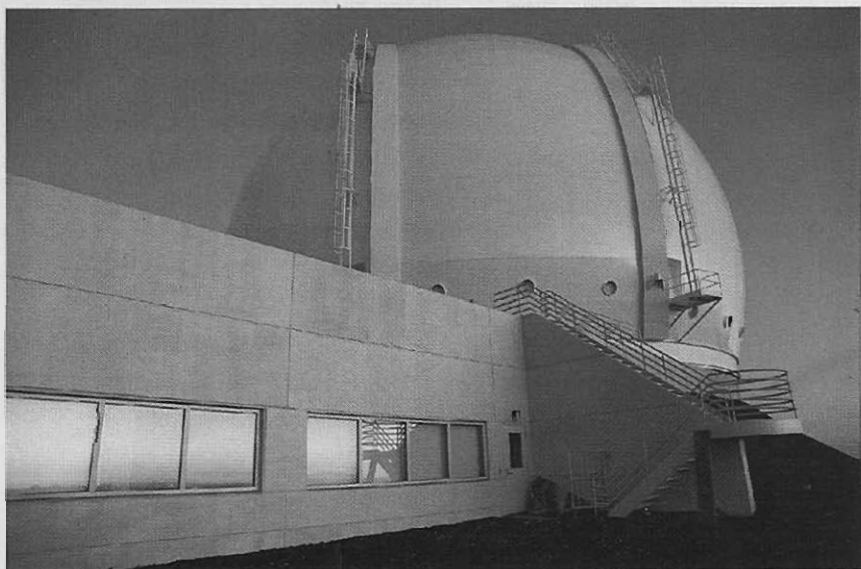


Photo by G. Brad Lewis/Photo Resource Hawaii