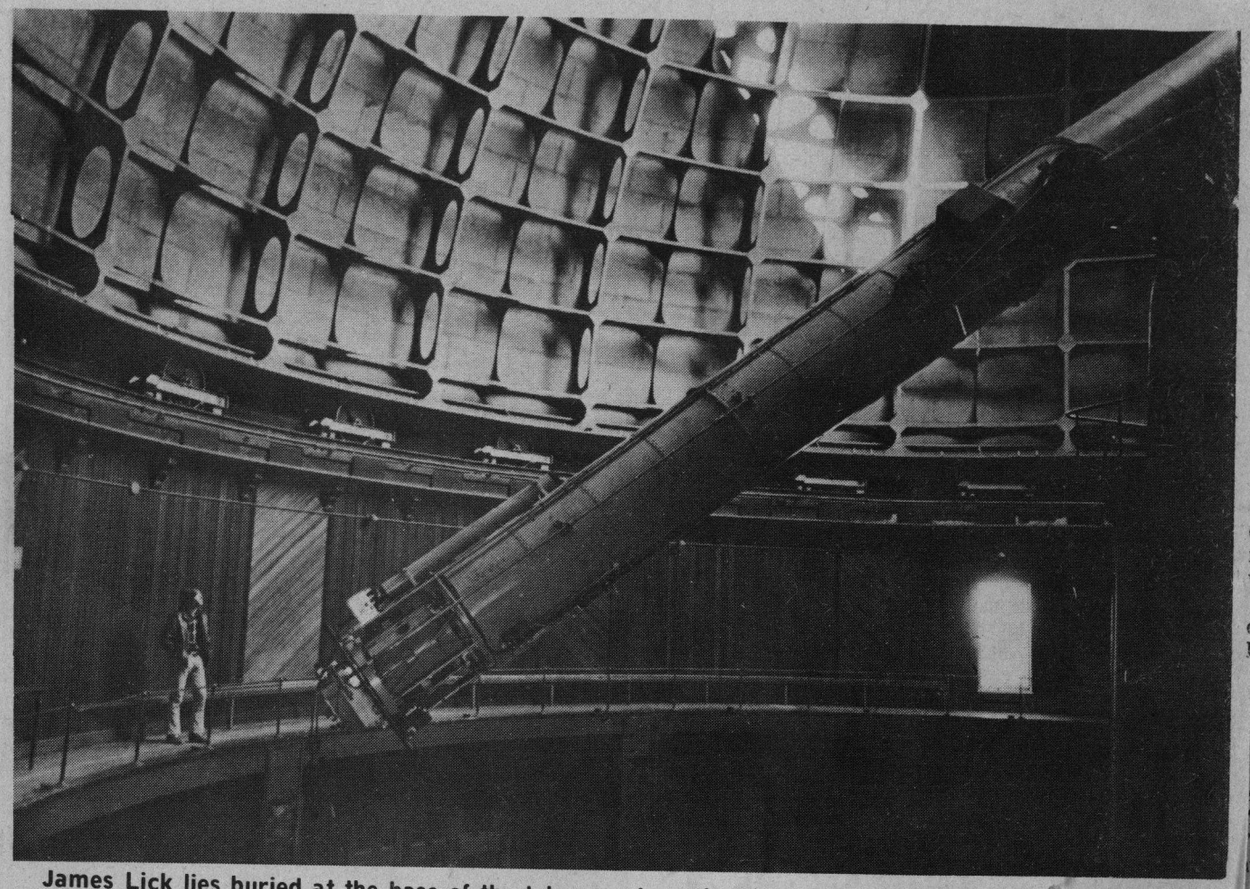


James Lick lies buried at the base of the telescope he ordered built for the University of California.

Lick—an eye on the universe

By BILL AKERS

From the top of Mt. Hamilton the view is spectacular, whether you're looking down into the valley, eastward toward the Sierra Nevada or out into the night sky.

From atop the 4,200-foot peak you can see north to Mt. Tamalpais in Marin County and south to Junipero Serra peak near Big Sur. On a clear day you can easily make out Half Dome in Yosemite with seven-power field glasses — 120 miles away.

Skyward, your view is limited only by the light-gathering power of the massive 120-inch reflector telescope—fourth largest such instrument in the world.

Mt. Hamilton is the home of the University of California's Lick Observatory, one of the most distinguished institutions of its kind. The site consists of 3,300 acres of University-owned land lying athwart the ridge which makes up the crest of the mountain. Spaced along the ridge are the domed buildings which house the 120-inch reflector and smaller telescopes, service buildings and the homes of the 45 men, women during the Gold Rush days — to make the commitment to do so in 1875. It was Lick who chose the site and gave $700,000 to buy it, build the buildings and construct a telescope "superior to and more powerful than any telescope yet made." And he ordered the whole works to be turned over to the University when completed. This was accomplished in 1888. From that time on all great observatories have been put on mountain tops.

For 10 years the telescope Lick commissioned — a 36-inch refractor erected in 1888 — was the world's largest and most powerful until a 40-inch refractor was built for Yerkes Observatory in Wisconsin. Lick's first telescope is still in use today, a major research tool which is put to work on every clear night of the year. Lick, who didn't live to see the observatory he established, lies buried beneath this massive instrument.

(There are two types of telescopes — refractors and reflectors. A refractor is what one generally thinks of as a "telescope." It has a lens, or set of lenses, in the

intricate electronics equipment attached, these instruments scan the sky on every clear night to chart galaxies, measure the distance to stars, their age, how hot they are, what they are made of, and to discover what new secrets lie in the great gas clouds which light up — or in some cases, obscure — vast areas of space.

The use of the telescopes are scheduled three months in advance, with each astronomer putting his bid in for three-night blocks best suited to the kind of work he is doing. Some need dark, moonless nights while others can work in the light of the full moon. The risk they all take is to schedule dates for one of the telescopes, only to arrive at the observatory and find it overcast or raining or the "seeing" so poor that direct observation is useless. ("Seeing" is a term used to denote generally the prevailing atmospheric conditions, such as air turbulence, which determine whether the images will be strong and sharp or indistinct and unstable.)

But when conditions are right,

among the silver domes which dominate everything, a complete community "just like any other small town — only more so," in the words of John Baumgartner, the man in charge of keeping the equipment functioning and the community supplied and operating.

In addition to the observatory buildings and the homes in which the nine families live, are a small, homey dining room, Post Office and one-room school in which Mrs. Baumgartner teaches nine children ranging from kindergarten through eighth grade.

Mail and supplies come up the hill once a day, and the people make shopping forays in the valley on a once-a-week average. The Baumgartners, who have lived on the mountain for nine years, usually make it to town every weekend.

There are the usual community activities — a Halloween party, for instance, and Christmas party at the school. In the spring there is a full-fledged commencement exercise even if the

nergy and no one knows why.

The object they searched for nd found is believed to be the most distant recorded object in he universe — perhaps 10 billion light years away — and is traveling at 90 per cent of the speed of light. The light and radio waves they recorded began their journey through space long before the earth and sun even existed.

Two astronomers — Wampler and J. S. Miller, developed sophisticated instrumentation incorporating a TV camera and revolving disc which, used with the 120-inch reflector, enabled them to get the first-ever pictures of the pulsating flashes of a pulsar (pulsating star) which lies at the heart of the Crab Nebula, itself one of the most spectacular displays in the heavens.

More recently, George Herbig, professor of astronomy and astrophysics at UCSC, "saw" something which no one else ever had. While analyzing the spectrum of Comet Kohoutek, Herbig discovered evidence of the presence of water molecules

significance of which must await further research.

Although Kohoutek was a dismal failure in the minds of the general public it was, scientifically, the most significant event of its kind to take place. Because of the advance notice the scientists had, it was the most observed comet ever to swing by the sun. It was observed from space by the astronauts and by radio telescopes. It yielded a mass of information that astronomers will pore over for years to come.

(Much of the daily information the public received during Kohoutek's pass came from Lick and from the observations of Herbig and Eugene Harlan, an astronomy specialist there.)

Instrumentation developed at Lick for study of quasars enables Lick's scientists to overcome another man-made blight — the

over the mountain top in gusts to 50 miles an hour, rattling the 90-ton dome, the illusion of having stepped back in time is heightened.

If the old telescope is Jules Verne, the newer 120-inch reflector is pure H. G. Wells — starkly modern and awesome in its massiveness. One of the visitors said as he took his first look at it, "It looks like if you pointed it down in the valley you could erase San Jose." But even while standing under it one doesn't get a true appreciation of just how big it is.

Herbig describes the telescope as a kind of bargain basement affair. The 10-foot Pyrex disc from which the mirror was ground was a sort of castoff. It was a test blank cast to test the equipment for making the 200-inch Hale mirror now at Palomar, the world's largest

the blank from Cal Tech in 1951, brought it to Lick and for less than $3 million the mirror was ground, polished and coated, auxiliary equipment bought and the telescope and observatory built. It would cost many times that to duplicate it today. Because it was built on a shoestring it doesn't have some of the refinements of the newer, larger telescopes, but it gets the job done, nonetheless.

The full and fascinating story of this telescope, and of the history of Lick and the work done there, is contained in a handsome 36-page booklet put out by the University. A greater understanding of the place and the science of astronomy can be gained by reading the booklet, but the true feeling of it can be experienced only by visiting there.

It's a long drive up the moun-

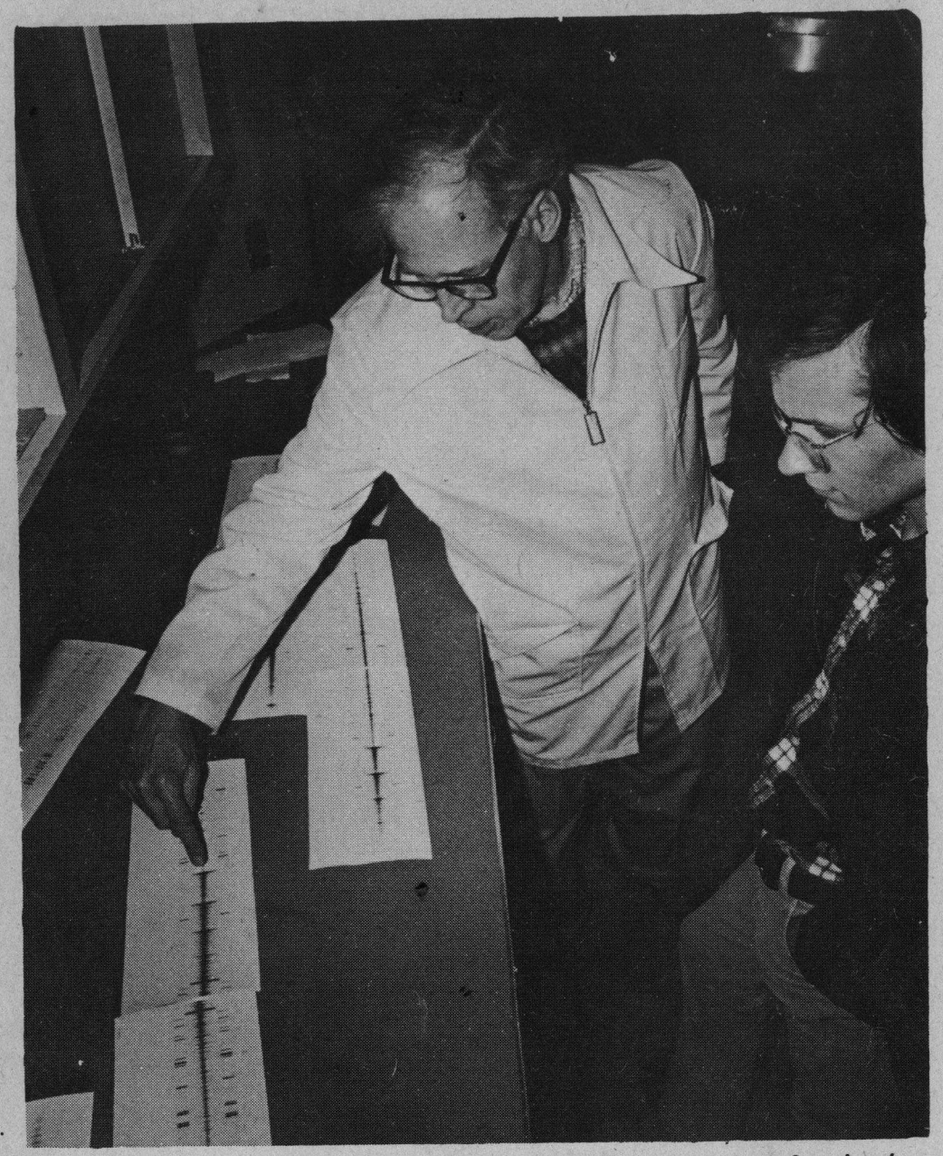
A savant's view

s short history UCSC has ited many fine cultural , the latest—and perhaps of which is a limerick st inspired by Comet tek among members of the omy and astrophysics ment.

ng the entries posted on illetin board, that of George g, the Lick Observatory omer who did much work houtek during its brief pass, erally conceded to be the r.

te Herbig in an ode to the t's discoverer, Lubos utek:

uoth a savant both wise enlightened,
Please, Lubos, you musn't frightened.
A scandal, it ain't,
Your comet's not faint,
'Tis merely the stars that ve brightened.



"That's San Jose." Lick astronomer George Herbig explains how San Jose's streetlights showed up on a spectrum of Comet Kohoutek.

and children who live there the year round. Until 1965, when the observatory headquarters and shops were moved to the UCSC campus, more than 100 people — astronomers, employes and their families — called the mountain-top their home.

The observatory has logged many "firsts" in its time — one of which is its very location. Construction started in 1880 on what was to become the first full-fledged, permanent observatory ever to be located on a mountain-top. Until that time, observatories were usually located near centers of learning with little regard for the quality of observing conditions. As far back as the early 1700s, Sir Isaac Newton had the idea of putting observatories on high elevations, but it took James Lick — a real estate speculator in San Francisco

tube. These lenses gather the light and focus it at the lower end of the tube where it is viewed through a magnifying eyepiece. The reflector is just that — a large mirror at the lower end of the "tube" which gathers the light and reflects it to a focal point where it is viewed through the eyepiece.)

Also still in use is a 12-inch refractor given to the observatory in 1882 by a wealthy amateur astronomer from New York. It is really the first telescope put to use at Lick.

Completing the battery of instruments are the 20-inch Carnegie astrograph — a pair of 20-inch reflectors mounted side-by-side shotgun style; the 36-inch Crossley reflector; and the 22-inch Tauchmann reflector. With cameras, spectrographs, photometers and a staggering array of

the astronomer spends the afternoon of his first night checking out the telescope and auxiliary equipment; and then — armed with a Thermos of hot coffee and clad against the cold of the drafty, unheated domes — spends the night in splendid, dark isolation measuring the universe. The daylight hours and the days between visits to the mountain top are spent in analysis of the information gathered.

Lick is reached after a 45-minute drive up a twisting, two-lane road which leaves the valley floor near the Eastridge shopping center in San Jose and wends its way through some lovely, largely unspoiled country. On a sunny day the drive is as beautiful as the view from the top. It may also be a mite nerve-wracking for the timorous, for the grade is steep and the curves are sharp.

Once on top, a visitor finds

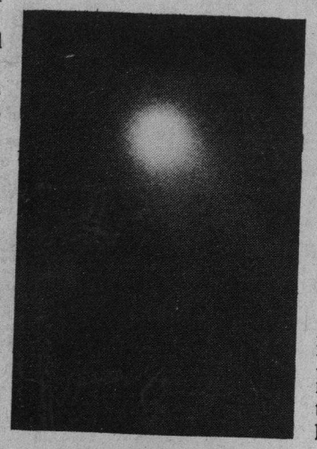
one student.

Scientifically, there's something going on all the time, and it is out of all that work that some of Lick's other "firsts" have come:

The National Aeronautics and Space Administration (NASA) chose Lick as its partner in an experiment with laser beams during the first moon landings. A pit — now dubbed the "swimming pool" — was dug at the base of the 120-inch reflector to house equipment to record the reception of laser beams sent from the moon and picked up by the telescope.

It was at Lick a quasar (quasi-stellar radio source) was first identified by astronomers E. Margaret Burbridge of UC, San Diego and E. Joseph Wampler of UCSC. Quasars are among the most baffling of stellar phenomena, for they generate incredible amounts of radio

— something never before found in a comet. This was believed to be a major discovery, the true



Comet Kohoutek as photographed at Lick.

light from the cities which intrudes into the night sky. Although the wall-to-wall shimmer of lights on the valley floor make San Jose beautiful at night when seen from a mountain top, to the astronomer it is a serious problem which threatens the usefulness of observatories everywhere. As an example, the spectrum of Kohoutek acquired by traditional photographic methods contained heavy black lines which Herbig identified as coming from the sodium and mercury vapor street lights in San Jose.

To overcome the problem, a method was developed at Lick of linking a variety of electronic instruments and a computer with telescopes by which the city lights can be "culled" from the spectrum, thus giving the scientist a true picture of the object he is observing.

All of this is of intense interest to the astronomer, but mostly meaningless to the general public. But there is much at Lick that all but the totally disinterested would find fascinating.

Although it is a major scientific facility, Lick is remarkably open to the public. In fact, 35,000 people a year make the long trip up the hill to visit the place. On every clear Friday night during the summer, visitors are given a look at some of the wonders of the universe through the 12 and 36-inch refractors. (Tickets may be obtained without charge by writing Lick Observatory, Mt. Hamilton, Calif., and enclosing a stamped, self-addressed envelope.)

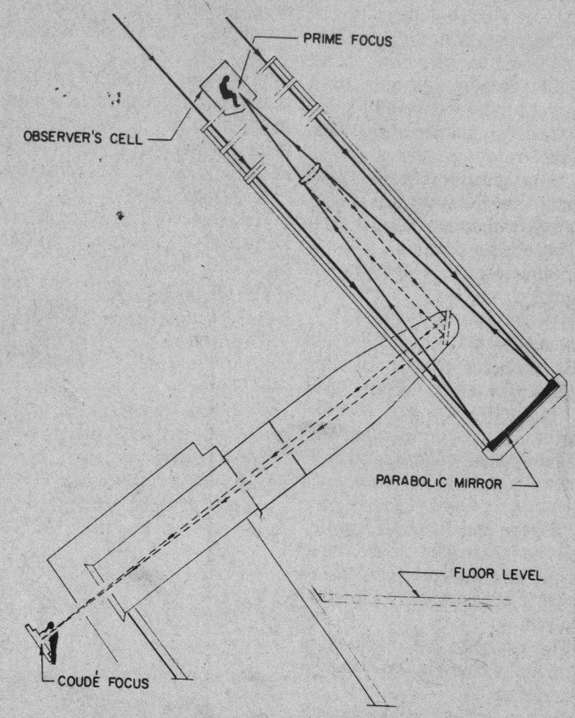
By day the observatory is open from 1 p.m. to 5 p.m., and on weekends there is a guide available to show visitors around.

A tour of the facilities at Lick are a study in contrasts. There is the original building which houses the 36-inch refractor, and which was built of brick made on the spot. The iron dome is the original one installed when the building was constructed. The wooden floor under the 58-foot long telescope which follows the eye-end of the instrument vertically for 17 feet, at one time was raised and lowered by an ingenious water-powered system. Electric motors now do the work.

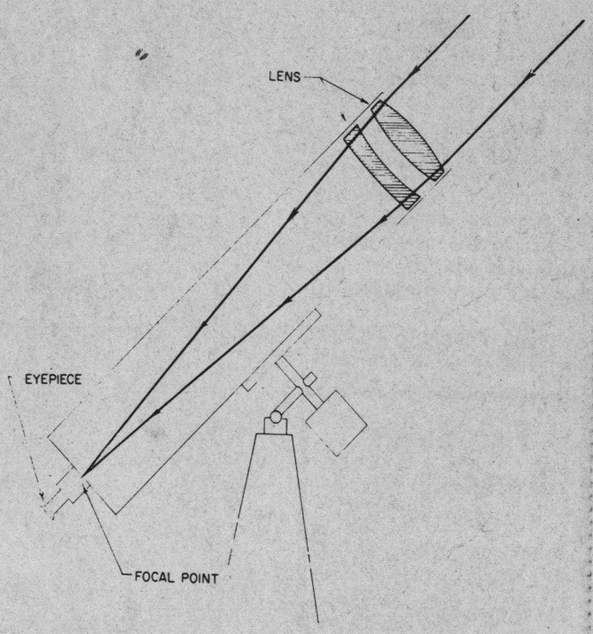
As one walks up to the base of this marvelous instrument, the 1880s style of architecture and design makes one feel he has stepped into a laboratory in a Jules Verne story. On a winter's night when the wind's whistling

telescope. The University bought

tain, but it's well worth it.



In the 120-inch reflector, the light rays converging after reflection from the main mirror may either go directly to the "prime" focus, or after reflection from two smaller auxiliary mirrors, to the spectroscopic laboratory at the "coude" focus.



The path of light rays through a refractor. The eyepiece may be replaced by a photographic plate, or by other devices.

The 120-inch reflector. "It looks as if . . . you could erase San Jose."