

Air and Space this Week

Item of the Week

Lick Observatory

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[KEY WORDS: Lick Observatory SCU Lightning Complex Fire Mt. Hamilton]

Last week's A+StW had an item about the Lick Observatory, atop Mt. Hamilton, outside of San Jose, CA and its very close call with the SCU Lightning Complex wildfire. Lick has been an important observatory for well over a century, so it, and its close call, rate the "Item of the Week" treatment.

I had briefly mentioned some of the noteworthy telescopes that have been used at Lick since its construction (it opened in 1887), including an Alvin Clark 12" refractor, from a company revered for the optical quality of their lenses, and another 36" refractor, in use since 1888. I also mentioned the 120" instrument that graces the summit of Mt. Hamilton today, but apparently I had "refractor" on the brain and typed it again there, instead of correctly identifying the 120" telescope as a reflector. I always welcome feedback of this type, as it makes for a better product. With so many experts and enthusiasts on the distribution list, you make a pretty tough audience to slip an error by! In this case, the feedback came from an astronomer who had conducted research at Lick and actually resided in the observer's house that was, sadly, destroyed in the fire. Thanks, again, and I appreciate the interest in A+StW!

Like many of the early major telescopes and observatories, the original funding for Lick Observatory did not come from any government entity, but rather it came from an independent philanthropist. In this case, his name was James Lick, who knocked around as a carpenter and piano maker before making his fortune in San Francisco real estate (he eventually became the richest man in California). Lick was somewhat eccentric, and thought about building a pyramid tomb for himself in SF, but opted instead for a great observatory, where [he is buried](#) at the base of the 36" Great Lick telescope.

The logistics of getting construction materials to the observatory site in the era of transport in mule-drawn wagons were formidable; the road built for that purpose remains today as CA 130, a very pleasant afternoon drive from San Jose.

The first telescope at Lick was the 12" Clark refractor, and one of the first on-site astronomers was Edward E. Barnard. The house on nearby Kepler Peak that recently burned was his back then. Barnard had excellent vision, and he discovered a number of comets during his career, starting early in 1876. Comet hunting was quite the rage at that time, and [H.H. Warner](#) (a purveyor of fire-proof safes and then patent medicines, the bottles of which are now highly-prized by collectors) offered a \$200 award for each new discovery. Barnard found five during

the award period, and used the money to build a house. He would ultimately discover 16 comets.

The 36" refractor saw first light the next year, 1888. At the time, it was the largest refracting telescope in the world, eclipsed only by the 40" at Yerkes Observatory, in 1897. One of Alvin Clark's sons ground the lenses, and their optical quality was characteristically high. Barnard used this telescope in 1892 to [discover Amalthea](#), the first new moon of Jupiter discovered since Galileo. Amalthea was also the last planetary satellite discovered by visual observation.

For a list of the major astronomical discoveries made at Lick Observatory, see [here](#).

Lick Observatory was turned over to the University of California system in 1888, and it became the first permanently-operated mountaintop observatory ever. Barnard wanted as much telescope time as he could get, and would have run-ins with Lick's first director, [Edward S. Holden](#) (by accounts a difficult boss) over that and other issues. As a result, Barnard joined the faculty of the University of Chicago in 1895, and observed from Yerkes Observatory in Wisconsin (the subject of a previous item). At Yerkes, Barnard made many observations with its 40" refractor, specializing in dark nebulae (clouds of gas/dust that obscured the light of more distant stars/galaxies). He also discovered a star with an unusually-large *proper motion* across the sky, which bears his name. Its "rapid" motion, [easily seen](#) in observations a few years apart, is due to it being the second-closest star system to Earth.

Lick Observatory's move to the UC system in 1888 came at the same time Lick was tapped by the Southern Pacific Railroad to supply data for Railroad Standard Time. Standardization of time and time zones at the national level had not yet been established prior, but railroad trains moved quickly enough east and west to make a timetable based on local solar time impractical, so standard time and time zones were required. Lick had a special clock built for that purpose, and the telegraph infrastructure necessary to get time signals to remote stations in real-time. The U.S. Naval Observatory in D.C. handled the same chore for railroad stations east of the Rockies.

Even though Mt. Hamilton is close to San Jose, light pollution from the growing Bay area population has had less of a deleterious effect on observatory observations as you might think. Local meteorological conditions in this area often include a low-level cloud layer, a two-fer benefit because the cloud blocks light pollution and the conditions that created the fog also make for very stable air, hence good telescope "seeing," above the clouds. San Jose also took the initiative to reduce light pollution with low-pressure, hooded sodium vapor lamps, and other tactics, an effort recognized by naming an asteroid after the city, [6216 San Jose](#).

The 36" refractor was outfitted with a then state-of-the-art spectrograph, used for, among other things, the determination of the radial speed of stars by astronomer William W. Campbell (who was director of Lick from 1901 to 1930). Campbell tried to make observations at the 1914 total solar eclipse in Russia to confirm the deflection of starlight by solar gravity as predicted by Einstein's General Theory of Relativity, but war clouds hampered his efforts, and the only equipment available to him was not up to the task. Arthur Eddington was successful in a similar

endeavor in 1919, and Campbell was able to confirm Einstein with data better than that of Eddington, from the 1922 total solar eclipse in Australia.

Campbell served as President of the University of California from 1923 to 1930. His son, Douglas, was the first American aviator flying in an American-trained air unit to receive “Ace” status. He was assigned to the famed “Hat in the Ring” squadron and flew its first patrol, with Eddie Rickenbacker and Raoul Lufberry. He and a fellow pilot were credited with the squadron’s “first kill,” and Campbell’s was probably first by a few minutes. He was awarded a DSC with four Oak Leaf Clusters, and the Croix de Guerre avec palme. He ended the War with six victories, and a back full of artillery fragments. After the War, he managed a major sugar mill in Peru, and would become the general manager of Pan-American Airways in 1948.

The Lick 120” reflector was completed in 1959. Other instruments at Lick at that time include a 24” Cassegrain reflector used to make accurate measurements of stellar brightness and a pair of 20” astrograph telescopes designed for position studies.

Another important advance in astronomical observing techniques [was pioneered at Lick Observatory](#): adaptive optics. From babyhood, we are all familiar the “Twinkling, twinkling of Little Stars,” caused by turbulence in the atmosphere. [Good luck getting that melody out of your head for the next few hours!] This is a truly profound technology. A laser is fired upward along the telescope’s line-of-sight. The beam ionizes sodium atoms in the atmosphere to create a spot of light that can be seen by the main optics. Distortions in that spot caused by turbulence are measured, and the telescope optics are distorted, in real-time, to compensate. The improvement in seeing is amazing, and this system and its follow-on technologies are now in use at many other observatories around the world.

By 2000, the Lick Observatory complex had grown into being a small town, with dozens of people in permanent residence, a police and post office, a diner, a one-room school, and a swimming pool. A decade later budget cuts began to impact the little town, and many who now work at Lick commute from San Jose. Funding cuts continue to threaten the Observatory, but the UC system [confirmed continued support](#) in 2014. Google kicked in some serious dollars, too.

Today, nine telescopes are in operation at Lick Observatory, including [C. Donald Shane 120” reflector](#), the [two 20” astrographs](#), the [Great Lick 36” refractor](#), and the most recently-added telescope, the [Automated Planet Finder](#). The [APF](#) is a 2.4-meter telescope with a very-high resolution spectrograph capable of the detecting minute changes in a star’s radial velocity caused by a small, unseen planet.

The Clark 12” is not listed in the [roster of present/past telescopes](#), and I am not sure as to its fate. The dome in which it was housed is occupied presently by the [40” Nickel telescope](#), built in 1979 using a small bequest from a San Francisco seamstress. Lick management was able to cobble together a functioning (but not super-useful) 40” telescope out of mostly spare parts, and craftily made it compatible with the instruments used with the 120”, a further savings.

Additional References

For more info and pictures about the fire, see: <https://skyandtelescope.org/astronomy-news/historic-lick-observatory-survives-california-fire>.

Lick Observatory Historical Collections: http://collections.ucolick.org/archives_on_line Includes a history of the Observatory, how it was built, on-line exhibit of instruments used at Lick, and more.

Edward S. Holden, Lick's first director published a handbook about Lick and his observatory, in 1888, available here:

<https://archive.org/details/handbookoflickob00holdrich/page/n7/mode/2up>.

For a detailed list of telescopes at Lick, and links to individual instruments, see:

<http://www.ucolick.org/public/telescopes/index.html>.

For a summary of astronomical research being conducted presently at Lick, see:

http://www.ucolick.org/public/research_lick.html.

For more information about the APF and other exoplanet research conducted in California, see:

http://exoplanets.org/exoplanets_pub.html.

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