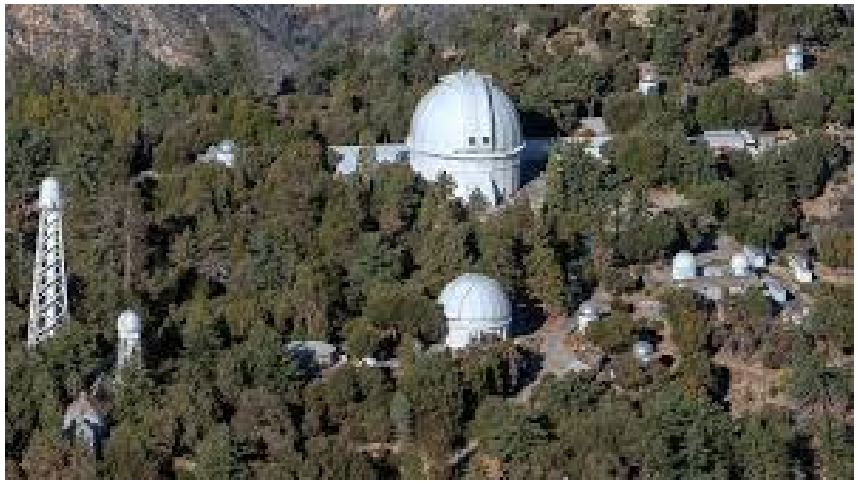
CVA members-Get your telescopes ready for spring and summer viewing

THE OBSERVER

The Newsletter of Central Valley Astronomers of Fresno March-April 2025

Special Report on the Mount Wilson Observatory



Top, an aerial image of the 100" and 60" domes at Mount Wilson, east of Los Angeles

Bottom-the 100" Hooker Telescope at Mount Wilson, once the largest in the world

In this issue-

Central Valley Astronomers

Web address
www.cvafresno.org

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The CVA Calendar:

March 1-Club starwatch at Eastman Lake

March 3-Private starwatch at Fairmont Elementary School, Sanger

March 7-Public starwatch at Riverpark Shopping Center

March 14-Monthly CVA meeting at Round Table Pizza, First and Bullard, Fresno 7pm

March 20-Private starwatch at Juan Filipe Herrera School, Fresno

March 29-Club starwatch at Eastman Lake

April 4-Public starwatch at Riverpark Shopping Center

April 11-Monthly CVA meeting at Round Table Pizza

April 26-Club starwatch at Eastman Lake

Tripods for Use

CVA member Alan Birnbaum has several tripods he not longer needs that can be used for binoculars, cameras, or other instruments. He's not asking any money for them; he simply wants them to have a good home. If you're interested contact him at siriusguy@aol.com

Number of exoplanets found as of February 2025

5,839*

How many more are out there?

Tens of thousands? Hundreds of thousands?

Maybe millions?

***From NASA's Exoplanet Exploration Site**

Profiles in Astronomy

Thomas Bopp 1949-2018

Thomas Bopp was an amateur astronomer with limited physics and astronomical training. Nevertheless, he made a substantial contribution to astronomy: the discovery of one of the brightest and most recognized comets of the 20th century.

Bopp was born in Denver, Colorado, but raised in Youngstown, Ohio, where his father instilled an interest in astronomy in him at an early age. Following high school, he enlisted in the Air Force, serving for five years. After leaving the military, Bopp majored in business at Youngstown State University, but at the same time took classes in physics and astronomy. In 1980, he and his family moved to Phoenix, Arizona, where he was a manager for a construction company and also an active member in the local astronomy club. On July 22, 1995, while at a club starwatch, Bopp noticed a fuzzy object in the sky which was not on any star chart, and showed it to the other members, who made official records of it. When he got home later that night, he contacted the Bureau for Astronomical Sightings at the International Astronomical Union in Cambridge, Massachusetts. That same night Alan Hale spotted the same object at his home in New Mexico and contacted the IAU as well. Eventually, both men were given co-credit for the discovery of what is now Comet Hale-Bopp.

The comet's discovery and resulting publicity made Bopp a well-known public figure. He quit his construction job and became a speaker and educator, traveling around the world to talk about the comet and astronomy in general. Because of his discovery, Youngstown State University awarded him an honorary Doctor of Science degree in 1998. An asteroid, 1086 Bopp, is named for him.

Star Stories

Alphecca

Alphecca is the brightest star in Corona Borealis, the Northern Crown. Also designated Alpha Coronae Borealis, or sometimes simply aCrB, it is an eclipsing binary, with two main sequence stars orbiting each other. It is about 75 light years from, with an apparent magnitude of 2.24 and an absolute magnitude of +5.05.

Of the two stars, one, known as aCrB A, is classified as an A0 white star with a mass about 2.5 times that of our Sun. It is believed to have a disc of dust orbiting it, which leads some scientists to believe that it may be in the process of forming planets. The other star, aCrB B, is a yellowish G5 star that has slightly less mass than the Sun. Unlike the first star, the second does not seem to have any evidence of planetary formation.

The name Alphecca comes from Arabic *Nayyir al Fakha*, the"bright star of the broken ring." Alphecca was traditionally also known as Gemma, the Latin word for "Jewel," as well as Gnosia, a Greek word referring to the goddess Adriane, who in Greek mythology is believed to have taken her wedding tiara and put it in the sky, hence the constellation of the Northern Crown.

What's New In Space

More than Just SLS on the Chopping Block-Maybe Even NASA Itself

In the last issue, this column predicted that newly-re-elected President Trump will probably cancel the SLS heavy lift rocket in favor of much less expensive commercial boosters from Space-X, Blue Origin, and ULA. Now, in the first month of his presidency and amid major government cutbacks, rumors are floating that, along with the SLS, the Gateway lunar space station, perhaps the Artemis Moon landing program, and the Mars soil sample return mission may also be facing the budget knife. All of them are years behind schedule and some are well over budget, forcing NASA to make some very painful decisions. Indications are that when Jerod Isaacman, Trump's choice to lead the space agency for the next four years, takes office(after being confirmed by the Senate), one of his first jobs will be to decide what should stay and what has to go, and indications are that a lot will have to go.

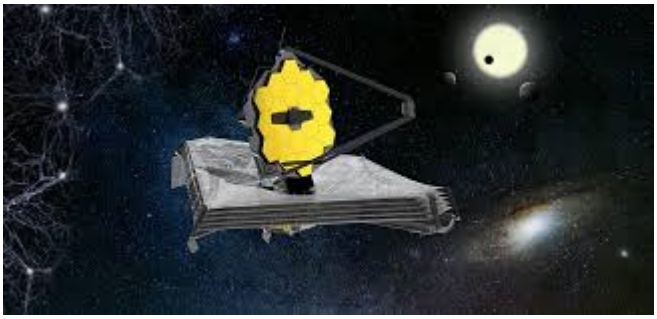
According to space observers, the end of the SLS is a given; it is now seven years behind schedule now and $8 billion over budget. An Inspector-General's report said that each launch would cost up to $5 billion, a sum that is "unsustainable." The Gateway was supposed to launch its first components this year; now the earliest date is 2028, and the program is several billion over budget. It, in turn, impacts the Artemis program. The next Artemis launch, which was supposed to be in 2023, will not come until April 2026, and some wonder about even that. As for the Mars Return Sample mission, NASA has scrapped its own plans and asked aerospace companies to come up with their ideas for returning soil from the Red Planet. The spacecraft was scheduled to be launched next year; now the earliest launch date is 2032, and the cost has risen from $3 billion to almost $8 billion.

Veteran space experts say that many of NASA's major projects, not just the ones mentioned above, is behind schedule and over budget. Part of it, they say, is NASA really has not had any budget increases relative to inflation for several years. Because of that, these programs are limping along with only enough funding to keep them going at a minimum level. Another problem, they say, is also what Trump's and Elon Musk's budget cutters are going after: according to critics, NASA has evolved into a huge bloated bureaucracy more concerned with protecting jobs and egos than pursuing truly innovative and far-reaching projects(one of the stories going around nowadays is that the main reason NASA is fighting to keep the Gateway is so it won't have to lay off several thousand employees after the ISS program ends). According to many, ever since the Challenger and Columbia accidents, NASA has been scared to death of failure and is afraid to take any kind of risk. Hence, endless commissions and studies that eat up time and money but don't get anything done or move any program forward. The word in the aerospace world is that the space agency is at a crossroads; either it slims down and becomes a lean "Can-Do" organization like it was in the 1960s, or it turns into another sclerotic government bureaucracy, which some think it already is, and allows China to become the world's leading space power.

All this has led to many in the aerospace community to wonder if NASA has outlived its usefulness. They point to the rise of commercial space companies, especially Space-X, Blue Origin, Rocket Lab, Axiom, and others, all of which already have or will soon be able to launch large payloads and spacecraft, including human occupied ones, into Earth orbit and beyond. Axiom has already sponsored crewed flights to ISS and has more planned, Blue Origin's main goal is to build a colony on the Moon, while Space-X may send humans to Mars by 2030, and Vast Space Systems is well on the way to having a private commercial space station in Earth orbit by the end of next year. These companies are achieving their goals with a fraction of the time and costs of NASA's programs. As it is, the space agency is becoming

more dependent on commercial spaceflight; after the retirement of ISS in 2030, it plans to lease space and crew positions on one of at least three private commercial space stations that are scheduled to be operational by then. Although some argue that commercial companies are too unreliable in the long run, many others believe that this is NASA's future if it is to stay alive. Isaacman's nomination has, in many ways, probably signaled the next phase in America's space effort; that of several space organizations, not just one, and the government-run one eventually playing an overseer role, akin to the FAA refereeing the airline industry, in the great adventure of space exploration.

Reports Say JWST Budget to be Cut



In the first month of the Trump Administration, with its emphasis on budget cuts to help reduce the deficit, reports say that NASA's "Great Observatories:" The Hubble Space Telescope, the Chandra X-Ray Telescope, and especially the James Webb Space Telescope, will face budget cuts of up to 20%. NASA's proposed budget for the 2025-2026 fiscal year, which starts October 1, earmarks $25.5 billion for the space agency, which will include cuts in several of its major programs. Scientists are most worried about the JWST situation, which they say will devastate the telescope's mission objectives while in its prime, about halfway through its observing program. They are hopeful that incoming chief administrator Jerod Isaacman, who has not yet been confirmed by the Senate, will restore full funding to the program. Sources in NASA say that the cost to operate the telescope has increased since it was launched due to inflation and unprecedented demand for it by astronomers throughout the world.

Galaxy in the Eyepiece

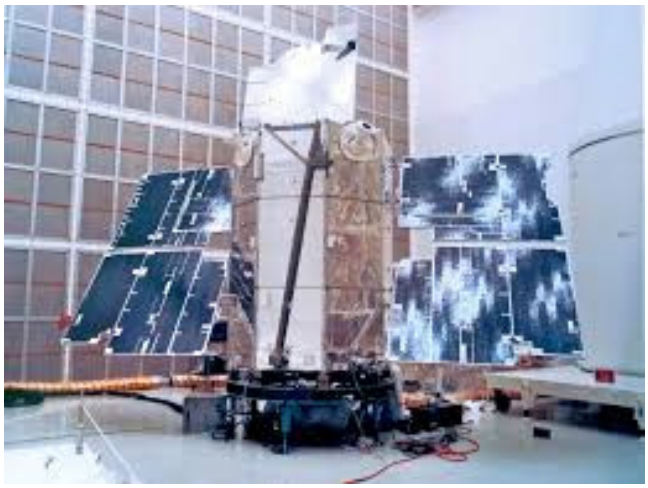
NGC 4694

The galaxy NGC 4694 has been in the news lately, not just scientific journals but mainstream reports as well. Oddly enough, scientists really don't know how to handle it. Technically, it is a Virgo galaxy cluster as part of the M49 group, which consists of 127 galaxies. And that's where agreement among scientists stops. They also know that William Herschel found 4694 in 1784. Everything else is up for argument.

Redshift measurements place 4694 at approximately 71 million light years from Earth. However, non-redshift measurements show that the galaxy is only about 28 million light years away. NASA studies indicate that the galaxy is 54 million light years from Earth. In addition, images of 4694 have all the hallmarks of an elliptical galaxy, which is almost always made up of older redder stars. But studies using the Hubble Space Telescope as well as Earth-bound telescopes show that the galaxy has vast populations of young blue stars, as well as star-making regions. So, scientists really aren't sure what's going on with 4694. Some classify it as a lenticular galaxy, but it doesn't seem to meet the criteria of a lenticular galaxy, either. What is known is that a nearby galaxy, VCC2062, shows signs of a collision with 4694, and that a long band of hydrogen gas connects the two. Some astronomers believe that 4694 is drawing off gas from 2062, and this is fueling the new star formation. A closer look at 4694 with the James Webb Space Telescope may eventually solve the many questions surrounding this peculiar galaxy.

Space Age Archeology

OAO-2



OAO-2, the Orbiting Astronomical Observatory, nicknamed Stargazer, was the first successful astronomical telescope launched into space, and the precursor for Hubble and every other space-based telescope since then.

The OAO program actually began in 1958, when NASA was first established. A number of scientists around the country realized that a space-based telescope would be able to observe objects better than on the ground, especially in wavelengths that were blocked by the Earth's atmosphere. They were especially interested in observations in the x-ray and ultraviolet range of the electromagnetic spectrum. The project was approved in 1961. Funding was allowed for four spacecraft, to be known as OAO-Orbiting Astronomical Observatories. Although they all looked the same, each was slightly different in overall size and instrument package. OAO-2, the first successful satellite, was seven feet wide with solar panels and eleven feet tall. It carried two different scientific packages: four ultraviolet telescope sensors, each about twelve inches long and two inched wide, sponsored and built by the Smithsonian Institution. The other instrument was a collection of seven ultraviolet telescopes that was designed and built by the University of Wisconsin-It was known as WEP-the Wisconsin Experiment Package. The satellite itself was built at the NASA facility at Cape Canaveral and weighed 4,400 pounds at launch by an Atlas-Centaur rocket.

A space-based telescope had never before been attempted and all kinds of problems had to be solved. The biggest one, according to Nancy Grace Roman, was how to keep it steady and stable for up to a half hour while observing a single object in Earth orbit. Roman, who worked on the OAO project as a senior scientist and would later be the chief scientist for the Hubble Space Telescope, said that eventually a system using tracking sensors to "lock in" on a target star and precise gyroscopes solved the problem. Another difficulty was building it light enough to be boosted into orbit, but strong enough to survive the forces and shaking during launch. The OAO observatories used a version of aluminum to keep the weight down. Somehow, it all worked.

OAO-1 was launched on December 6, 1966, and carried instruments to detect ultraviolet radiation, X-rays, and gamma rays. The satellite went into orbit, but a failure in the solar panels caused it to lose power after three days, and no significant data was returned. The second satellite, OAO-2, was launched on December 7, 1968, and went into a nearly circular orbit about 480 miles above the Earth. This time, the solar panels worked well, but one of the WEP cameras failed after about six weeks. Most of the other cameras, however, worked flawlessly for almost five years until the satellite was deactivated in 1973. One of the Smithsonian cameras, known as the Celescope, imaged over 8,000 objects, and scientists on the ground identified and catalogued 5,000 of them as ultraviolet stars. The other cameras imaged over 1,200 stars, as well as comets, galaxies, and even some of the solar system's planets.

The third observatory, known as OAO-B, failed during launch on November 7, 1970, and was destroyed before reaching orbit, but the fourth, named Copernicus, launched on August 21, 1971, was operational for almost nine years. A joint venture between NASA and the British Science Research council, it focused on X-ray astronomy and, among other things, discovered several long period x-ray pulsars. It was considered the most successful of all the OAO observatories and set the stage for the next generation of space-based observatories, which would include Hubble.

Special Article-
The Mt. Wilson Observatory

Mt. Wilson, east of Los Angeles, is known for the storied Mt. Wilson Observatory, arguably one of the best-known astronomical sites in the world. Yet, its history actually goes back long before the founding of the observatory by George Hale in 1904 and involves several other astronomical facilities along with a cast of colorful characters.

The modern history of Mt. Wilson begins in the 1850s with a man named Benjamin Davis Wilson, a winemaker in nearby San Marino. Wilson, who was the grandfather of General George Patton of World War II fame, wanted a particular kind of oak for his wine casks, and hoped to find it on the slopes of the mountain that he gave his name to. He built a trail to the top, but instead of quality oak he found the remnants of cabins which were probably built by early Spanish explorers in the area. He did not find any suitable wood but built his own cabin at the summit. Eventually the trail became popular among locals who would hike to the top as well, and the mountain itself gained a reputation as a spectacular vista site. Several years later, after a dispute between claimnants to the mountaintop was settled in court, a tollway trail for use by hikers was built. The summit became kind of a tourist and recreation area for adventurists in the Los Angeles area. (Right-Benjamin Davis Wilson 1811-1878)

In 1889, the Harvard Observatory under William Pickering decided to build a western observatory and chose Mt. Wilson. The trail was expanded to a rough dirt road, and Harvard students came out West to handle two Alvyn Clark-built telescopes, a four-inch refractor and a thirteen-inch refractor. However, bad weather in 1890 forced the Harvard team to abandon the site. Two years later, in 1892, Harvard came back with plans to build two 40″ Alvyn Clark telescopes on adjoining Mt. Harvard, as it was named. Then the main financial backer suddenly died and the money for the project never materialized. One of the 40″ lenses eventually became the main objective for the Yerkes refractor telescope in Wisconsin.

Now enter George Ellery Hale, one of the most interesting people in modern science. Hale was born in Chicago, educated at MIT, and an astronomy professor at the University of Chicago, where he secured the 40″ lens to build the Yerkes Observatory. He then decided to move to Southern California in 1903, seeing its clear skies and dry climate as an ideal place for astronomy. Hale was a solar physicist by profession; he looked around the Los Angeles Basin for a place to build a solar telescope and found it on Mt. Wilson. Among other things, Hale was associated with the Carnegie Institute in Washington, D.C., and he persuaded the Institute to buy forty acres on top of the mountain and approve a 99-year lease for an observatory, to be named the Mt. Wilson Observatory. Starting in 1904, he built a regular road to the top, and in 1905, built his solar telescope on Mt. Wilson, the first of several famous telescopes at the site. At the same time, a small hotel was built at the summit and used by tourists who could drive or take horse and mule caravans up the road. Eventually, it would also be used by the astronomers as well(the original hotel burned down in 1913. It was rebuilt the next year and operated until 1966). (Right-Hale 1868-1938)

Hale was, without any doubt, a mover and shaker as well as a born salesman, and was determined to make Mt. Wilson the premier astronomical observatory in the world. Only a few years after he built the Solar Tower, as it was called, he talked his father, a wealthy Chicago businessman, into financing what was then the largest telescope in the world, a 60-inch reflector that saw first light in 1908. In 1912, Hale built a much larger solar observatory, and in 1914, he persuaded William Hooker, a Los Angeles banker, to sponsor and finance and even larger reflector telescope, a 100-inch. The Hooker Telescope was completed in 1918. He used the 100-inch telescope, the largest in the world at the time, to attract a corps of outstanding astronomers, the most famous of which was Edwin Hubble, who came to Mt. Wilson in 1919. (Above right -Hubble 1889-1953)

The telescopes for the Observatory were located on Mt. Wilson, but by 1920, Hale had also built an observatory administration building about a mile from the campus of the California Institute of Technology, Caltech, in Pasadena. The building eventually became known simply as Santa Barbara Street, after the street it was on, and in the 1920s through the 1950s, it was the center of the astronomical world. Besides Hubble, who had the largest office at Santa Barbara Street, Hale assembled a galaxy of world-class astronomers, including Walter Baade, Ralph Minkowski, Halton Arp, and Allan Sandage. (Left-Baade 1893-1960 Right-Sandage 1926-2010)

The 1920s into the 1950s were Mt. Wilson's golden years. Its corps of astronomers, led by Hubble, made one discovery after another in stellar evolution, galaxy distribution and evolution, cosmic distances and makeup, and many more. Hubble is best known for his "discovery" of the Island Universes and the Expanding Universe. (Actually, both of these concepts had been known for some time before Hubble came across them. As early as 1917 Vesto Slipher, at Lowell Observatory, found that the galaxies were far outside the Milky Way; and the Belgian priest-astronomer Georges Laimatre formulated the recession-velocity correlation in 1927, two years before Hubble, showing that the galaxies were rushing away from the Milky Way at unimaginably high speeds. As such, the best that can be said was that Hubble simply confirmed what others had already discovered. But, as so often happens, credit usually goes to the person who popularizes the finding, not to the originator).

Even after the observatory was settled and churning out discoveries, Hale was not finished. in the mid-1920s, he conceived of a larger telescope, a 300-inch monster that would dwarf even the 100-inch. Realizing the technology of the time could not produce such a telescope, he scaled it down to 200-inches and convinced the Rockefeller Foundation to fund it. There was a problem, though. The Rockefellers refused to give money to an organization sponsored by the Carnegies. So Hale, who was also a member of the Board of Trustees at Caltech, proposed that the Rockefellers give the money to Caltech, and it and the Mt. Wilson Observatory would share management of the new telescope.

By 1930, a partnership agreement, The Mt. Wilson and Palomar Observatories, was negotiated and signed. In it, the two organizations agreed to combine their facilities, including the 200-inch telescope, which would built on Palomar Mountain halfway between Los Angeles and San Diego, where Caltech already had a small observatory; Hale realized the 200-inch would be far too large to place at the Mt. Wilson site; located on a very narrow ridge, by the early 1930s, it was already overcrowded with the 100-inch, the 60-inch, two solar towers, several smaller telescopes, and support buildings-as well as the hotel. (Above right-Einstein, Hubble, and Walter Adams at the 100-inch Hooker Telescope, c. 1935)

Hale never saw his greatest creation; he died in 1938, shortly after construction on the 200-inch was under way. According to his family and friends, his last words, a few days before his death, were, "It is a beautiful day, the sun is out, and they are working on Palomar." Eventually, the 200-inch would be named for him. It was scheduled to be completed in 1942, but the advent of war slowed progress, and by mid-1941, work was stopped altogether. (Right-the 200-inch being built at Palomar, c. 1938)The same was true with Mt. Wilson. After the U.S. entered World War II in late 1941, almost all the Mt. Wilson astronomers, including Hubble, took leaves of absence to help with the war effort. The one exception was Walter Baade; as a German national, he was restricted to the Pasadena area. Walter Adams, who succeeded Hale as observatory director, talked to Justice Department officials and got Baade's travel restriction extended to the Mt. Wilson telescopes. Baade had almost unlimited access to the 100-inch Hooker telescope during the war years and took full advantage of it, making fundamental discoveries in stellar evolution and classification and galaxy structure. When the war ended and the others returned, he, not Hubble, was the leading scientist at Mt. Wilson.

The 200-inch was finished in 1948, and at the same time, Walter Adams retired as director. Hubble was expected to get the position, but it went instead to Ira Bowen, another Mt. Wilson astronomer, as Hubble was thought not to be interested in administration(it was also widely believed he alienated people with his aloof, almost arrogant, attitude. According to Dennis Overbye in *Lonely Hearts of the Cosmos,* when the Palomar Time Allocation Committee met in 1947 to divide up observing hours among the astronomers on the new 200-inch, Hubble asked for 50% of the total time for his projects. He was turned down). Nevertheless, he embarked on a series of observations to determine the structure and age of the universe. However, in the early 1950s, his health deteriorated, and he died from a heart attack in 1953.

The 1950s saw a continuation of scientific dominance for the Mt. Wilson astronomers. With the 200-inch Hale, they pushed knowledge of the universe even farther than before. Yet, the post-War years also gave the first stirrings that its supremacy would not last forever. Other observatories and organizations were catching up to it. The 120-inch Shane Telescope was established at Lick Observatory in 1959, followed by the 107-inch Smith Telescope at McDonald Observatory in Texas in 1968, then the 160-inch Mayall Telescope at Kitt Peak in Arizona in 1973(Left). As well, other observatories, both in the U.S. and overseas, were planning more Hale-class telescopes for the future. Another major shift in astronomical research came in the mid-1960s, when several observatories decided to build facilities in South America, to explore the mostly unobserved southern skies. Among them was the Carnegie Institute, Mt. Wilson's parent institution, which established an observatory at Las Campanas in Chile in 1969. In addition, new technologies, such as CCD cameras, computerized viewing and monitors, and adaptive optics systems started appearing at observatories; the Mt. Wilson telescopes were considered outdated and many of the younger astronomers went off to other institutions with more modern equipment. Mt. Wilson's name was no longer a draw for top scientific talent as it had been years before.

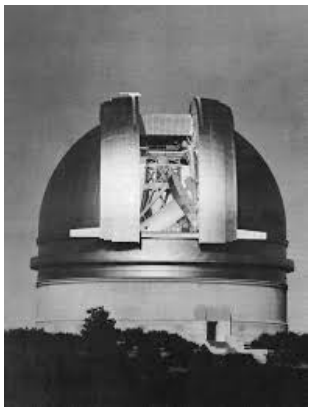
A major blow to Mt. Wilson occurred in 1979, when the 1930 agreement to share ownership of the 200-inch Hale Telescope was dissolved, and Caltech took over complete control of it. With Carnegie's Las Companas Observatory and Caltech's own projects, including a proposed ten-meter telescope using segmented mirrors(which would become the Keck Telescope on Mauna Kea), the arrangement was becoming too cumbersome. Although the dissolution agreement guaranteed that the Mt. Wilson astronomers could continue to use the 200-inch, it was the first time in the organization's history that it did not have at least partial ownership of the largest telescope in the world. (Above right-the twin Keck ten-meter telescopes at Mauna Kea)

The mid and late1980s brought even more crises to Mt. Wilson. The advent of segmented and giant spun mirrors were pushing it even further into the past, as other observatories around the world were either planning or building a new generation of eight-to-ten-meter and larger mirror telescopes. In addition, the increasing air and light pollution in the Los Angeles basin made scientific study even harder and more expensive. In 1989, the Carnegie Institute decided to shut down the telescopes on Mt. Wilson, citing obsolescence. They were given to a non-profit organization, the Mt. Wilson Institute, which updated the 100-inch with adaptive optics and computerized controls and imaging and resumed astronomical research in 1992. However, in 2012, the Institute decided that it was no longer viable as a scientific instrument, and converted it for public outreach events, which it started doing in 2014. Today, both the 100-inch and 60-inch are used for public viewing. The two solar towers are still used for scientific research; one is operated by the University of Southern California; the other by UCLA. In 2004, Georgia State University built and instituted the CHARA interferometer at Mt. Wilson, which is also still operational today. (Above right-The large solar telescope tower at Mt. Wilson)

The Mt. Wilson Observatory organization, now known as the Carnegie Institute for Science, is still headquartered at Santa Barbara Street in Pasadena, and the astronomers there have access to the 200-inch Hale* and the other telescopes on Palomar Mountain as well as the telescopes at Las Companas. In 2028, the Giant Magellan Telescope, with seven 8-meter mirrors, one of the largest in the world, will come online, giving the Santa Barbara Street scientists a powerful new window on the universe. After over one hundred years, Mt. Wilson is still one of the premier astronomical organizations in the world, and will no doubt make many groundbreaking discoveries in the future.

***The 200-inch Hale Telescope on Mt. Palomar is still operational, is used every clear night, and occasionally makes newspaper headline discoveries. From 1948 to 1994, it was the largest telescope in the world; today, it is the eighteenth largest and, in a few years, will be the twenty-first largest, but it is still active and revered by astronomers throughout the world. Due to the increasing light pollution in Southern California, optics experts say that it has ten to twelve years at the most of quality world-class observing left, then Caltech will have to decide what to do with it. Indications are that it will probably become a museum and public outreach piece, much the same way Mt. Wilson has.**

The Mt. Wilson Observatory, now the Carnegie Institute for Science, administration building on Santa Barbara Street in Pasadena



The 200-inch at Palomar Observatory