

EARLY PHOTOGRAPHS OF THE DISTANT SIERRA NEVADA MOUNTAINS TAKEN FROM LICK OBSERVATORY

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Abstract: During World War I, a group of American chemists, physicists and astronomers developed processes for greatly increasing the infrared sensitivity of photographic emulsions, for long-distance reconnaissance from airplanes or the ground. After the war Lick Observatory astronomers, beginning with C.D. Shane and Mary Lea Heger, used long-focal-length astronomical cameras and these hypersensitization methods to photograph the distant Sierra Nevada range, including Yosemite Valley and Half Dome, nearly one hundred miles away across the Central Valley of California. These pictures, widely exhibited and admired, strengthened links between astronomers, the Eastman Kodak Company and the public.

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Figure 1: Panoramic photograph of the Sierra Nevada Mountains taken in December 1931 by Lick Observatory photographer, J. Fred Chappell. This photograph is prominently displayed at the Lick Observatory (Lick Observatory photograph).

Public visitors to Lick Observatory on Mount Hamilton, California, see daily a large, striking photograph displayed there of the snow-covered Sierra Nevada mountain range, over 100 miles (160 km) away (see Figure 1, above). It was taken on 16 December 1931, by J. Fred Chappell (Figure 2), long-time Lick Observatory photographer, using a special long-focus lens, an infrared filter, and a glass astronomical photographic plate hypersensitized for infrared 'light'. Very probably, the camera he used was built around a 2.25-inch (6-cm) diameter Voigtlander lens (stopped down), with 60-inch (1.5-m) focal length, that had been used to photograph the Sun and its corona on Lick Observatory eclipse expeditions, and for other special purposes (Chappell, 1933). This photograph was the culmination of a series of experiments going back to 1920 at Lick Observatory, where the distant Sierra Nevada mountains can be seen several times each winter, especially after storms which bring heavy rain to the Central Valley, washing out the haze and dust in the atmosphere for a few days, and depositing snow on the mountain peaks beyond.

Keivin Burns, a former Lick graduate student and later postdoctoral fellow, who was a research physicist at the National Bureau of Standards from 1913 to 1919, had brought the process used to take all these successive photographs to Mount Hamilton in 1919. During World War I he had worked with other physicists, chemists and astronomers in a group which developed the process for long-range photography. Infrared radiation penetrates haze and dust-laden air much farther than ordinary blue light, to which the early photographic emulsions then in use were most sensitive. In addition, infrared radiation is considerably less affected by the twinkling, blurring or 'poor

seeing' that result from atmospheric turbulence. The scientists working on this project had developed several dicyanin-type dyes and a method for using them to hypersensitize photographic plates to infrared radiation. Burns brought samples of the best hypersensitizing chemical they had found, kryptocyanin, to Mount Hamilton to use in his post-war research program of obtaining infrared spectrograms of the Sun (Burns, 1920). He described these concepts to the astronomers and graduate students there, and showed them how to use the dye to hypersensitize their photographic plates for the infrared (Shane, 1980).

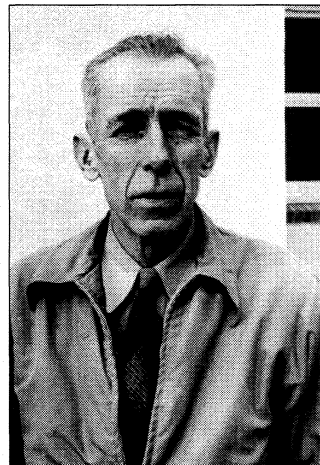


Figure 2: J. Fred Chappell, Lick Observatory photographer (Mary Lea Shane Archives of the Lick Observatory, UCSC Library).

C. Donald Shane and Mary Lea Heger, then both graduate students (but later both Ph.D.'s and husband and wife), took the first successful photographs of the Sierras from Mount Hamilton on 25 January 1920, using a camera variously described as "... of 20-inch focal-length ..." or "... a 21-inch [focal-length] Goetz lens." No doubt it was one of the many Lick Observatory photographic telescopes used on eclipse expeditions. Shane and Heger probably took their photograph from the flat area, now a parking lot, south of the large dome of the 36-inch (0.9-m) refractor. This is the site from which a photograph was taken in 1920, which was included in an early list of Sierra negatives in the Shane Archives. This photograph was published as the frontispiece of the February 1920 issue of the *Publications of the Astronomical Society of the Pacific* (Publications Committee, 1920). Shane also took several infrared photographs of individual snow-capped peaks in the Sierras, using the 12-inch (30-cm) Clark refractor as a long-focus camera, but they are not as spectacular as the panoramic pictures of the range, and their definition is only fair, because of the effects of seeing at this very great enlargement.



Figure 3: W.H. Wright, Lick Observatory astronomer and later Director (Mary Lea Shane Archives of the Lick Observatory, UCSC Library).

William H. Wright (Figure 3) of the Lick Observatory staff was an outstanding observational astronomer (and later Lick Director from 1935 to 1942), and he then decided to try his hand at this long-range terrestrial photography. He was an active member (and an honorary Vice-president for 18 years) of the Sierra Club, then a small, elite outdoor hiking, camping and mountaineering organization. After "... a considerable number ..." of trial exposures over a period of two years, Wright took his best picture of the Sierras from Mount Hamilton on 12 March 1922. He used a different camera, also with a 60-inch (1.5-m) focal length, a four-element Ross lens, one of a pair specially designed to have a wide field and made for the upcoming solar eclipse of 22 September 1922. W.W. Campbell and Robert J. Trumpler of the Lick staff took these two photographic telescopes and others to a site in remote Australia to obtain the direct

photographs (at totality) which confirmed Albert Einstein's General Theory of Relativity and its prediction of the gravitational deflection of light by the Sun to high accuracy. Wright's Sierra photograph has better definition than the earlier one by Shane and Heger, and is also better pictorially, because it was taken from a different site, looking over more of the foreground ridges of the Mount Hamilton range, which block part of the view of the Sierras in the earlier photograph. We have no record of just where on Mount Hamilton Wright set up his camera for this picture, but a partial list of sites he tried includes the saddle near Galileo Peak, and another through an open window on the second floor of the 'old' dormitory just below the 36-inch (0.9-m) dome. Wright (1923) published a section of his photograph in an article in the *Sierra Club Bulletin*, in which he stated that the earlier photograph had been taken by Shane and Heger. Carl A. Bergmann, the Lick Observatory photographer at that time, prepared the print of Wright's photograph for it. Bergmann, a part-time employee, operated a photography studio in the San Francisco Bay area, but came up to Mount Hamilton for a week's work whenever a sufficient backlog of orders had built up for him, or when an important set of illustrations was needed for a scientific publication.

These spectacular photographs of the snow-covered mountains and the Yosemite Valley, with the romantic names that Bret Harte, Mark Twain, John Muir and Theodore Roosevelt had made famous in their writings, excited admiration and respect, particularly at the Eastman Kodak Co. in Rochester, New York. Campbell (1921), the Lick Director, had sent negatives of Shane and Heger's best photographs to Frank E. Ross, the astronomer trained at Berkeley and Lick, who was then working as a research physicist at Kodak. Ross passed them on to the heads of the Laboratory. Soon a Kodak official suggested to Campbell that these photographs be entered in an exhibition of the Royal Photographic Society in England (Newton, 1922). Campbell (1922) replied that Wright's photographs, very recently taken, were even better, and should be used. The Kodak Laboratory technicians produced an excellent panorama print, which received a medal at the exhibition (Newton, 1924; Wright, 1924a).

This episode brought Wright into close personal contact with C.E. Kenneth Mees, the founder and Director of the Kodak Research Laboratory, and with George Eastman himself, the founder and President of the company. Both congratulated him and promised to help him with their best new emulsions for his projected series of photographs of Mars (Eastman, 1924; Mees, 1924). Wright and Ross, who left Kodak in 1924 for a faculty position at Yerkes Observatory, became the pioneers in this newly-available field of monochromatic photography of planets with filters and various orthochromatic, panchromatic and infrared plates (Wright, 1924b).

Wright turned the negatives that Kodak had made for him and their copyrights over to the Sierra Club, which then ordered several prints for him and one for their own use (Webber, 1924). This was probably the source for the two additional photographs published in the *Sierra Club Bulletin* in 1925, credited to Wright (1925). They are in a long fold-out, one above the

other, and are even more professional looking. There is no text or information about the exposure, camera, etc., but they are the best of his published photographs.

By 1925 Campbell, who had become President of the University of California but retained the Lick Directorship though he lived in Berkeley, and Robert G. Aitken, his Assistant Director in immediate charge on the mountain, decided they needed a full-time photographer on Mount Hamilton. Chappell, who had been working in a studio in La Crosse, Wisconsin, since 1919, got the position and came west (Aitken, 1925; Chappell, 1925a, 1925b). He was an excellent photographer and photographic technician, and was highly interested in astronomy and in advancing the photographic techniques then so important to it. After Chappell had proved his skills and abilities, Wright encouraged him to try to take an even better photograph of the Sierras. Chappell took several pictures over a period of years before he got the 'best' one (still sold today) from Copernicus, the peak where the Mount Hamilton fire tower is located, just east of the 120-inch (3-m) telescope dome. Chappell worked long and hard on this picture, preparing a master negative with instructions for dodging it, and printing and assembling the sections of the very large print (100 inches = 2.5 m long) which now hangs in the Main Building on Mount Hamilton (Chappell, 1943).

Chappell continued his photographic work at Lick Observatory for thirty-one years, and is probably best known for his excellent direct photographs of the Moon, taken with the 36-inch (0.9-m) refractor under the supervision of Joseph H. Moore. Several of these pictures were included in a large-format folio of *Photographs from the Lick Observatory* (Moore, Mayall and Chappell, 1940). Chappell retired in 1956 and moved to San Jose with his wife Dorothy, who long survived him (Shane, 1956). She was the person who inspired young Bill Unruh, now W.J. Shiloh Unruh, to become a dedicated Lick buff and amateur historian.

Most recently, Professor Don Olson, the 'Celestial Sleuth' of Texas State University, informed Lick Observatory that he, a colleague, and a group of their students, had studied the Chappell photograph and had noted (among other minor errors) two incorrect identifications of peaks on the old key to it (Olson, 2005). Robert Gargett, of the Lick Publications Office, then carefully studied all the old identifications, found a few more misidentifications, and updated all the elevations to reflect the values on newer maps. All have now been corrected on the prints and on the Lick Observatory web page. Olson et al. (2005) published a good reproduction of the Chappell Sierra photograph in a longer article, primarily on the Yosemite photographs of Ansel Adams.

I am most grateful to Dorothy Schaumberg, Curator of the Mary Lea Shane Archives of the Lick Observatory, University of California Santa Cruz Library, and to Arnold Klemola, Remington P.S. Stone, Anthony A. Misch, Robin Witmore and Robert Gargett of the UCO/Lick Observatory staff for helping run down the facts of these Sierra photographs in the Shane Archives. We are all especially indebted to the first two named for saving several original negatives, especially Chappell's negatives, from being discarded and lost.

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Don Osterbrock is a Professor Emeritus of Astronomy and Astrophysics at Lick Observatory of the University of California Santa Cruz. He was Director of the Observatory from 1973 to 1981, and after that remained an active research worker until he formally retired at the end of 1992. He specialized mostly in observational research on gaseous nebulae in our Galaxy, and in other nearby ones and in active galactic nuclei, after his theoretical Ph.D. work on gravitational interactions between stars and giant molecular clouds and his postdoc work on the internal structure of red dwarf stars.

He wrote and published the research monograph and graduate-level textbook *Astrophysics of Gaseous Nebulae* (1974), and the later, updated and expanded *Astrophysics of Gaseous Nebulae and Active Galactic Nuclei* (1989). Most recently, he and Gary J. Ferland wrote the still further updated and greatly expanded *Second Edition* (2006) of the latter book.

In his later years at the Lick Observatory Osterbrock became interested in the history of astronomy in the 'big-telescope era' in the United States, beginning about 1888, and has written and published five books on various topics in that subject. One of them, with John Gustafson and Shiloh Unruh as co-authors, is *Eye on the Sky: Lick Observatory's First Century* (1988), and his most recent one is *Walter Baade: A Life in Astrophysics* (2001). He has also written more than fifty historical papers or articles on many subjects in this same era of big-telescope research.