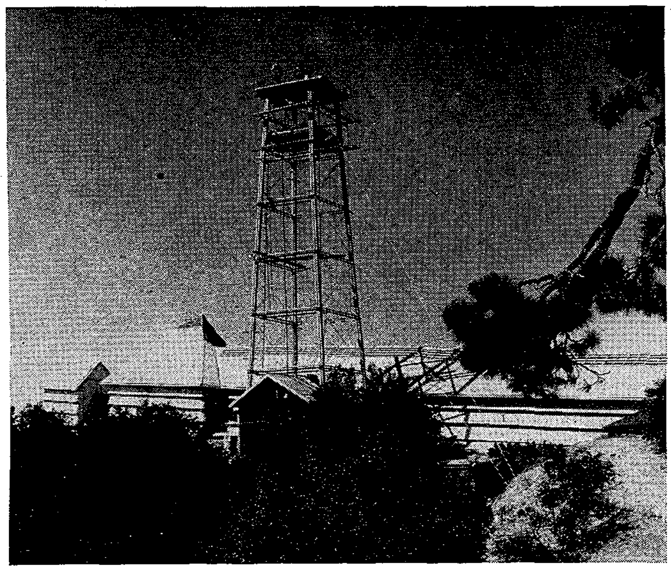
Mount Wilson

WORK that resulted in the establishment of the Mt. Wilson Observatory began in the spring of 1903, when George Ellery Hale first set up a small coelostat and a portable four-inch refracting telescope on the mountain and began taking direct and spectroscopic photographs of the sun. The success of these experimental observations was such that the following year The Carnegie Institution gave Hale a $10,000 grant to move a solar telescope from Yerkes Observatory to Mt. Wilson on an expeditionary basis. Impressed with the results of this experiment, Carnegie made Mt. Wilson a full department of the Institution with an initial grant of $150,000, and started the Mt. Wilson Solar Observatory, as it was then known, on its way.

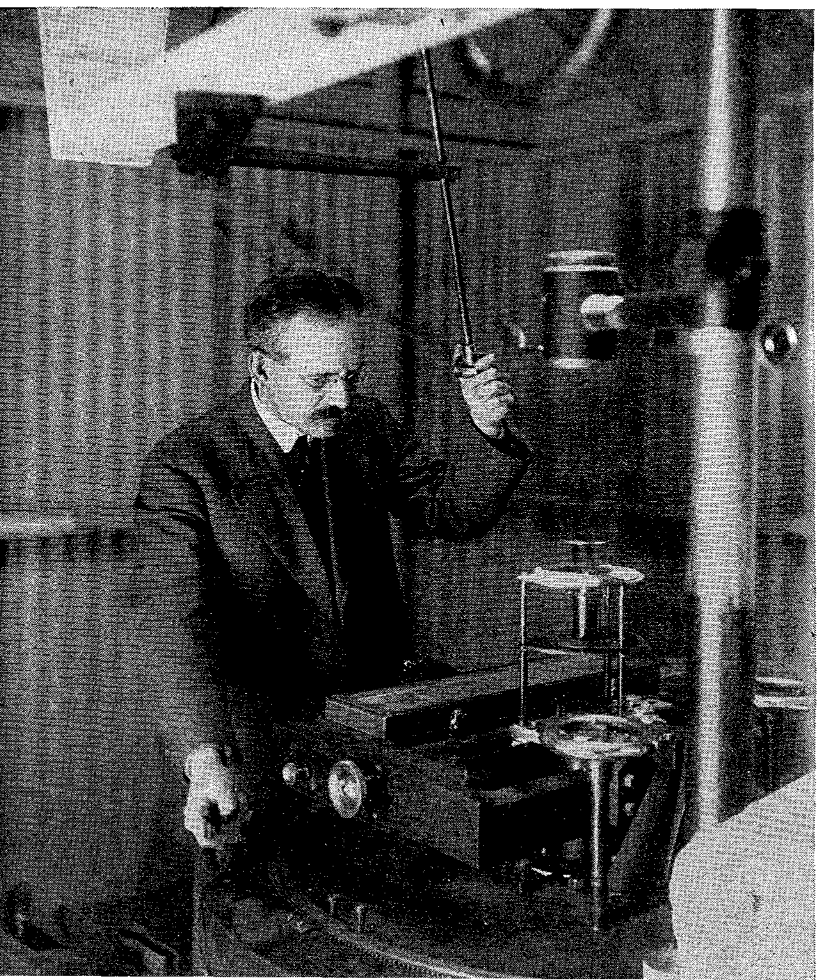
From Yerkes with the Snow telescope had come George Ritchey, Ferdinand Ellerman, and Walter Adams, and a short time later, Francis Pease. These men, with Hale, were the nucleus who took part in the establishment of the Mt. Wilson Observatory. Life on the mountain in the early days was itself in the nature of an experiment. The only lines of contact with the valley were an old, precipitous Indian trail which led up Little Santa Anita Canyon from the village of Sierra Madre, or a somewhat shorter, equally rugged "toll road", no more than two feet wide, which zigzagged up from the mouth of Eaton's Canyon in Altadena. Over one or the other of these trails, vital supplies, bulky equipment, and world-renowned astronomers had to be transported by mule or afoot to the mountain top.



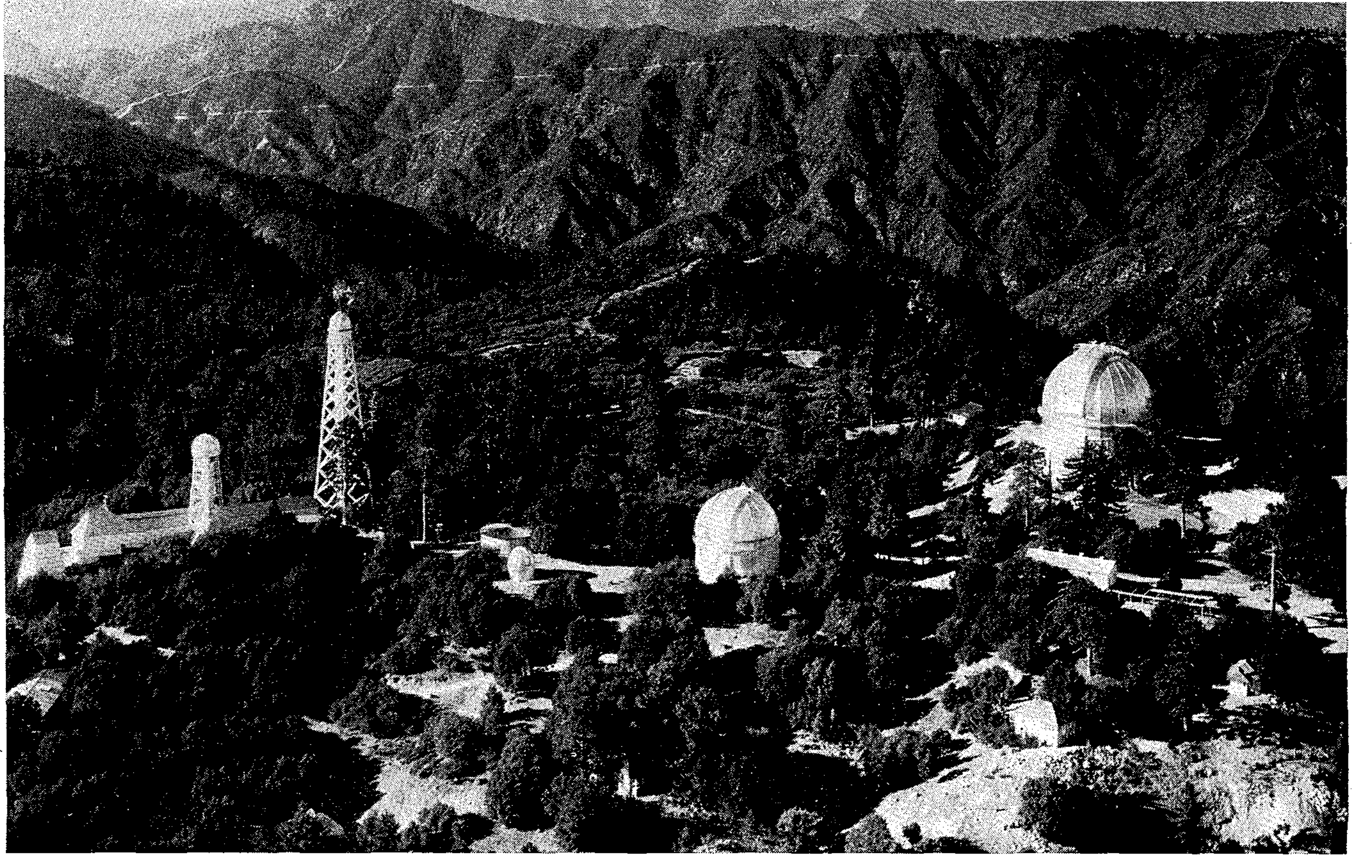
The 60-foot tower telescope at Mount Wilson as it looked in 1907. The horizontal shed behind it houses the Snow solar telescope. These same structures are seen at extreme left in the picture opposite.

When Hale first visited Mt. Wilson, the only building standing was a half-gone log cabin, called the "Casino", vestige of adventurous vacationers who had formerly visited the spot in the summer months. The Casino was soon patched and made waterproof, and living conditions were immensely improved with the construction of a huge granite fireplace. By December 1904, a residence known as the Monastery was completed to serve as living quarters for Mt. Wilson astronomers.

During the summer of 1904, plans went ahead for the design and construction of the building to house the Snow telescope. With the complete financing of the Mt. Wilson project assured by the Carnegie Institution, George Hale had a 60-inch glass disk, an earlier gift from his father, moved from Yerkes to optical shops which had been established in Pasadena. Ground and polished for two years under the direction of Ritchey, it was laboriously trucked up the mountainside on the toll road especially widened for the occasion from two feet to a spacious eight. The truck



Dr. George Ellery Hale observing the sun at the 60-foot tower telescope in 1907.



Aerial view of Mount Wilson today. At left, the 60-foot and 150-foot tower telescopes; behind them in long white shed, the Snow telescope. Center, the dome housing the 60-inch reflecting telescope. To its left the tiny dome housing the 6-inch refractor for visual observation. On the right is the dome of the 100-inch Hooker Telescope. Photograph by E. R. Hoge.

used in the process was a unique affair, having a gas engine connected to a dynamo which powered individual electric motors in each of the four wheels. Driver of the machine was Jerry Dowd, who became chief electrician for the Palomar project in 1930. The 60-inch, then the world's largest, was installed without mishap and went into service in 1908.

This was the point when stellar observation at Mt. Wilson began to take its place in importance beside solar investigation. While Adams, Pease, and others made spectrographic photographs, Frederick Seares worked with direct photographs at the main focus of the 60-inch, and in the first five years they made more than 4000 photographs. They began to reach conclusions which indicated a termination of our galaxy but at an undetermined distance. The 60-inch mirror was not big enough to answer the theory which it posed. Only an infinitesimal number of stars could be analyzed, and at a limited distance. It became increasingly evident that a larger instrument would be necessary to bring a greater number of more distant stars within range.

Then came an offer from John D. Hooker of Los Angeles, who had helped earlier to finance Hale's first work at Mt. Wilson, to build a 100-inch reflector. The uncertain task was taken on by the French glassworks at Saint Gobain, which had produced the 60-inch. Although bubbles seemed to mar each of the four disks poured, Hale finally had their first and best attempt sent to Pasadena for inspection. Stored for a time in the Santa Barbara Street shops, the surface was used as an assembly table for other instruments until a Carnegie Institution geophysicist looked it over and advised Hale to go ahead with the grinding. While Ritchey closeted himself with the glass for six years of polishing, Carnegie himself visited Mt. Wilson, showed intense interest in the work going on, and increased the Institution endowment with specific recommendation that the Mt. Wilson project be encouraged. In 1917 the 100-inch Hooker telescope was first used

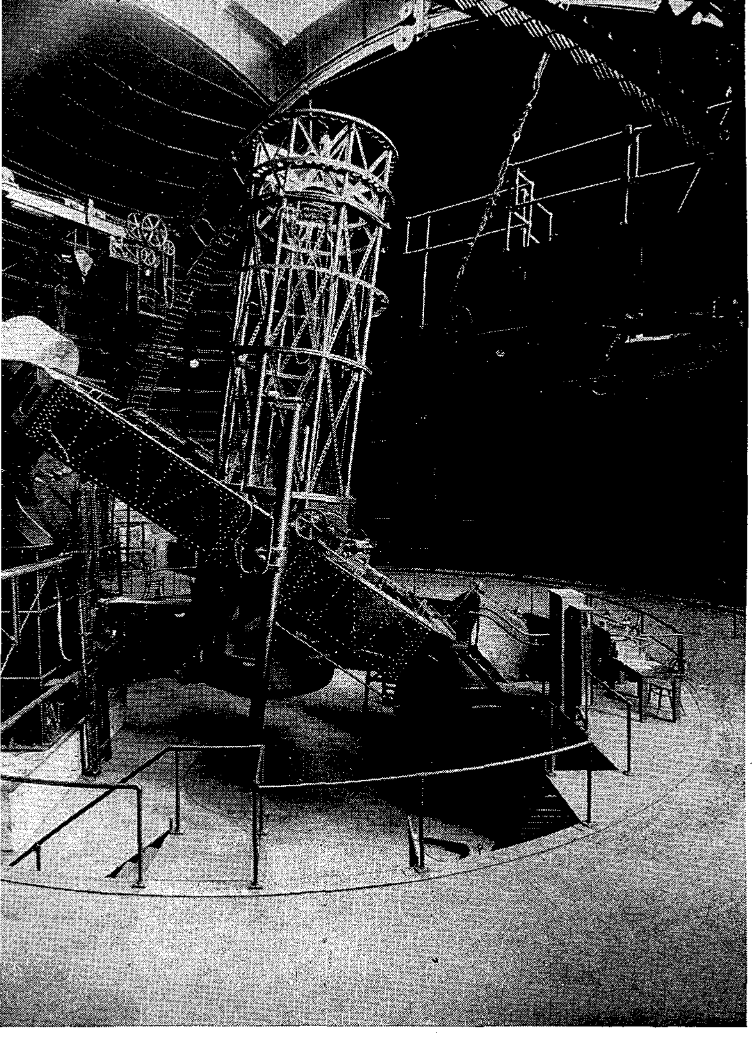
During the thirty years since, the 100-inch has been the center of a great cooperative effort by leading astronomers and physicists to reach farther out into the universe. Adams and his associates devised new methods of measuring the distances of stars; Harlow Shapley's studies gave an accurate idea of the extent of our galaxy; A. A. Michelson applied his interferometer to the 100-inch to measure stellar diameters; Edwin Hubble mapped "island universes" 900,000 light

Ira S. Bowen

Dr. Ira S. Bowen is Director of the Palomar and Mt. Wilson Observatories and at present is a research associate in astrophysics at the California Institute and chairman of the Observatory Committee.

Joining the Caltech faculty in 1921, Bowen served as a member of the faculty for 10 years, as instructor, assistant professor, and later associate professor in physics. He received his B.A. from Oberlin College in 1919 and a Ph.D. from the California Institute in 1926. Member of the Carnegie Institution, he was named Director of Mt. Wilson Observatory in 1946 and began service this year as ex officio chairman of the Observatory Committee of Mt. Wilson and Palomar. In 1938 he was also Morrison research associate at Lick Observatory, Mt. Hamilton.

In his work at Mt. Wilson, Bowen has been engaged in research in the division of stellar spectroscopy. Professional societies of which he is a member include the American Physical Society, American Astronomical Society, Astronomical Society of the Pacific, National Academy of Sciences, and the American Philosophical Society. Bowen is also holder of the Draper Medal from the National Academy of Sciences and the Franklin Institute's Howard N. Potts Medal.



The 100-inch Hooker Telescope, showing the interior of the dome, the Cassegrain observing platform, and the control panel, as seen from the west.

years away. In 1923, increasing ill health forced Hale to resign as director of Mt. Wilson, to be succeeded by Adams. While investigation went on with the 100-inch, Hale realized that the telescope's size still was inadequate. Again it led to questions which it could not answer. By 1928, he was seriously considering a mirror increased to "200 inches or, better still, to twenty-five feet."

As the idea took shape he interested the Rockefeller Foundation in the project; and it was finally agreed that the Foundation would finance the construction of the giant 200-inch through the California Institute of Technology, with the aid of the staff and facilities of Mt. Wilson.

With the development of the Astrophysical Observatory and Laboratory at Caltech, Mt. Wilson provided facilities for the testing of auxiliary instruments and attachments for the projected Palomar telescope. Thirty-six-inch and 60-inch grinding machines had already been made available to Caltech from the Mt. Wilson shops. The cooperative plan was continued as experimental correcting lenses were designed for the 60-inch and 100-inch reflectors to increase photographic ranges without altering the ratio of focal length to aperture. Successful experiments on the Mt. Wilson telescopes led to the design of correcting lenses for the Palomar instrument following the same plan. Similarly the Rayton lens to determine radial velocity of remote nebulae, the B.S.I.R.A. lens, and photo-electric amplifier have been perfected on the 100-inch and are expected to increase greatly the efficiency of the 200-inch telescope.

During this cooperative development, regular investigation at Mt. Wilson continued. Solar observation, Dr. Hale's specialty, has always been an important part of the Mt. Wilson program. In the early years, when it was known as the Mount Wilson Solar Observatory, there were three solar and only one stellar telescope. After the completion of the 100-inch reflector more attention was given to the stars and "solar" was dropped from the name though solar investigations have been continued as a major activity. Probably the most outstanding achievement in the study of the sun was the discovery of magnetic fields in sun spots by Dr. Hale in 1908. Investigation of this phenomenon has since been carried on almost exclusively at Mt. Wilson. The solar tower telescopes built in the early days of the observatory are in regular use today and are still the most powerful of their kind. The long series of solar photographs made almost daily at Mt. Wilson are a nearly complete record of the sun's activities for the last 40 years.

Another field of investigation carried on at Mt. Wilson has been a study of the materials composing the moon's surface and of the surface temperatures and atmospheric conditions of planets. Since the moon itself gives out no light but is merely a reflecting surface, it has been necessary to use the progress of the earth's shadow across the moon at total eclipse as a basis for testing the rate of surface cooling. Another method is to compare the polarization of light from the moon's face with that of known terrestrial materials. From these investigations, Mt. Wilson observers have concluded that the visible lunar surface is not exposed rock but rather a fine dust or sand, possibly volcanic. Using a vacuum thermocouple, the surface temperatures of planet areas have likewise been determined, the extremes on Mars, for example, being set at 60° and —40° F. Analysis of all but the outermost planets also has been made, by means of a spectroscope.

Mt. Wilson Observatory has continued to make extensive contributions to the study of the stars in our galaxy, establishing what is now the international scale of stellar brightness, and measuring the magnitudes of 70,000 faint stars. These observations have made important advances in the determination of the distribution of stars in our galaxy, the size of our stellar systems, and the eccentric position of the sun in it. The distances of some 400 stars of low luminosity located nearest to the sun have been measured trigonometrically, aiding in evolutionary studies and in plotting the distribution of stars in space. Study and classification of nebulae have led Mt. Wilson astronomers to conclusions concerning the nature of the composition of these nebulae, their location and numbers, and their relative distances. Spectroscopic observations of nebulae outside our galaxy have led to Hubble's "red shift" discovery and resulting "expanding universe" and other cosmological theories.