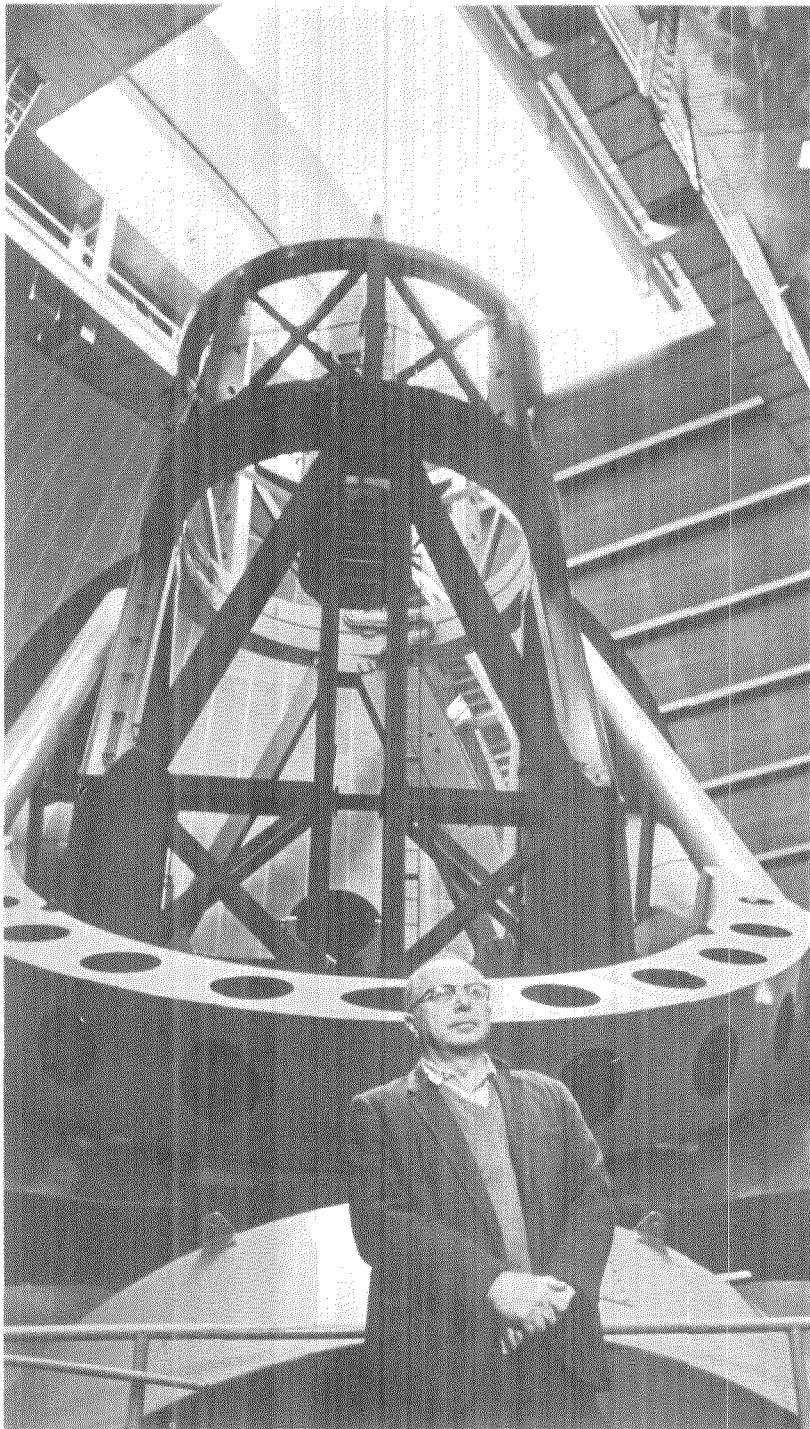


A Night on Palomar Mountain



Jesse Greenstein and the 200-inch Hale telescope. Dr. Greenstein is professor of astrophysics and executive officer for astronomy at Caltech, and a staff member of the Mount Wilson and Palomar Observatories.

By unbreakable tradition, each astronomer makes his own observations at a large telescope. He is surrounded by engineering marvels and advanced electronic technology. But making a critical and delicate observation is still, ultimately, a one-man struggle. Bad weather, malfunction of equipment, cold, and lack of sleep are the enemies. It is therefore not just a scientific challenge. The romance and beauty of the night, of the half-seen, faint glow of starlight, promise excitement and mystery. The observing process is an irresistible adventure for me, even after 30 years. I am a telescope addict, and in love with a 500-ton steel and glass monster, at Palomar.

From Santa Barbara Street and Caltech (our Pasadena offices), every few days, a station wagon carries equipment, supplies, and one or two astronomers. Conversation during the 130-mile ride shows weather as the obsessive anxiety. Even the most distinguished member of the Mount Wilson and Palomar staff is assigned (a year in advance), at most, 25 nights a year—clear or cloudy. Success or failure may depend on tonight's work—and if failure tonight, next year may bring another chance. City and suburbs and freeways are replaced by a country road up scrubby hills, and a flat-topped 6,000-foot mountain. The first sight of the silver bubble of the great dome startles even the most unromantic.

Inside, it is cold and quiet but, in the first hours, desperately busy as equipment is unloaded, mounted on the telescope, and tested. Each scientific problem requires its own special technique and auxiliary apparatus. Some observers use a roomful of electronic equipment. Mine is simpler, the prime-focus spectrograph, to be mounted at the top, looking down on the giant mirror. The cage, a six-foot-wide cylinder supported by thin steel fins, is reached by an elevator creeping 60 feet up the curved inside of the dome. We mount the spectrograph with its finely ruled diffraction grating and a three-inch solid quartz schmidt camera. By late afternoon all is adjusted, the photographic plates have been cut to correct size, and I can at last lean back inside the gray tube and the half-light for a moment to breathe the thin air, not of a

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By Jesse L. Greenstein



Greenstein is carried to the observing cage in an elevator which climbs 60 feet up the inside curve of the observatory dome.

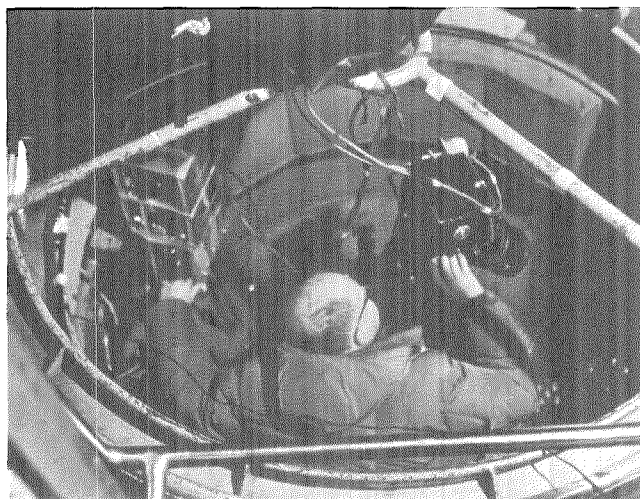
mountain, but of other, distant worlds.

By 6 p.m. (11 hours after the morning's alarm clock) I am ready to begin work. Dinner is brief; in the "monastery" where I will sleep I put on warmer clothes—an electrically heated flying suit—and then go back to the cage. Now the stars begin to show through the opened slit of the dome. A computing machine printout is my list of objects to be studied, with priorities and technical specifications, and I have star charts and the plates. Down below me the night engineer starts the generators, pumps, and telescope drive, and through the intercom his voice rises:

"Are you ready, Dr. G.?"

"Yes. Fix on finding star number 32; after I've focused, we'll go to the object."

Relays bang; the motors roar through the loudspeaker, and the tube tilts downward and to the east, toward my celestial object. In the cage gravity goes mad; gimballed boxes swing, and I furiously crank my observing chair to a level position from which I can still reach the spectrograph and, I hope, survive the next four hours. The tube lurches as the brakes lock on; small motors hum for fine settings. Through the eyepiece I see a blue disk which sharpens into a star as I set the focus. If I am lucky, I have a dazzling point of light to center on the spectrograph slit, but,



Inside the cage, with spectrograph mounted, he adjusts his camera, checks his star charts, and settles in for the first cold hours of observation.

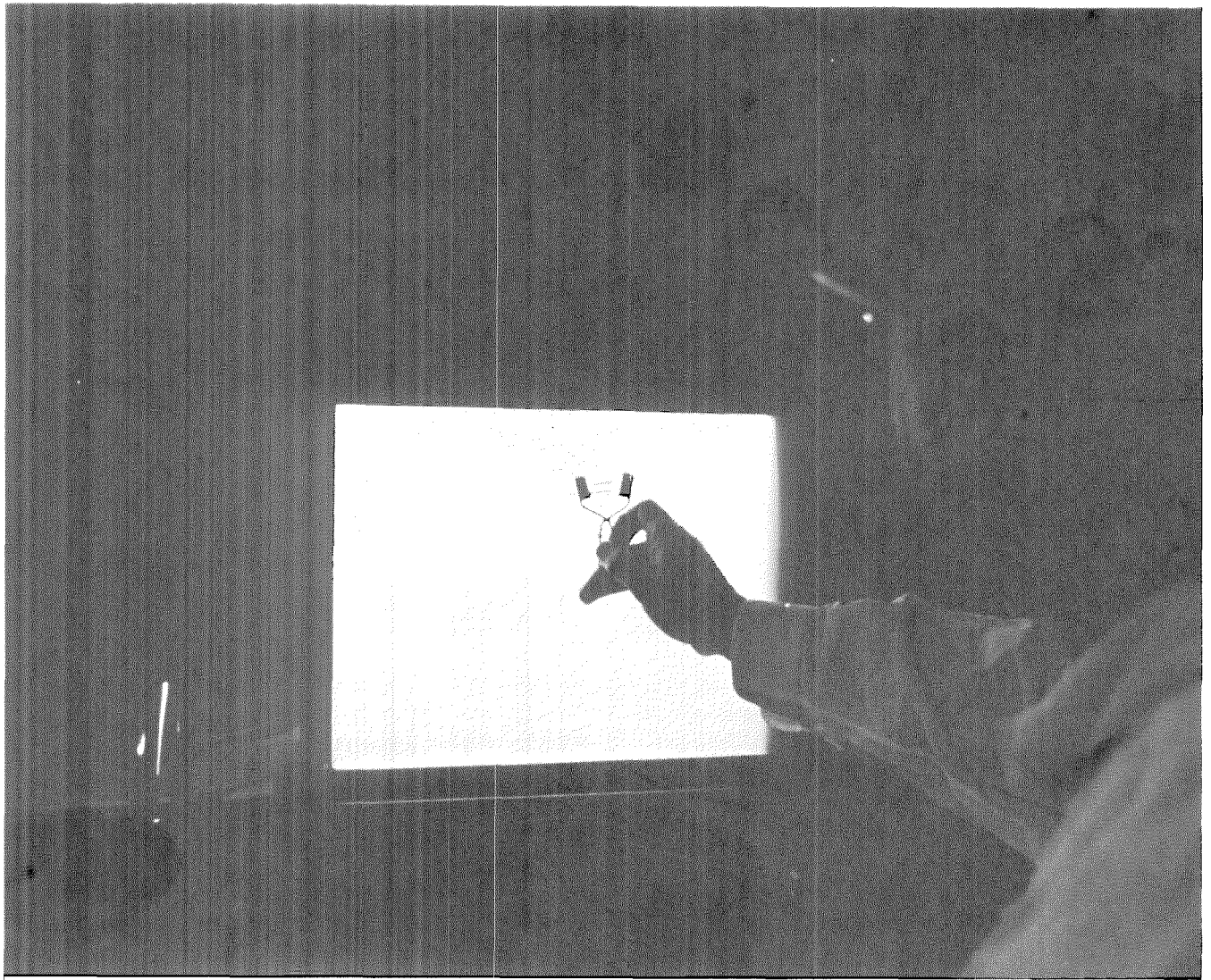
if the seeing is poor, a jumping blob.

"Good, we're centered and focused; let's go to the object—R Monocerotis."

The telescope slides a few degrees; I look down the tube at a black pool filled with tiny lights, the mirror 55 feet away catching starlight. Then, in the eyepiece is a strange, pale, white glow, shaped like a comet; at its tip, a star being born. Our view is as old as civilization; the light is 5,000 years old.

A bustle of final settings, calibrations, data for the observing record; I pull out the camera-cover slide, and the exposure begins. Then silence, only the distant pumps, and the passage of time. The telescope is turning 15 feet an hour to follow a star 3×10^{16} miles away! The star stays frozen on the spectrograph slit, but every few minutes I check and reset the fine motions of the telescope, perhaps a thousandth of an inch, to maintain centering. I retilt the seat. Once I climb on it to look out at the nearby sky; 42 degrees F feels cold if you sit still near midnight. What do I think of? Usually of nothing, hypnotized by the dulling reality of chill and fatigue, or of what I might have done incorrectly, or about the next exposure. But sometimes I think of what may be creating the dim glow I see.

Then a flurry of activity at the end of the exposure



The rewards of a night of observing—the photographic plates which record the spectra of half a dozen stars.

—reloading the camera in the dark—and the ride to the next object, back toward the east since the sky has turned 60 degrees. Another focusing, another faint star which is a suspected white dwarf—near the limit of vision and hard to find. We start a new exposure, for two more hours, and I think about superdense matter and, meanwhile, listen to my radio playing Mozart, who lived in a different world.

After midnight I climb out of the tube, to the elevator, to descend to the darkroom, and have lunch. The plates, still wet, show the nebula spectrum was well exposed. The faint white dwarf gave a narrow streak of blackened silver grains that tells me something new. Up the elevators to the cage, to new objects and another four hours. At the end of the last exposure, dawn begins; the telescope is set vertical; the motors stop. It is a sudden relief, in the lurching

elevator with the giant dome closing, to be able to stand and feel the end of cramped muscles and nervous tensions—all pure joy.

By dawn I am in the monastery, completely darkened and quiet, to sleep five hours till breakfast. To the darkroom again at 1 p.m. to prepare for the next night. Are these objects interesting? Shall I change the program? It is the first of my four nights of this run. Tonight might be crucial; last night's plates suggested something new. I will be more tired; if there were only more time! Were I sensible, would I be an astronomer again? Of course, because next year, science will be better; new objects and instruments will be found; new ideas already are boiling, and there is so much unknown. What were all those flying specks of light in the mirror? What new marvels are waiting?