

# My Trip to Mauna Kea

Jeff Beish

## INTRODUCTION

I had an interest in astronomy from the age of six and since then longed to become more active in observing the heavens and seeking knowledge of our Universe. For decades the opportunity to participate was limited to chance meetings with those interested in astronomy or once while attending astronomy class in college, and at other times when opportunity arose. Listening to science-fiction programs on radio brought Mars into my life. One science fiction radio program was **Dimension-X** that broadcast Ray Bradbury's *Martian Chronicles* (April 1950). Also, while lying out amongst the stars in our yard, I nurtured a deep appreciation and love for the stars, a love that still haunts me today.

Several years after my father returned from WWII he used his GI Bill, and help from his spinster grandmother, to attend a photo engraver school in St. Louis, MO and then another in Milwaukee, Wisconsin. As it turned out a war buddy of his, who lived north of Milwaukee, had written to my Dad with plans to meet him there and attend the school as well. Because my mother had to take care of my younger brother and me during the war, they decided that Dad would take me with him. So, in the summer of 1948 we set out to St. Louis via stream trains to the various places; it seemed to take an eternity. When the first school was over my Dad's friend drove us to Milwaukee and after that school he took us to his home in Kenosha, Wisconsin.

We attended a tour at the Yerkes Observatory where the world's largest refractor (40" aperture) is located and actually looked through it! At Mars!!! The trip back seemed even longer. Those memories would stay with me the rest of my life -- probably reinforced by conversations with my father during his lifetime -- but still faintly in my mind. So, my first Mars observation was in the summer of 1948 and I continue observing the Red Planet today.

My parents would occasionally take me to visit one of a planetarium in Chapel Hill, NC where local amateur astronomers would set up telescopes nearby so we could observe. I always requested to see Mars, if it was up, and they would do so. After that I saw Mars in a telescope occasionally wherever a telescope was available. In early 1960 I joined the U.S. Air Force and off visiting the world and while stationed at Naha, AB, Okinawa would occasionally observe Mars -- whenever the spirit moved me and the amateur group would set up -- right there on base where the sky was velvet black.

1973 we moved to Miami and I visited the Miami Science Museum and Space Transit Planetarium and met some [Southern Cross Astronomical Society](#) (S.C.A.S.) folks. They invited me to their monthly meeting and use their observatory on the roof of the museum. I returned occasionally and began to attend the monthly meetings and met Bill Douglass, the president of the Society. In 1975 at the S.C.A.S. monthly meeting I met [Dr. Don Parker](#) and then Chick Capen, an internationally known Mars expert and Mars Recorder for [Association of Lunar and Planetary Observers](#) (A.L.P.O.) to hear their lecture about Mars. Bill, Don, Chick and I became friends after that and I began observing Mars more often and by 1977 my Mars observing was in full swing.

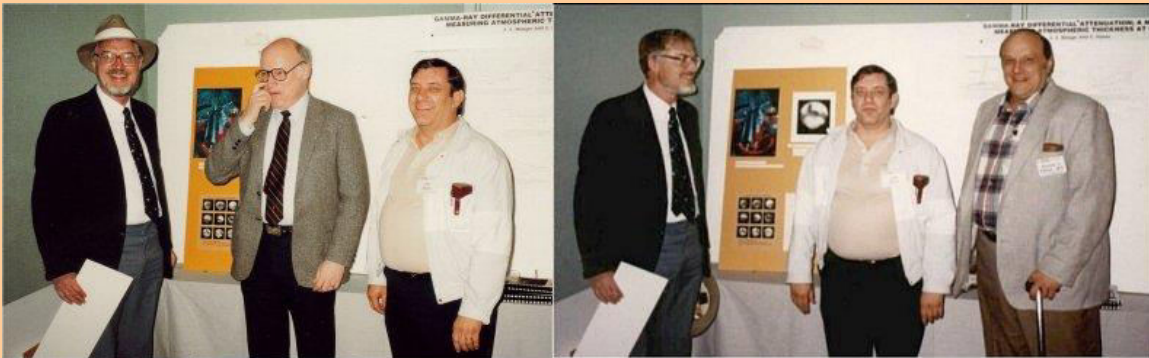
[Charles F. \("Chick"\) Capen](#) gave a second talk on Mars at the Southern Cross Astronomical Society meeting in February 1979 and urged both Parker and me to help him with the A.L.P.O. Mars Section. We had been contributing observations to him for a few years and soon thereafter we both became assistant Mars Recorders. After talking with Chick about his life I suddenly

remembered his name in an old book that I had from my high school days, [Men, Rockets, and Space Rats](#), [Lloyd Mallan, (C)1955, Pub. Julian Messner, Inc.] and discussed the book with him at length. This book had a great influence on me and may have changed my life [*Charles F. Capen - Men, Rockets, and Space Rats*, 50, 51-54]; [*Secrets of Space Flight*, 45, 94].



Chick Capen, me and Don Parker in my Cutler Ridge, Florida (1980) observatory under my homemade 12.5" f/30 Cassegrain

From those amateur activities we have made contacts with many noted planetary astronomers and worked on several projects with them. One project, the International Planetary Patrol, had been successfully operated for decades by Charles F. ("Chick") Capen and Leonard [Martin](#), both at the Planetary Center at Lowell Observatory when we joined them in photographing and mapping the planet Mars. Leonard Martin was the primary Mars researcher at the Lowell Planetary Research Lab, so he would call upon us from time to time to observe for the International Planetary Patrol. My participation in [the IPP Mars photographing](#) program.



LEFT: Leonard Martin (Lowell), Phil James (U. of Toledo) and Jeff Beish. RIGHT: Leonard Martin, Jeff Beish and Don Parker at the 4th International Conference on Mars in Tucson, AZ (1989).

## A MEMORABLE TRIP FOR AN AMATEUR ASTRONOMER

During a two-week period in late October and November 1990 my assignment was to photograph Mars for the International Planetary Patrol using the University of Hawaii's [24-inch Planetary Patrol Telescope](#) (UH24). The 24-inch Boller and Chivens Cassegrain telescope was fitted with a specially modified 35-mm movie camera that would operate electronically to capture single exposures instead of continuous framing. The equatorial mount was a typical Boller and Chivens mount with a 3-foot or 4-foot polar gear housing.



Photograph of Mauna Kea from access road far below the summit. The road crosses a large dark lava flow seen in this photo. Orographic clouds cover much of the big volcano. Interestingly, most of this land is cattle country.

Those who drive up the winding, treacherous dirt roads each night from the living quarters at [Hale Pohaku](#) (9,200-foot level) to the observatories at the top are well aware of the hazards involved. My guide and instructor, George Lundburg, for the first night made me very aware of the perilous journey by nearly flipping us over and down a steep embankment! He was talking and not paying attention to driving. In some ways observers seem glad to return to sea level after a few weeks up there; however, the experiences there are unforgettable and a return trip for this observer will not be turned down.



LEFT: Meeting hall at the living quarters, CENTER: Cafeteria at Hale Pohaku, RIGHT: George Lundburg

Each observer would trek up the hazardous dirt road to the top of Mauna Kea to operate the telescope and expose a few frames of film each hour. The observing sessions, weather permitting, were all night affairs in some rather cold but dry conditions. At nearly 14,000 feet not only can the cold air bother an observer; one can experience strange sensations when deprived of oxygen! For a neat photographic tour of the trip up to Mauna Kea go to: Telescopes on Mauna Kea (<http://www.johnharveyphoto.com/BigIsland/Mauna%20Kea/index.html>)



LEFT: Photo of at Hale Pohaku from winding road form within the clouds. RIGHT: Road up the mountain.



LEFT: Just one short stretch of the hazardous dirt road leading up to the top of Mauna Kea. Not shown are the sheer drop-offs to thousands of feet below. RIGHT: Some of the smaller volcano domes on the way to summit of Mauna Kea. Rocks tend to get redder the higher one drives up the big volcano.

As we drove higher and higher the terrain began to resemble more like Mars than Earth. The surface material began to turn red and orange; not unlike what I imagined Mars would look like. Finally we reached the summit area and we both took a long look at the surrounding terrain. White domes of the various observatories stood out against the Mars like mountain and my sojourn had begun for real. A video of the [drive up to the top of Mauna Kea](#)



Several astronomical observatory domes during the changing of Sunlight as the night draws nearer. Colors of the white domes begin to change as light dims. From left to right: The dome for the [UH88 or 88-inch telescope](#), the [W. M. Keck Observatory](#) and [120-inch infrared telescope \(IRTF\)](#).



Stark beauty of the 120-inch [Canada-France-Hawaii telescope](#) dome as the Sunset draws near.

Driving past the larger observatories we barely missed the turn off to the small dome that housed the Patrol telescope. What appeared to me as a 20-foot diameter dome and stood about 25 feet high was to be my research instrument for the next two weeks. This was a fine instrument, but is gone now -- replaced by a giant machine that will dwarf the University of Hawaii's 88-inch telescope (UH88) located around a hundred yards away. Walking between domes was more effort than I had experienced before and a few stopped along the way was necessary to rest and catch whatever breath I could muster. The original substitute 88-inch concrete mirror was on the ground about 50 yards away so one could sit on it to take a breath.



LEFT: The dome for the UH24 with Isuzu Trooper rental car in the foreground and the large Canada-France-Hawaii telescope dome behind. RIGHT: Aerial photograph of the University of Hawaii 2.2-meter telescope, 2005, Richard J. Wainscoat



**TOP:** Breathtaking photograph of the UH88 telescope dome as seen in the background of the UH24 dome. Found on Internet, photographer unknown (Photo ID: planpatD). **BOTTOM:** Photo of Canada-France-Hawaii telescope dome and UH24 dome (Photo ID: MK88-152w by Fred Espenak).



Photo-1: 24-inch f/75 Boller and Chivens Cassegrain telescope (UH24). Photo-2: Another view of UH24. This telescope and dome are gone and replaced by huge 8-meter telescope.

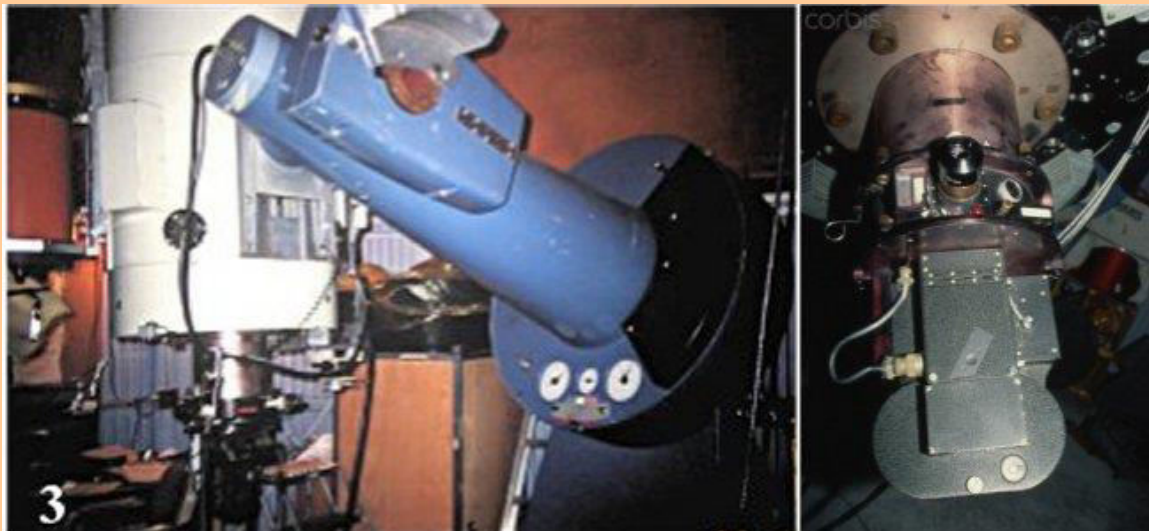


Photo-3, LEFT: Another view of UH24 with the modified movie camera and filter system. RIGHT: Close up of the modified movie camera

Originally designed with the help of [Clyde Tombaugh](#), discoverer of Pluto, this instrument was a convertible system with a removable secondary section for either an f/13.3 secondary used for photometry or an f/75 secondary system for planetary photography. Using a high quality 55mm eyepiece in the camera housing that was forward of the shutter one could observe images at 830x magnification. The camera was semiautomatic and we took exposures in each of the primary colors and a few in Ultra Violet and Infrared light.

## FIRST IMPRESSIONS OF A MARS-LIKE PLACE

One cannot stay at the top very long before they experience several natural phenomena that are rarely seen anywhere else on Earth, especially in populated, well lighted urban areas. First, the air is clean and dry up there. At night there is no perceptual light pollution, so the stars appear as tiny brilliant specks, millions of them it seems, and finding familiar constellations may be confusing because the stars seems to be very close to the same intensity. Maybe it was just some

illusion I did not understand or my imagination and it was hard at first to detect differences in their color.

Having observed in some very dark areas before, such as [Flamingo](#) and [Burn's Lake, Florida](#) and Flagstaff, Arizona, I was having great difficulty in recognizing the Constellations from my perch atop Mauna Kea. Oddly enough I first saw the Andromeda galaxy (M31) and followed some stars in the Constellation of Andromeda; then over until recognizing the square of Pegasus. I extended my arm and the ~3-degree wide galaxy M31 was about three knuckles wide of my fist and the 1.3-degree M33 was about the width of one knuckle. The transparency of the sky was crystal clear and it is so dark there that nothing in my surroundings could be seen.

The sky is velvet black with streams or hazy patches of stars. Even the brighter deep-sky objects (DSOs) amateurs are always observing seems to be larger and easily recognizable. Lower down in our atmosphere stars appear more bloated and the brighter ones may seem to catch our attention more readily. So, they are easily recognizable in their groupings and the same DSOs are rarely seen without optical aid. It is a virtual paradise for deep sky observers up that high in altitude.

For the nature lovers, they will first notice the colors associated with the surface materials of Mauna Kea. Volcanic cinders, ash, streams of dark gray lava strewn in all directions away from the many volcano domes within the main caldera. At first one gets the impression the whole mountain is a very large pile broken red firebricks and assorted broken rocks and dust. It makes one wonder if that is what one would see while standing on the surface of Mars!

One evening while sitting in the doorway of the dome, awaiting the sky to clear several stratus clouds began to drift over the summit and began to block off the light from the 11 day old gibbous Moon. One striking feature of this barren landscape is the many changes in color as the lighting conditions vary. As illumination decreases a most indescribable transformation takes place over the entire mountain -- something before was only theoretical to this observer's knowledge. The great titanium white domes of the UH88 and nearby 120-inch telescope began to slowly turn gray, then almost black, and then completely disappear into the blackness this observer has ever experienced.

Later, as the clouds began to thin out and expose a layer of fresh snow covering the ground, several familiar objects began to brighten only very dimly at first; then slowly increase in intensity with an eerie bluish glow. Strange color sensations began to appear that is difficult to explain before some theory is discussed. After the clouds had cleared away I saw a scene reminiscent to that pictured in Figure above.

After the battery in my camera went dead I saw several things that should have been photographed. While sitting out front of the dome under the overhang I saw the [shadow of Mauna Kea](#) off in the distance and waved my hand as if I could have seen the shadow of my tiny arm so far away! Must have been a lack of oxygen affecting my brain!





**B&W photo of the shadow of Mauna Kea in the distant clouds.**

## SOME COLOR PERCEPTIONS OF THE HUMAN EYE

The human eye contains two light sensing elements or nerve ends: *cones and rods*. Rods respond to different intensities of light and not to color stimuli. Three types of color sensations are produced by a composite response of red, green, and blue color-sensitive cones. The smaller cones are 0.0015 mm in diameter and are called fovea. In order to stimulate two cone nerve ends the subtended diameter of the light beam has to be larger than 12.4 seconds of arc.

The eye is sensitive to wavelengths ranging from deep violet 390 nanometers (nm) to 710nm (deep red). Maximum sensitivity is around 550nm at normal illumination. With decreasing light levels this sensitivity shifts toward the blue. Cones do not function at light levels below 0.03 candlepower per square meter (cd/m<sup>2</sup>).

**Scotopic** (*night*) vision and **photopic** vision (below 0.03 cd/m<sup>2</sup> ) are subject to *Purkinje effect*, which causes objects to appear bluer to us in very low light conditions.

In some lighting conditions, yellow-green or reddish-orange objects appear more yellow than they really are. The size, or angular extent, of the object may even effect our color perception, i.e., very small reddish features on Mars may appear gray or blue-green, etc.

Brightness ranges from 0.5 to 50 cd/m<sup>2</sup>, above the Purkinje effect, referred to as the *Bezold-Brucke phenomenon*. This renders red, yellow, green, and blue light to remain the same hue, with decreasing intensities the yellow- greens colors begin to look more yellow and violet and blue-green appear bluer. At high surface brightness colors tend to lose saturation. While increasing the angular extent of an object colors begin to increase in saturation, especially with violet, blue, and green.

While increasing the angular extent of an object colors begin to increase saturation, especially with violet, blue, and green. *Tritanomalous vision* is when violet and yellow-green colors begin to appear gray and other colors look more reddish- orange or blue-green [*Dobbins et al*, 1987].

If we consider the color of Mars is predominately RED, with a mix of features displaying dark gray-orange and brown hues, it becomes interesting when attempting to describe Martian dust clouds as "yellow." When we observe bright Mars against the dark nighttime sky, the planet's color hues are often perceived as complementary to the dark background sky. This effect is known as "*simultaneous contrast*" [*Hartmann*, 1989].

*After-images* are seen as a *ghost image* in your eye after staring at some object for a long time. The after image takes on the complimentary color from the object, that is, it will appear as a ghost image but is of the opposite color of the image you stare at.

## HOW A LITTLE THEORY MADE A MAUNA KEA EXPERIENCE AN EXPERIENCE

So, if you are bored with theory, then here's a real story that may be more exciting. Don't you just love it? Back to the mountain observatory. As the Moonlight penetrated the clouds a strange bluish glow began to appear in the general direction of the large UH88 dome. With light levels only barely above the threshold of my vision, the snow covered ground began to appear as coated with an iridescent bluish paint. Shortly thereafter, the outline of the large dome began to loom in the horizon. It was not the usual bright, flat white color -- it was a beautiful deep blue

colored vast space before me, nothing like I had ever seen before. The snow was a slightly different shade of blue.

Taking my eyes away from the huge bluish void that was the giant telescope dome; I peered out into the darkness toward the inner regions of the caldera hoping to see anything familiar. Then, strange triangular formations began to emerge. Against the background of the cloud, that slowly began to increase brightness, stood this nearly black outline of the summit. Moonlight began to increase more rapidly as the clouds thinned. The Moon was 13 days old then and close to being full; however, due to the clarity of the air, except for some reflections from the Isuzu Trooper rental, I barely noticed the Moonlight.

Remembering that color hues of objects in low lighting conditions begin to appear quite differently as lighting conditions varied, I began to look around at the different shapes that were becoming more familiar to me. The summit and several of the inner volcanic domes began to appear a little brighter and their color changed from a pure black to a deep blue, then quickly through out the spectrum until the reddish and black streaks of lava emerged.

Now, the colors of the streaks of lava and ash from nearly black to a pail green against the deep red background of the surface material. This green color persisted quite a while after the Moonlight began to increase and the snow had returned to a slightly blue-white. The large telescope domes began to appear flat white, with tones of color from yellow to a slightly reddish tint. Looking at the large the big telescope domes they began to appear less blue and more yellowish in color.

If a person suddenly found themselves in this situation, without warning, and see the colors emerging from the volcano caldera floor - red with pail green streaks running in all directions -- one might assume they were looking at fields of green grass imbedded within mounds of Georgia clay. That is a well known form of dust commonly found near the coast of the State of Georgia.

In the almost total darkness surrounding me, it was hard not to stare at things. As the lighting increases I begin to be bothered by yet another perception -- one in which made me nearly dizzy and disoriented. As one glances in a different direction from which you are staring, the after image assumes a complimentary color and nearby blinds you with a false sense high intensity light.

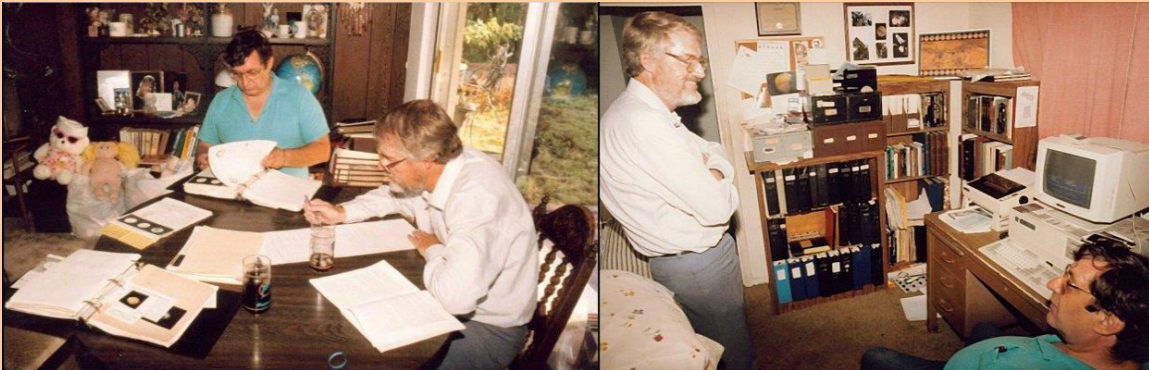


What observers imagine themselves' as the night grows older. A lack of oxygen can affect one's mental state. This image was produced by Chick Capen many years ago as a joke.

All this was made even better when I received a call from Don Parker informing me that a dust storm has been seen earlier on Mars. Using my personal Praktica-RTL Astro/Micro film camera with a machined adapter to fit the eyepiece holder of the camera I inserted it into the tube and began exposing frames with different filters. The results were good and I had a couple of roles of film with the dust clouds recorded. The photographs were taken at Cassegrain prime focus ( $f/75$ ) and with Mars at an apparent diameter of 17.5 seconds of arc the linear image diameter the 35mm frame was 3.9mm (0.1527").



LEFT: Dust clouds on Mars obscuring the NW part of Solis L. In red light Phoenicis L. and Phasis had seen forming the western border of this cloud. Daemon is visible. The second cloud lies SSW of Solis Lacus in Claritas-Foelix. Three discrete dust clouds noted east, south, and northwest of Solis Lacus. Photographed by J. Beish using University of Hawaii's 24-inch f/75 Cassegrain at Mauna Kea, HI on November 06, 1990 (Ls = 329°). Film Fuji-100. RIGHT: Praktica-RTL Astro/Micro film camera



LEFT: Leonard Martin and me in my home in Cutler Ridge, Florida looking over ALPO Mars observational records and discussing my Mauna Kea photographs. RIGHT: Having a laugh in the ALPO Mars Recorder room sometime in 1991.

## DISCUSSION

One must remember, the air is very thin up on Mauna Kea and a dose of 40% oxygen at regular intervals is necessary if you do not want to be caught up in your own illusions. So, careful records must be made for the observer to read later and determine which was real and which was an illusion!

This experience while observing Mars on Mauna Kea was truly amazing and extremely beautiful beyond this observer's imagination. From the time I first became interested in the stars, back in the 1940's, one thing that always struck me -- the absolute beauty of the night sky. In those early years, when radio was our only electronic entertainment, we used our imagination to enhance the sounds from the radio and would go off into long daydreams of space travel adventures and the like. Then, as a youngster, I would lay in the grass looking up at a sky, free of light pollution, and wonder out loud to my father, sitting nearby, that the brighter stars must be closer to us than the dim ones, and the colored ones must be a measure of heat. Yes, we could see different colors in the stars then as the background sky was pitch black.

## REFERENCES

Dobbins, Thomas A., Donald C. Parker, and Charles F. Capen, **Introduction to Observing and Photographing the Solar System**, 1987.

Hartmann, William K., "What's New on Mars?" *Sky & Telescope*, pp. 471-475, May 1989