My Stay at the World's Highest Telescope

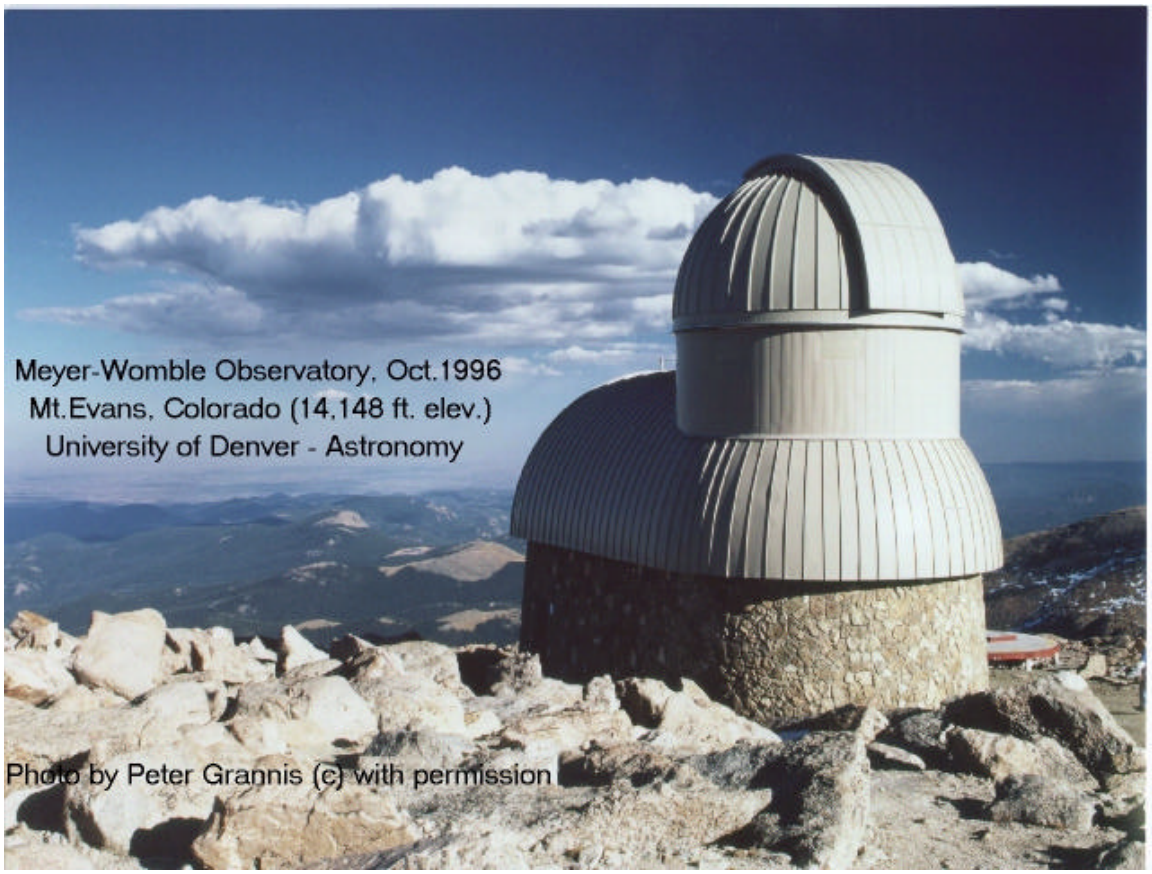
by Phil Rastocny

There are 71 mountains in the continental United States higher than 4,267m, 54 of them in state of Colorado, and Mt. Evans, the 15th highest in this state, is only 70 Km from Denver. Since the 1940s, the University of Denver (DU) has performed science at various laboratories and observatories on top of or very near Mt. Evans studying the visual heavens, gamma rays, weather, and environmental phenomenon. In 1997, DU dedicated its most ambitious scientific project in celestial observations with the completion of the world's highest telescope, the 4,312m Meyer-Womble Observatory (MWO), high atop Mt. Evans. This state-of-the-art observatory houses two telescopes both aimed at the same point in space.

Far below at the small village of Echo Lake stands log-cabin style dormitories constructed by DU in the 1940s that astronomers and geologists use during their stay. On July 20, 1998, ten people and I arrived at these 3,291m dormitories volunteering our time to get this 9,000 kilogram telescope into full operation. Each of these individuals represented their local astronomy club, one of the criteria for acceptance to this volunteer program.

Dr. Robert Stencel, director of Physics and Astronomy at DU, organized this program to permit amateur astronomers exposure to a professional telescope and obtain their assistance in correcting problems with the site. After a brief presentation on unusual environment experiences at extreme elevations, safety procedures and health concerns, it was time to eat, make lunches, and take the long-awaited drive to the summit.

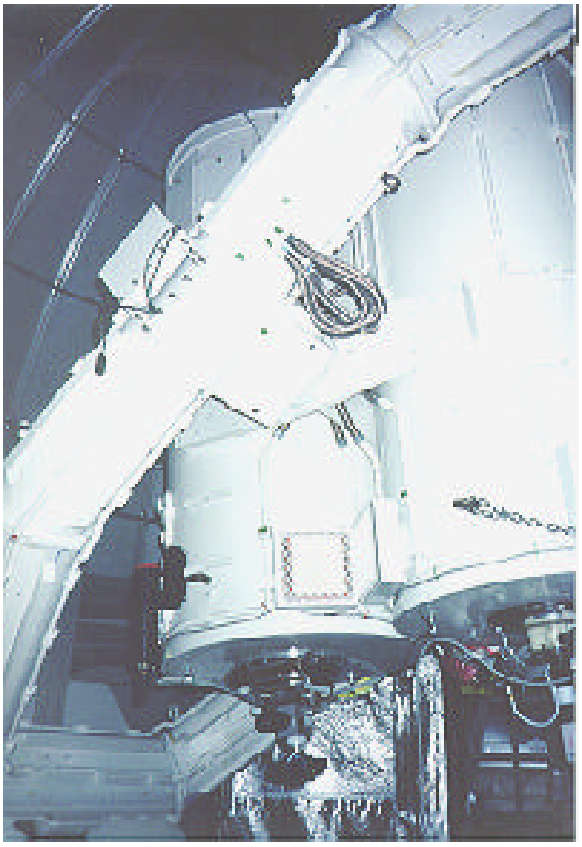
A well maintained, narrow road winds up the steep sides of this precarious mountain ending at the observatory. Along the way several stretches dropped straight down for over 600m without guard rails so you had to be very alert during these incredibly beautiful but extremely hazardous stretches. Reaching the summit about an hour before dark, this unique observatory blended into the treeless environment almost as if placed there by nature.



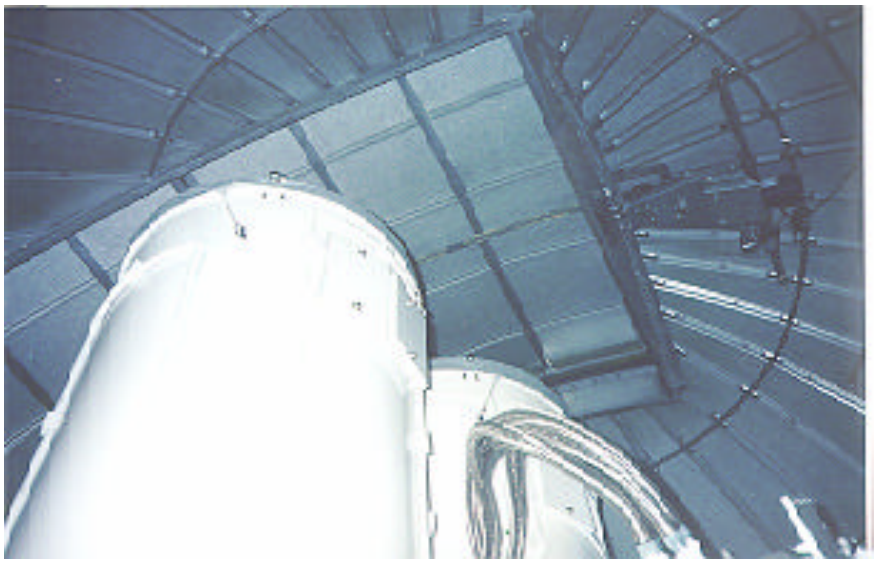
Once inside the observatory, we were introduced to the three control room computers and explained their operations. *ET* runs communications programs and establishes data connections between MWO and the DU campus. *HESS* runs image processing programs, controls the telescope's cameras, and records the exposures. *APOLLO* guides and slews the massive telescope through the heavens. Apollo runs a beta version of Software Bisque's *TheSky Level V*. Loading all databases to this program paints stellar objects over the entire screen so densely that its otherwise black background turns a hazy gray.

MWO Control Room, from left to right, Apollo, Hess, and ET
Photo by John Smith

Climbing up the stairs to the dome, Dr. Stencel introduced us to this newly dedicated telescope. The MWO is a dual aperture (binocular), Zerodur substrate, FSS 99 coated, 0.72m Ritchey-Chretien f/21 telescope. These types of telescopes fold light much like a Schmidt-Cassegrain but use hyperbolic primary and secondary mirrors. This configuration provides a wide field of view and eliminates both spherical aberration and coma. The MWO telescope is designed to observe the visual (V) spectrum through one optical tube and the mid-infra-red (IR) through the other. They sit side-by-side in an English-yolk equatorial mount providing for simultaneous measurements of the same object. The mount, optical tube, and both primary and secondary mirror cells are fluid cooled to obtain optimum temperature stability and its 14.92m focal length provides a field of view of just a few arc seconds. Plans in 1999 are to install laser corrected adaptive optics and the IR camera. Currently a small Sanyo low-lux video camera sits in the IR-tube's focuser and provides an excellent way to guide this telescope during long exposures. This video camera also provides viewing of brighter images in the control room at real time.



MWO binocular telescope showing V-tube (left) and IR-tube (right)
Photo by Rick Foye and John Smith



Dome slit of MWO
Photo by Rick Foye and John Smith

Several folks set up their scopes on the adjoining concrete pad but the winds and clouds in the early evening blocked views of an otherwise pristine sky. The temperature dove as the twighlight turned into night and the excitement grew as the waning moon appeared above Denver's encroaching sky-glow. As the night wore on, thousands of unwanted visitors flocked to this dimly lit sanctuary in the sky. The Miller moths in their regular migratory patterns soared to the coolness of high mountains after mating to converge, commune, and here to buzz the computer screens and lamps. The next hour or so was spent starting up the binocular and encouraging these moths to find refuge elsewhere.

South-east telescope pad at MWO.

Photograph by John Smith.

High-thin clouds rolled in and out through the night and the Miller moths retreated on their own shortly after 0200. Although the seeing was good, tracking and slewing were chronic problems so we finally gave up and just did some manually controlled observing. The Veil nebula looked fantastic with its wispy lanes and subtle ghosting features while Jupiter was an intense retina-burning, eye-opening delight with swirling colored clouds and 3 moons in the field. Other objects were equally rewarding and the optics proved to be visually superb, the best I had ever seen with my own eyes at this aperture.

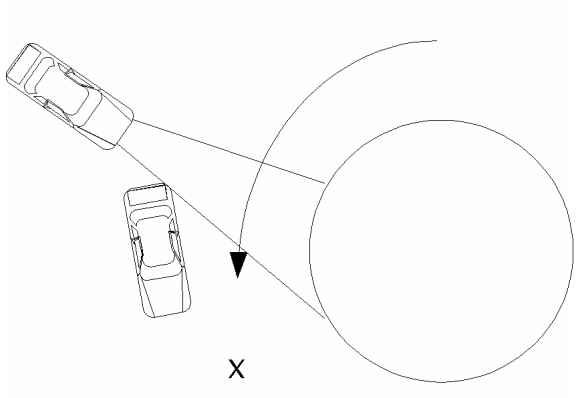
All too soon, the moon rose and twilight came, ending a very, very thrilling first night. While driving down the mountain, the sun rose and details of the valleys below came into full view. An expansive 40,000 acre wilderness flowed to the south and joined other National Forests on two sides. I could see the mountain ridge that obstructed my home in the town of Conifer and my thoughts momentarily wandered to the modest observing sight in my 3,000m-high back yard. I thought that the seeing both here and there were quite similar and I was glad again for the choice I made in picking the location of my home. As the week wore on, I would change my opinion of my own little dark-sky site. I crawled into bed at about 0700 and dreamt of the wonderful things I had just seen and done.

July 21 – It is very cloudy and rainy today with a poor chance for observing this evening so two work details were organized. At 1400, two volunteers swept out the A-frame structure next to MWO in preparation for its renovation. At 1600, three other volunteers worked on the RA and Dec drive gears adjusting their meshing and greasing them thoroughly. Still others worked on the dome automated control, and the installation of a heavier motor for the dome's slit opener. It was a busy day and the night was yet to come.

That evening, we ventured back to the summit to be greeted by dense fog and light rain. Darkness came cloaking the mountain top in a misty veil. Shining flashlights high into the darkness never penetrated these clouds. It seemed hopeless but ET linked us to weather maps that raised our hopes for later that evening. We settled in and watched as Thomas Bisque, owner of Software Bisque, demonstrated the virtues, features, and enhancements to his new software program, TheSky level V.

Periodically, one or two of us ventured outside to check the weather and about midnight, two of us witnessed an unusual high-altitude weather phenomenon. There were two cars parked next to the observatory, one with its headlights on in this dense fog. Its headlights shone behind the other car casting its long light beams across the side of the observatory (see drawing at left). In this 3.5m-wide space between the car and the observatory, the fog rolled eerily toward where we stood. Then suddenly, this back-lit fog began to swirl toward us. Swirling vortexes emerged in the foggy darkness looking like tiny, face-on galaxies with central black holes. These 3cm sized black holes pin-wheeled in a CCW direction, growing in a few seconds to

15cm, and then dissipating. 40 or 50 of these curious swirls appeared before the car moved off ending this fascinating observation.



Viewing position of weather phenomenon.
Sketch by Phil Rastocny.

Later that night the sky cleared and Thomas Bisque demonstrated how the T-Point system in TheSky V improves a telescope's pointing and that it did. After locating 6 objects and mapping them into the program, the error of short slews shrank to about 1 minute making objects land easily within the finder and most within the field of view. This was a great improvement over the previous night's efforts where objects would appear regularly outside the view of the finder. Finding and tracking objects now took seconds instead of minutes. The scope was really starting to shake down and the bugs chased away. We all felt great about the work we had done and were very encouraged about making it even better.

Climbing the stairway and looking through the slit in the dome at about 0300, I saw some wondrous naked-eye sights. I saw M31's central bulge taper outward to distinct, thin edges. Turning my head toward Cassiopeia, I saw the double cluster NGC869 with black sky between the two and its companion NGC957 with absolute clarity. Other objects seemed to jump down out of the sky and land on my eagerly awaiting eyes. Seeing these objects this clearly in the cold night air proved to me without a doubt as to why the best telescopes are this high. My Conifer dark-sky site now seemed woefully inadequate compared to this vantage point where naked-eye views of M31 only hint at a smudgy blur of stars with no particular shape.. It is no wonder that the Hubbell space telescope is capable of getting the images that it does. This was an emotional experience that left me with a sense of awe I will never, ever forget!

During this same time, we shared the observatory with some scientists from the University of Alaska who studied a lightning-related weather phenomenon called *sprites*. This phenomenon randomly occurs during intense storms and sends small, beautiful salmon-colored energy bursts to altitudes as high as 93 Km above sea level. These bursts plume into colorful clouds or flashes of light, reported by pilots for years, is now being investigated by several groups. Sharing our humble accommodations with these pioneers of a new field seemed fitting since first

light of this telescope was only one year ago. Both groups were in their infancy and both excited about doing their particular line of science.

All too soon the dawn came and we once again drove down the mountain. Tonight we seemed better acclimated to the altitude in that breathing and moving was not as tedious as in the previous night. As predicted, however, our visual acuity diminished and fainter objects that normally were observable faded somewhat into the darkness. We were also becoming used to the all-night work-hours of astronomers but we looked forward to getting into our beds.

Looking due south at dusk. Weather did not look promising.
Photograph by John Smith.

July 22 – It was cold and raining most of the day and at dusk things did not look promising. Local forecasts predicted clearing after 0200 so the mood was not as hopeful as in the previous nights. Four of us trudged up the mountain again at about 2030 hoping to arrive at the summit before dark. The clouds were spectacular this evening and we stopped several times along the way as our cars crested over their pillowy tops. This was the first time that some of us ever looked down on these giants from land and we were thrilled to see such a spectacle. As our cars climbed higher and higher, we saw telltale evidence of an earlier hail storm. Piles of hail filled lower spots in the landscape, especially near the observatory. We parked the cars and went inside.

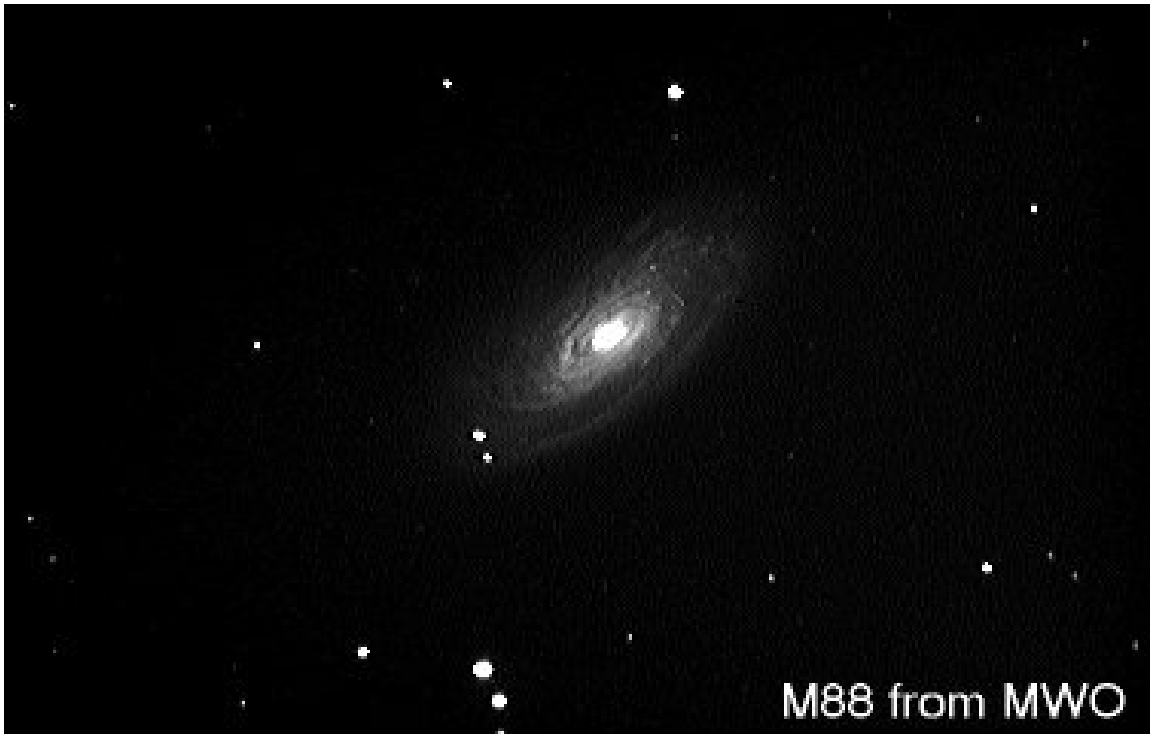
We took down all three computers, moved them around, performed upgrades, and reorganized the work areas in the control room. Shortly after midnight two of us selected images from previous observing sessions. We collected a cross section of planets, nebulae, and globulars to work with Software Bisque's *CCDSoft* image-processing software.

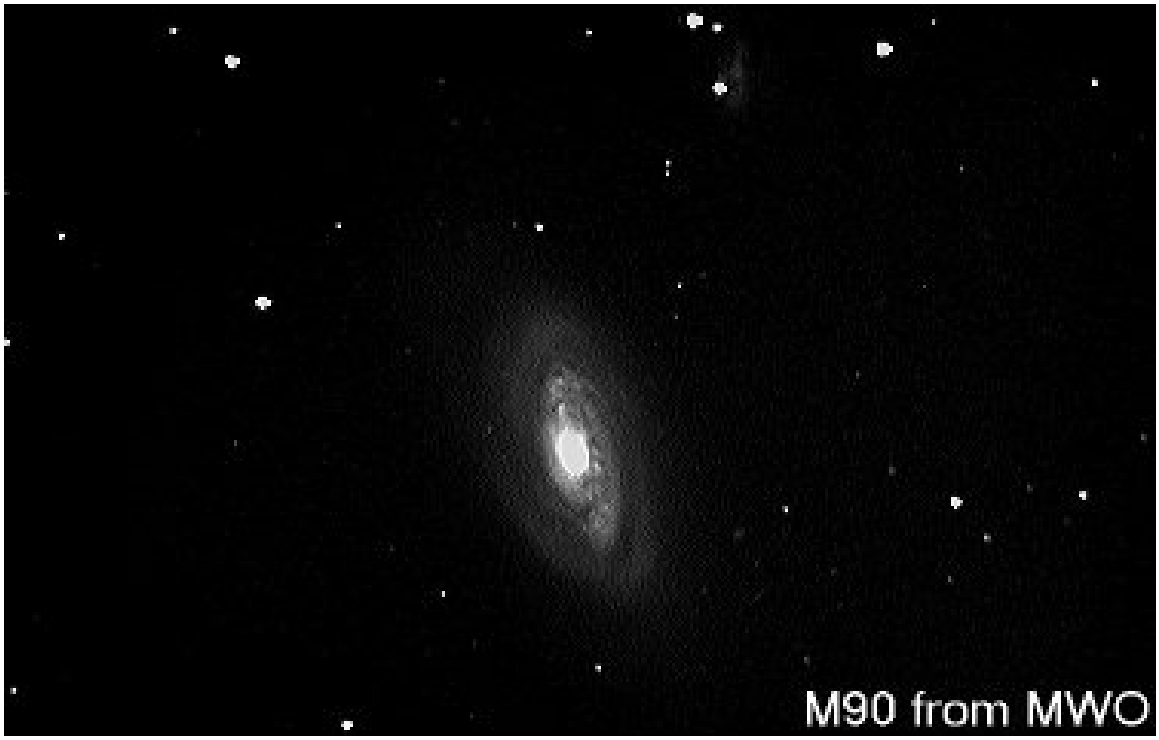
We shut down the computers at about 0230 and began to lock down the observatory for the night when suddenly the batteries gave out and all went black. It is amazing how dark it was and how quickly everyone found their flash lights. Since we were nearly ready to leave it seemed fitting that the batteries, not the weather, chased us off the mountain.

Driving down was interesting and challenging. Other astronomers in similar foggy conditions drove with their car windows rolled down and a flashlights in hand to see the edge of the road. Another time someone walked in front of the cars with flashlights to guide the cars down the 23Km road back to the dorms. Fortunately, my car had fog lights. Adjusting them and the headlights down to a very low angle, we cautiously ventured down the hill. The fog was very thick to say the least and our little caravan crept slowly through the night. Idling along in first gear at times did not seem slow enough but then suddenly the fog broke and we virtually dropped out of the clouds. Whisps of fog and vapor beat against the rock cliffs as if some invisible ocean lay just beyond the road. Like some great surf crashing against a reef, streams of mist plunged upward streaking high into the sky forming striated gray curtains of water droplets. We made it safely down and looked forward to another night and one last opportunity for clear skies.

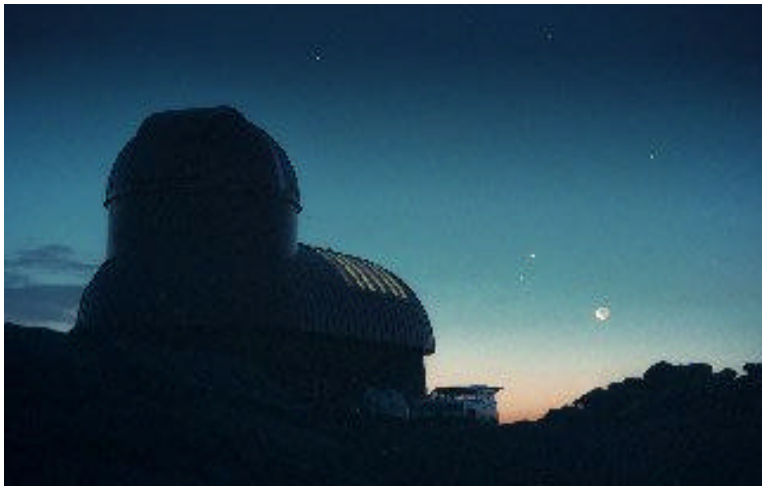
July 23 – Again the weather was formidable and it now seems as if Colorado's monsoon season is here to stay. On this last night, five of us crept up to the summit hoping for the usual break in the clouds in the early morning. About midnight, Dr. Eugene Wescott from University of Alaska loaned us two video tapes to watch about sprites. The first was a 5-minute color promotional explaining their work and the second a 20-minute B&W showing an amazingly intense storm in TexArkana with virtually hundreds of sprites firing off into the upper atmosphere. Dr. Stencel then took us back into the observatory dome and pointed out to us a change in the welding of the north telescope-pier's top plate that caused this scope's polar alignment error. We also watched some of the earlier-recorded video footage of Jupiter, Saturn, and the moon. The weather never did break and regretfully we all came down at about 0300.

July 24 – Time to leave. As we packed up the cars and said our good-byes, there was an intense feeling of pride and accomplishment knowing that the only tasks that remain to bring this new telescope into its prime are polar alignment and a minor optical tube assembly alignment. Our combined efforts raised this instrument from the level of infancy to that of near maturity, something that we were thrilled to do. We all saw some interesting objects and touched some phenomenal observing equipment.


M88 from MWO


M90 from MWO

Being at MWO has personally rekindled my serious interest in astronomy and I am truly thankful for that. I also want to thank Dr. Robert Stencel, Terry Chatterton, Marc Jones, the University of Denver, Tom Melscheimer, Thomas Bisque, and all of the others who help make this stay so enjoyable despite the cloudy weather. I hope to see you all at some time in the future, probably at a star party or observatory near you!



MWO , Altair, and Lunar conjunction, July 20, 1998
Photo by Brad Hoehne

Bio Brief

Phil Rastocny is a graduate of Oklahoma State University and works as an MIS Manager for Lucent Technologies, Bell Labs Innovations. He and his massage-therapist spouse, Althea Rose, have lived in and enjoyed the high, dark skies of Conifer, Colorado, for the past 18 years. Phil is primarily interested in the astronomical phenomena of dark matter and variable stars, and teaches classes on buying your first telescope at local institutions.