FIRST LIGHT AT THE NEW MT. EVANS OBSERVATORY

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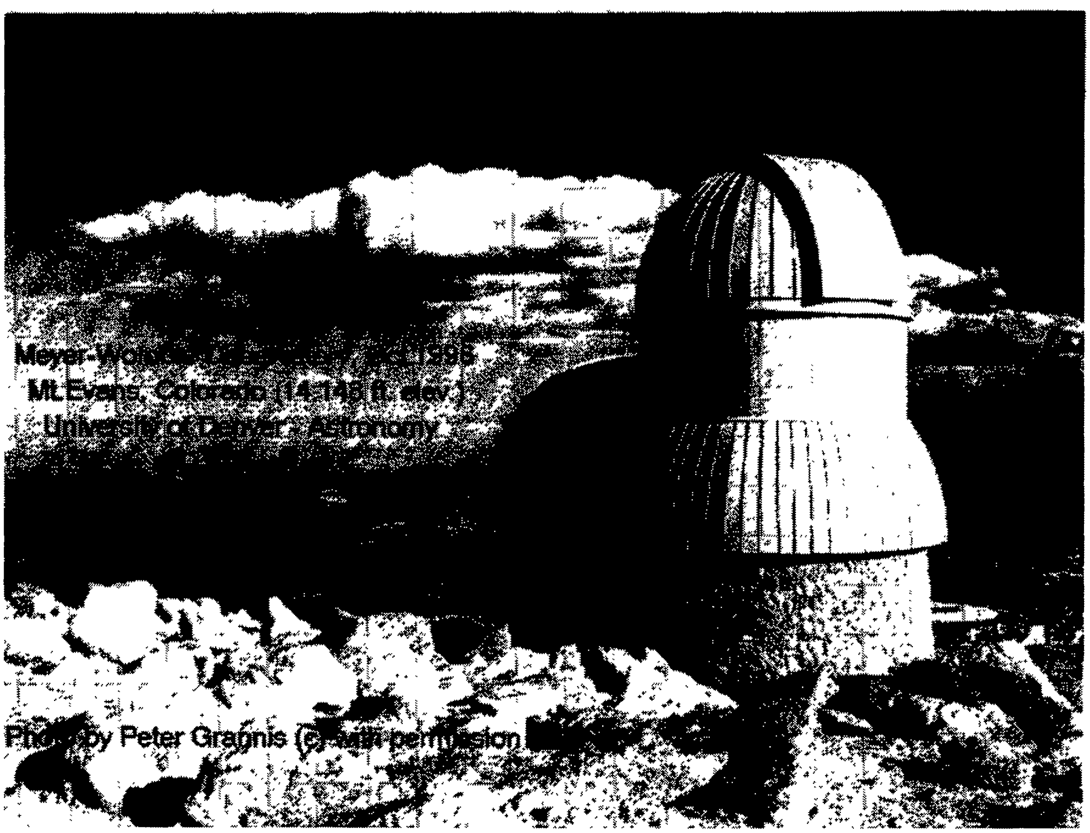
Abstract

The new Mt. Evans Meyer-Womble Observatory may be one of a few professional-grade facilities with a strong orientation to the work of the American Association of Variable Star Observers. Some details of its construction and its telescopic capabilities are given here.

1. The observatory and telescope

The University of Denver's claim to have the "world's highest operating observatory" is based on the official observatories listing that appears in the *Astronomical Almanac* (1998). At 4,313 meters (Georgetown, CO), the new Mt. Evans Meyer-Womble Observatory (shown in photo below) is nearly 100 meters above the highest point listed for Mauna Kea (4,215 m), the nearest competitor. Still higher sites are either proposed or closed, but nothing else in North America comes close. The observatory is operated under a Special Use Permit granted by the USDA Forest Service.



The topography, which includes a steep ridge immediately upwind, favors excellent seeing conditions. Sub-arcsecond seeing has been measured, and both acoustic sounding and differential image motion monitoring suggest atmospheric cell sizes of order one meter. The Meyer Foundation recognized these advantages and selected Mt. Evans for installation of their unique Meyer Binocular Telescope, comprised of twin 0.72-meter optics. The completion of the 2,100 square foot all-steel building, designed to withstand 200 mph winds, during the remarkably short construction season at 14,000 feet is a testimony to the skill and expertise of the contractors, subcontractors, and organizations involved in the effort.

To take advantage of the high altitude, the building and telescope design incorporate airflow and thermal management strategies. The building is rounded to slip through the prevailing westerly winds, with the dome located in the upwind side. The dome is elevated 40 feet to place the telescope above as much of the ground-layer turbulence as possible. The cylinder wall that supports the dome has six adjustable windows and vents to further manage airflow in and around the main slit of the 22'6" Ash Dome. Inside the dome room, a false floor has been installed with airflow grates that connect to an underfloor plenum and a 4000-cfm air handing unit in the room below, in order to manage "dome seeing." The telescope tubes themselves include 4 exhaust fans, each mounted around the mirror cells, to draw a steady stream of air into the tubes and across the mirrors and out, to stabilize "tube seeing" insofar as possible.

The twin 28.5-inch Zerodur mirrors are finished to 20th wave accuracy by Contraves. They are overcoated with a multilayer dielectric enhanced silver, providing high reflectance from the near UV to well into the infrared. The overall system f-ratios are f/21, giving 600 inches of focal length—90% of prime focus on the Palomar 5-meter! Observing experience has shown that the excellent seeing at the site is compatible with this huge plate scale. For additional telescope specifications, please see details posted at my website (www.du.edu/~rstencel). The telescope control system has been designed and built by Merlin Controls Corporation, and uses high precision encoders and software to enable arcminute pointing accuracy even following 180 degree slew motions. The control system interfaces with Software Bisque's *THE SKY* Level 5 to further ease object identification and acquisition, and lends itself to remote control operation.

The high altitude is conducive to infrared astronomy in particular. Average water vapor columns are 5 mm in summer and less than 1 mm in winter, providing for infrared transparency to 27 microns and in the submillimeter regions. At the University of Denver, we are emphasizing this use for the observatory, and have constructed instruments that make use of new infrared array technology. The educational mission of the University permits us to plan the eventual remote access of the new telescope via computer networks, given the line-of-sight link between campus and mountain that permits a microwave link for real-time communications.

2. Notes concerning the high altitude site

2.1. First light

We succeeded in making the new telescope operational August 16, 1997, after the success of building construction during the prior summer (which ended with an early snowy autumn, plus some minor overwinter damage to the Ash Dome, discovered in May 1997).

2.2. Microwave data link established

In June of 1998, with the help of FreeWave, Inc., wireless data transceivers, Mt. Evans Observatory was linked to the outside world at speeds to 115 kbps via 900 MHz spread-spectrum technology pioneered locally by FreeWave (www.freewave.com).

Watch the website for live images and remote operations to follow as soon as these can be organized. This link is vital, as Mt. Evans has no commercial electrical or phone lines. In related developments, Merlin Controls is completing automation of the Ash Dome, which will allow the telescope and dome to be controlled under one software package (www.merlin.com). This is essential for eventual remote operations.

2.3. Solar power

The University of Denver's new Meyer-Womble Observatory now receives its continuous supply of electrical power directly from the Sun. Because the observatory is remote from any electrical power lines, generators have been the only power sources to date. The installation of a continuous power source moves the new facility one step closer to the goal of remote operability. The provision of a modest but steady source of power will enable us to begin overwinter monitoring of the observatory systems, and develop the communication pathways needed to ultimately bring telescope images to classrooms, Gates Planetarium, and the internet. What is unique about the installation of this 1400-watt photovoltaic system, other than its location, is that the Unisolar panels are amorphous silicon triple junctions that are integrated into the roofing shingle material, so no exposed boxes will stand off above the normal-looking roof.

2.4. The Collins Electro-Optics I3Piece

We are fortunate to serve as a test site for a significant new instrument that can greatly improve student experiences with modest-aperture telescopes. The I3Piece is made by Collins Electro-Optics of Denver, Colorado, and includes an ITT image intensifier and S-20 photocathode capable of 50,000 amplification, 60 lines/mm resolution, while using only a 3V photobattery (versus classical intensifiers that required many kV). The unit is ruggedly packaged with 1.25- and 2-inch barrel options, and can mate easily with an eyepiece, video camera, or CCD camera (with total lengths under 12 inches). When coupled with a typical video camera and monitor, one can readily deliver a better-than-visual limiting magnitude view of stars, clusters, and galaxies. The limiting visual magnitude for a telescope of aperture d is 7.6 + 5 log d (cm) (Garstang 1999). The I3Piece is too sensitive to look at planets or the moon, but students can usually view these bright objects without difficulty. The real advantage of the device is how it can surmount the "fuzzy blob" view usually experienced by first-time telescope users, and deliver literally picture-book quality views, even from light-polluted sites.

The I3Piece works best under clear skies, as it amplifies haze and clouds, as well as stars. When coupled to our 0.7-meter telescope at Mt. Evans Observatory, we were able to identify 17th-magnitude stars in real-time on the monitor, viewing the calibrated cluster NGC 7006. Comparably outstanding views were obtained when used with our 20-inch Clark refractor at the University's Chamberlin Observatory in central Denver. My key point is that in either eyeball or video mode, the I3Piece will insure that students won't leave the telescope session disappointed, because they will easily see the physical principles illustrated when we share with them views of self-gravitating systems of stars or star-forming nebulae. I strongly recommend that instructors investigate the website (www.ceoptics.com), or contact me.

3. Many thanks

An observatory project of this magnitude does not happen without the support of many. Its roots trace back to the founders of the University of Denver, particularly Governor John Evans (who also founded Northwestern University). His vision enabled astronomer Herbert Howe to be hired in 1880, resulting in Humphrey Chamberlin's investment in the construction of a campus observatory housing a 20-inch Clark refractor in 1890. We estimate that more than a quarter-million Denver students,

residents, and visitors have viewed the heavens with the refractor since its first light, including William Herschel Womble—a University of Denver alumnus of the 1930's who left a bequest to the University to support its astronomy program and "to build and equip a mountain-top observatory to promote educational research in astrophysics and astronomy, in the memory of his mother, Cora Taylor Womble Fowler." Mr. Womble's vision has been realized, particularly with the provision of the Meyer Binocular Telescope from the Meyer Foundation, and "far-sighted" Eric T. Meyer, its designer.

Many persons have contributed in large and small ways, in adding to the observatory project successes—see my website for details. Personally, I want to acknowledge my astronomical mentor, Edward Halbach, prodigious observer for the AAVSO and co-founder of the Astronomical League. His leadership locally and nationally enabled this astronomer to follow the stars since youth. His charge that the League should "promote the observing programs" is a guiding principle that should be foremost in consideration by all astronomers. Finally, I want to cite longtime AAVSO observer and Denver resident Ronald Ham. Following his recent death, Mrs. Ham made available to the University of Denver his 8- and 10-inch telescopes and his extensive collection of original AAVSO charts. Acquisition of these materials has enabled an expansion of variable star studies via promotion with amateurs in this mountain region that might not have otherwise occurred. Hence, I salute Ron's observing career and am pleased to think that his work continues, and will hopefully attract new students into variable star astronomy.

References

1998, *Astronomical Almanac*, U.S. Government Printing Office, Washington, D.C., p. J1.

Garstang, R. 1999, *J. Amer. Assoc. Var. Star Obs.*, **27**, 80.