the Webfooted Astronomer
News from the Seattle Astronomical Society
July 2008

A visit to Whipple Observatory

by Burley Packwood

I recently visited the Fred Lawrence Whipple Observatory, located at an elevation of 7,500 feet in the Santa Rita Mountains 35 miles south of Tucson, Arizona. It is owned by the Smithsonian Astrophysical Observatory and is their largest field installation outside of their main site in Cambridge, Massachusetts. Construction began in 1966 and the observatory became operational in 1968. The observatory is run by the University of Arizona and the Smithsonian Institution and has a visitor center in nearby Amado, Arizona.

Fred Lawrence Whipple (1906-2004) was an American astronomer who is best known for proposing the "dirty snowball" hypothesis for comet composition. He received a doctorate in astronomy in 1931 and, while at the Harvard College Observatory, confirmed that meteors originate within the solar system rather than interstellar space. He also invented a "meteor bumper" or "Whipple shield," which protects spacecraft from impact by small particles by vaporizing them. During WW II he invented a device for cutting tinfoil into chaff to confuse enemy radar tracking Allied aircraft. Whipple died in 2004 at the age of 97.

The largest observatory at the Fred Lawrence Whipple Observatory is the Multiple Mirror Telescope Observatory (MMTO), the home of the Multiple Mirror Telescope (MMT), which currently has a 6.5-meter diameter primary mirror. The name comes from the fact that the light gathering for the original telescope was performed by six 1.8-meter diameter mirrors before the current primary mirror was installed. The light gathering equivalent of the original six mirrors was that of a 4.5-meter mirror, making it the third largest optical telescope in the world at the time of its dedication. The original version of the MMT operated from 1979 to 1998. It featured ambitious design innovations including its unusual optical design, a co-rotating building, and an alt-azimuth mount.

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NEXT MEETING

July 16, 2008— 7:30 p.m.
University of Washington Physics/Astronomy Building, Room A-102

Hard lessons in scope building

For amateur astronomers to enjoy the celestial wonders, one of the most important things to own is a telescope, and if that telescope was self-made, the time under the night sky could be even more enjoyable. The fun (and not so fun) parts of making a telescope from scratch go beyond just astronomy, especially for a total beginner.

Jingchun Chen, SAS VP Programs, will be sharing with us his experiences in making two Dobsonian telescopes in just six months, starting with glass blanks and materials from hardware stores. He will emphasize the mistakes he made and the lessons he learned, which may be useful for future telescope builders.

SAS Calendar

July 9 — Jupiter at opposition

July 10 — Mars 2/3° south of Saturn

July 12 — 7 p.m.
Seattle Astronomical Society Star Parties
- Green Lake, Seattle
- Paramount Park, Shoreline

July 16 — 7:30 p.m.
Seattle Astronomical Society Meeting
Guest speaker: Jingchun Chen on telescope building. Details on page 1.

July 16 — 9 p.m.
UW Observatory — Public viewing night

July 19 — 6:30 p.m.
Amateur telescope makers SIG meeting
Contact: atm@seattleastro.org

July 20 — 2 p.m.
Astrophotography/Imaging SIG meeting
Contact: astrophoto@seattleastro.org

July 29 — Peak of Delta Aquarid metor shower

July 31 — New Moon

July 31-August 2
Table Mountain Star Party

August 2 — 8:30 p.m.
Tiger Mountain Star Party (members only)

August 6 — 9 p.m.
UW Observatory — Public viewing night

August 9— 7 p.m.
Seattle Astronomical Society Star Parties
- Green Lake, Seattle
- Paramount Park, Shoreline

SAS officers

The Webfooted Astronomer is the monthly publication of the Seattle Astronomical Society (SAS). All opinions expressed herein are those of the contributors and not necessarily those of SAS. Advertising display rates: full page (7″ x 9.5″) $50; half page (7″ x 4.75″) $30; less than half page: $5 per page inch (1″ x 5″). Personal ads are published free to current paid members of the SAS. For all others, 10 cents per word, 50 word minimum charge. Submit article ideas to Editor, The Webfooted Astronomer, PO Box 31746, Seattle, WA 98103, or e-mail to editor@seattleastro.org.

Editor: Greg Scheiderer

Star party season is here

From the president's desk
By Jon Bearscove

As the summer approaches, more opportunities for star parties will arise. Last summer I spent as many new moons as possible under the stars up at Table Mountain with fellow astronomers and had the best time. There's nothing better than observing the stars with friends at such a location. This year I hope to return to my favorite dark sky site once the snows melt and the clouds part.

There may be new members who have never observed at a dark sky site and will want to join in the fun for the first time. There are a few things to consider before planning a trip up to Table Mountain for an overnighter in order to make your experience enjoyable.

First and foremost, Table Mountain is a remote site. It's not as remote as what I've seen in the deserts of California, but it comes in second place. At least it has a single-toilet bathroom, like a permanent Honey Bucket. This is the one single factor that makes Table Mountain a wonderful site, because I've been to observing sites that have no toilets at all, and for the lady astronomers and spouses, that's a challenge and a major turn-off. Pack a roll of toilet paper just in case the roll is empty in the bathroom. Bring hand sanitizer; there's no sink or water. In fact there's no water on the whole mountain, so pack plenty for your family.

The easiest way to imagine a night under the stars at Table Mountian is to consider this simple equation:

Camping – campfire – white light = star party

If you prepare your family for a one or two night camping trip, with a tent, sleeping bags, camp stove, warm clothes, food etc. you're all set. Campfires are bad for two reasons: they are too bright and affect night vision, and they produce ash which can damage optics. White light is our enemy and affects night vision and it only takes a second to wreck hours of built-up night vision. Take the time at home before you go to cover all interior lights in your car if you can't switch them off. Use black duct tape to cover them or remove the bulbs (including trunk) if necessary. You will need to get "something" out of your vehicle in the middle of the night and that can cause an explosion of white light…yuck.

Telescopes are optional because you can go to Table Mountain with just your astronomy magazine and a pair of binoculars and have the best night under the stars you've ever had. Plus there's bound to be other astronomers there with telescopes that would be happy to share the views. My first couple of years I only had binos and star charts. That's why a telescope is not part of the equation; it's a great place to relax and learn the constellations and asterisms.

Of course there are advanced tips for making Table Mountian more enjoyable, so please post your questions in the Google Group and we'd be happy to answer them. A lot of us are long-time veterans of Table Mountian and know the place like it's our backyard. Don't be shy, pack your gear and join us on the mountain!

Whipple Observatory

Continued from page 1

The MMT heralded a change in telescope design. All major optical telescopes since the MMT have been built with alt-azimuth mounts. Several technologies pioneered at the MMT contributed to the success of the subsequent generation of large telescopes. These included high dynamic-range servos for the alt-azimuth mount, highly accurate pointing that eliminated the need for sky charts, co-alignment and co-phasing of multiple telescopes, improvements to optical performance by attention to the thermal environment of the facility, contributions to vacuum coatings deposition, optics cleaning and maintenance, and early experiments in co-phased adaptive optics.

The 12-meter diameter Very Energetic Radiation Imaging Telescope Array System (VERITAS) at Whipple Observatory. Burley Packwood photo.

The new 6.5-meter mirror MMT was dedicated on May 20, 2000. This mirror is notable because it is of a lightweight honeycomb design made by the University of Arizona's Steward Observatory Mirror Laboratory, where mirrors are cast in the interior of a rotating oven. It was the first 6.5-meter mirror cast at SOML. In late 2002, a novel deformable secondary mirror was added to the telescope. The MMT is also notable because of its building, which does not resemble the typical observatory dome. The building's unique shape allows it to completely roll back the walls and roof around the telescope, thus allowing it to cool down very quickly in order to improve the seeing.

The observatory also has 1.5-meter and 1.2-meter reflectors for solar system, galactic and extragalactic astronomy and a 1.3-meter reflector named PAIRITEL (Peters Automated IR Imaging Telescope) for infrared observations, gamma-ray burst afterglows, supernovae, and other variable sources. Also on site are the IOTA (Infrared Optical Telescope Array), which is used by many institutions and the HAT (Hungarian Automated Telescope), which is used for robotic searches for variable stars and exoplanets.

The observatory is known for its pioneering work in ground-based gamma-ray astronomy through the development of the Imaging Atmospheric Cherenkov Technique (IACT), which began with the Whipple 10-meter Telescope. It was constructed in 1968 and is still fully operational.

In April 2007, VERITAS (Very Energetic Radiation Imaging Telescope Array System) began full operation at the FLWO. This is a ground-based gamma-ray observatory with an array of four IACT 12 meter optical reflectors for gamma-ray astronomy in the 100 GeV-10 TeV energy range. The telescope design is based on the design of the existing Whipple 10-meter telescope and is located near the Visitor Center at 4,159 feet elevation. ★

On the Web:
http://cfa-www.harvard.edu/facilities/flwo/

SAS elections set for November

Call for volunteers and nominations; all club officer positions to be filled; immediate need for VP of programs

While the November annual meeting of the Seattle Astronomical Society may seem a long ways off, with summer barely, finally, showing its face around these parts, the process for coming up with a slate of officers is already under way. The current SAS executive board is actively seeking volunteers or nominations for people to fill all seven of the society's elected board positions.

Of those, there is an immediate need for someone to fill the position of Vice President/ Programs. Other commitments have forced current programs VP Jingchun Chen to step down, so the post is currently vacant. This officer is the one primarily in charge of SAS's outstanding guest speakers program. The rest of this year also provides a great chance for a volunteer to test-drive the position. A tentative lineup of speakers, topics, and presentations is already in place for the rest of the year, so a fill-in VP/Programs could get a jump start on 2009.

Article III, section 2 of the SAS by-laws stipulates that a nominating committee propose a slate of officers to the membership, and that the list be published at least a month before the election. That means the slate should be ready in October, so the nominating committee — in this case the current executive board — will be working from now until early October to identify candidates for office. Contact President Jon Bearscove, or any current board member, to volounteer for or nominate someone else for a board position.

Full descriptions of the positions are available in the SAS by-laws, on-line at http://www.seattleastro.org/SASbylaws.pdf. Here's a quck look at the responsibilities of each.

★ President. Presides over all meetings, performs "traditional duties" of executive office.

★ First VP, Programs: arranges speakers for monthly meeetings, coordinates other activities.

★ Second VP, Education: designs education programs for beginners, schools, and the general public.

★ Third VP, Membership: recruits new members, maintains database and membership list.

★ Fourth VP, Publicity: coordinates activities to publicize activities of the society to members, other astronomy groups, and the news media.

★ Secretary: keeps brief minutes of meetings, handles other correspondence.

★ Treasurer: keeps the books.

There has been some misunderstanding in recent years about the start of the terms for officers. The by-laws state the newly elected officers assume their duties with the completion of the annual meeting.

Space Buoys

by Dr. Tony Phillips

Congratulations! You're an oceanographer and you've just received a big grant to investigate the Pacific Ocean. Your task: Map the mighty Pacific's wind and waves, monitor its deep currents, and keep track of continent-sized temperature oscillations that shape weather around the world. Funds are available and you may start immediately.

Oh, there's just one problem: You've got to do this work using no more than one ocean buoy.

"That would be impossible," says Dr. Guan Le of the Goddard Space Flight Center. "The Pacific's too big to understand by studying just one location."

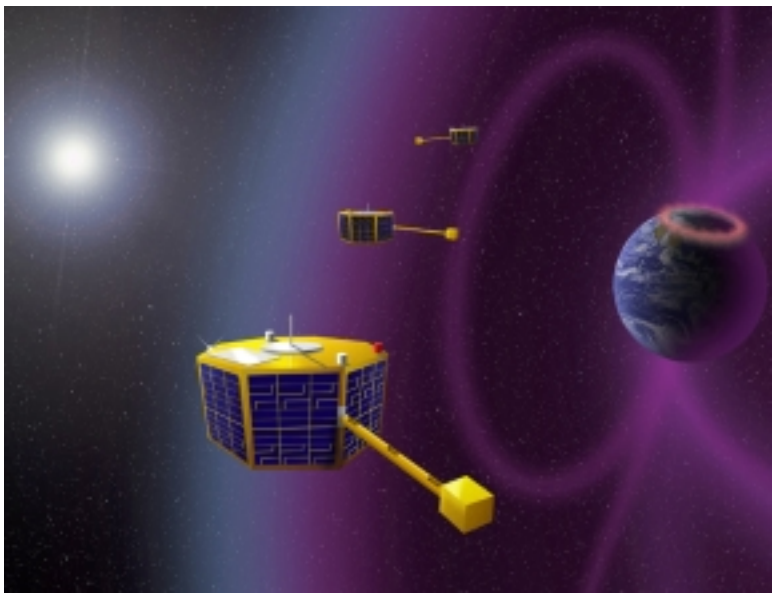
Yet, for Le and her space scientist colleagues, this was exactly what they have been expected to accomplish in their own studies of Earth's magnetosphere. The magnetosphere is an "ocean" of magnetism and plasma surrounding our planet. Its shores are defined by the outer bounds of Earth's magnetic field and it contains a bewildering mix of matter-energy waves, electrical currents and plasma oscillations spread across a volume billions of times greater than the Pacific Ocean itself.

"For many years we've struggled to understand the magnetosphere using mostly single spacecraft," says Le. "To really make progress, we need many spacecraft spread through the magnetosphere, working together to understand the whole."

Enter Space Technology 5.

In March 2006 NASA launched a trio of experimental satellites to see what three "buoys" could accomplish. Because they weighed only 55 lbs. apiece and measured not much larger than a birthday cake, the three ST5 "micro-satellites" fit onboard a single Pegasus rocket. Above Earth's atmosphere, the three were flung like Frisbees from the rocket's body into the magnetosphere by a revolutionary micro-satellite launcher.

Space Technology 5 is a mission of NASA's New Millennium Program, which tests innovative technologies for use on future space missions. The 90-day flight of ST5 validated several devices crucial to space buoys: miniature magnetometers, high-efficiency solar arrays, and some strange-looking but effective micro-antennas designed from principles of Darwinian evolution. Also, ST5 showed that three satellites could maneuver together as a "constellation," spreading out to measure complex fields and currents.



The Space Technology 5 micro-satellites proved the feasibility of using a constellation of small spacecraft with miniature magnetometers to study Earth's magnetosphere.

"ST5 was able to measure the motion and thickness of current sheets in the magnetosphere," says Le, the mission's project scientist at Goddard. "This could not have been done with a single spacecraft, no matter how capable."

The ST5 mission is finished but the technology it tested will key future studies of the magnetosphere. Thanks to ST5, hopes Le, lonely buoys will soon be a thing of the past. ★

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

Long Journey Into Night

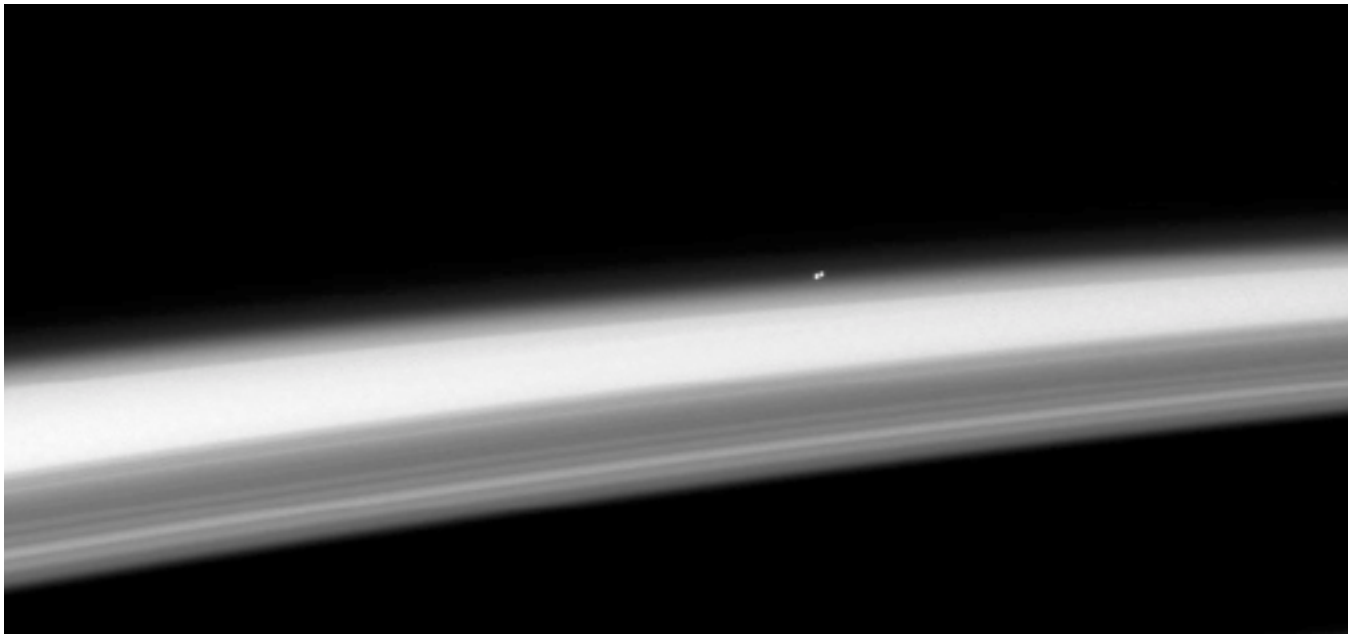
by Ron Hobbs

On June 8, the New Horizons probe passed an important milestone on its long journey to (134340) Pluto, crossing the orbit of Saturn and plunging outward into the portion of the Solar System unknown to the ancients. New Horizons becomes only the fifth spacecraft to enter the icy hinterlands of our stellar system, bound for interstellar space. On July 14, 2015, it will contribute to the on-going saga of discovery of this part of the Sun's realm when it zips past Pluto and its system of at least three moons. New Horizons has been under way for two and a half years and is still seven years from its goal. It will spend most of the remaining time napping, regularly sending back coded signals to let its builders know that it is doing fine.

The voyage of New Horizons is a wonderful indicator of and a great teaching tool about the true vastness of the Solar System. The probe reached Jupiter just 13 months after launch, but took another year and a half to reach the distance of Saturn. It will take almost two and half additional years to reach the distance of Uranus, and then almost three years after that to reach the distance of Neptune. Pluto is "just beyond" Neptune, having passed perihelion in 1989. A spacecraft would have to make that journey more than twice again to reach the new, most distant regular member of the Solar System, (136199) Eris.

Back here on Earth, Pluto continues to be at the center of strife and discord over the classification of planetary objects in the outer Solar System. On June 11, the International Astronomical Union announced yet another category into which objects that orbit the Sun can

Continued on page 8



The nearest star system, the trinary star Alpha Centauri, hangs above the horizon of Saturn. Both Alpha Centauri A and B—stars very similar to our own—are clearly distinguishable in this image. (The third star in the Alpha Centauri system, the red dwarf Proxima Centauri, is not visible here.) The view was captured from about 66 degrees above the ringplane and faces southward on Saturn. Ring shadows mask the planet's northern latitudes at bottom. The image was taken in visible red light with the Cassini spacecraft narrow-angle camera on May 17, 2008. The view was obtained at a distance of approximately 534,000 kilometers (332,000 miles) from Saturn. Image scale on Saturn is about 3 kilometers (2 miles) per pixel. Photo: NASA/JPL/Space Science Institute

Long Journey Into Night

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be classified, the eponymous "plutoids." As far as I can tell, a "plutoid" is a trans-Neptunian "dwarf planet," the previous taxon the IAU came up with to come to grips with the emerging complexity of the outer Solar System. At this point, (134340) Pluto and (136199) Eris are the only two recognized "plutoids," though there are at least eight other previously discovered bodies (and possibly many more) that may qualify. (There are currently 10 TNOs with absolute magnitudes smaller than that of (1) Ceres, the other body currently designated a dwarf planet.) I agree with Mike Brown, one of the discoverers of Eris, that this new category is mostly unnecessary[1], though others in the planetary science community have been less generous.[2] In my opinion, with this proclamation the IAU continues the focus on Pluto, instead of tackling the difficult work of naming the trans-Neptunian worlds we have discovered so far and understanding the structure of the "third zone" of the Solar System.

Regardless of how we classify (134340) Pluto, it is, and always will be, the first of the trans-Neptunian objects to have been discovered, the first to have been discovered to be a binary system (30 years ago in June), and, we hope, the first to be studied at close range by spacecraft. The study of the Pluto system has and will continue to tell us much about the other similarly sized worlds that inhabit trans-Neptunian space. This is particularly true of its nature as a binary.[3] The study of astronomical binaries has taught us much about the universe. Herschel's discovery of binary stars allowed the mass-luminosity relationship, and ultimately stellar evolution, to be discovered. We do not yet know the true prevalence of satellites in the outer Solar System, but we do know they are quite common among the largest objects. Five of the seven largest TNOs have satellites; two of these, (134340) Pluto and (136108) 2003 EL_{61} (known affectionately to its discoverers by the nickname "Santa") are multiple systems. The presence of satellites allows astronomers to calculate the mass of these objects with great precision. What is clear is that the total mass of the TNOs discovered so far is about an order of magnitude smaller than what the astrophysical modelers predict should be there. There are certainly more trans-Neptunian objects to be discovered, which means that the IAU will have to work harder to find names for all of them. ★

Footnotes:

[1] Britt, RR. Pluto Now Called a Plutoid. June 11, 2008 http://news.yahoo.com/s/space/20080611/sc_space/plutonowcalledaplutoid

[2] BBC News. 'Non-planet' Pluto gets new class. http://news.bbc.co.uk/2/hi/science/nature/7449735.stm

[3] Noll, KS, et al. Binaries in the Kuiper Belt. Accepted for publication in The Kuiper Belt, http://arxiv.org/PS_cache/astro-ph/pdf/0703/0703134v2.pdf

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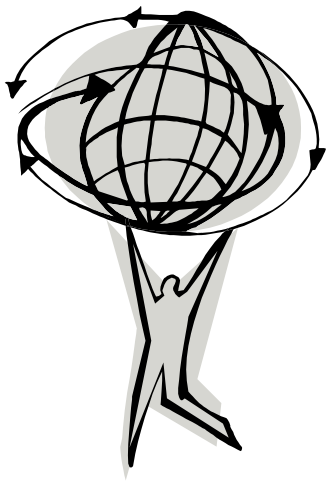
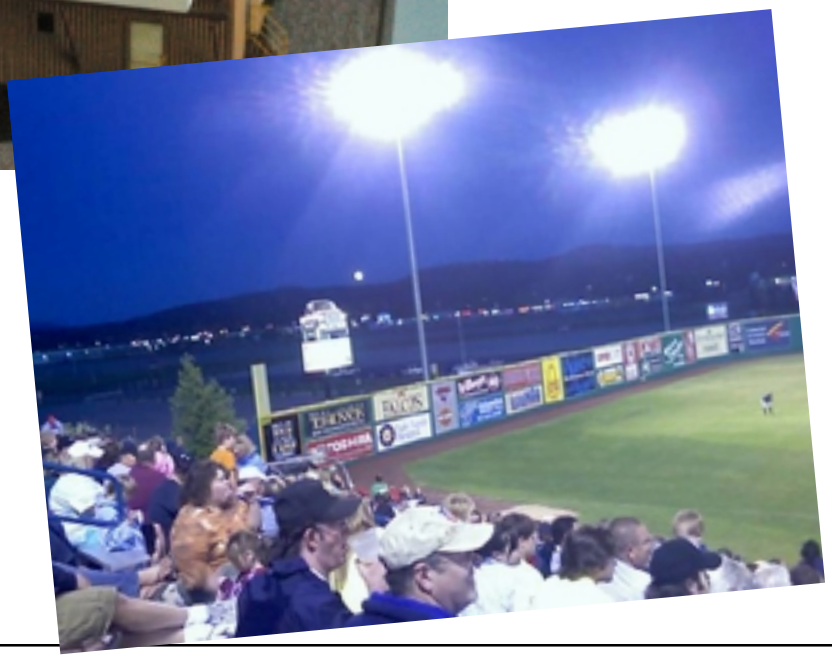
The Solar System Ambassadors Program is a public outreach program designed to work with motivated volunteers across the nation. These volunteers communicate the excitement of JPL's space exploration missions and information about recent discoveries to people in their local communities. Ron Hobbs, a member of SAS, has been an Ambassador since 2001.



SAS Gallery

The Multiple Mirror Telescope Observatory, right, is the largest observatory at the Fred Lawrence Whipple Observatory. The building's shape, atypical of an obervatory, allows the walls and roof around the telescope to be rolled back completely, promoting cooling of the optics. The model below shows the doors open. See article beginning at page one. Photos by Burley Packwood.



At right a near-full Moon rises behind the left field wall of Spokane's Avista Stadium during the Spokane Indians' home opener June 17. This cellphone-camera shot by Greg Scheiderer, though not likely to make the next issue of Sky & Telescope, *also captured two spectacular globular clusters near the top of the frame.*

NEXT MEETING

July 16, 2008

Hard Lessons in Scope Building

Details, page 1

The Webfooted Astronomer

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