

Volume 22, No. 2

Celebrating 38 Years of Observing

Summer 2005

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MEETING NOTICE

Summer Meeting
 Saturday, August 13th
 2005
12:00 PM

Pine Mountain Observatory
SEE MAP ON BACK

details on page 14

for more information:
 Mary Hill
 visions@pacifier.com

PMO Open For 2005 Visitors' Season

COME TOUR THE SKY AT THE 6500 FOOT ELEVATION PINE MOUNTAIN OBSERVATORY on Friday and Saturday evenings throughout the summer. Drop-in programs start at 9:00 PM (8:00 PM as earlier darkness falls in late August and into September).

There is a primitive (no water) Forest Service campground right next door so you can stay overnight. View through our 24", 15" and 10" Cassegrain reflecting telescopes and through the multitude of portable telescopes that are usually set up outside the main domes. On selected Saturdays this year we'll feature special daytime programs about current astrophysical topics of interest. See our website for calendar and details. Also see our website for the latest current weather info from our quick-cams and our weather station <http://pmo-sun.uoregon.edu>.

For further details and to make reservations for groups over 8 people, call Mark Dunaway at (541) 382-8331. Suggested donation \$3 per visitor. There is a gift shop on site where you can purchase souvenirs, revenue is used to support our educational programs. Dress warmly as temperatures can drop below freezing even during summer evenings, and bring a small light shielded with red or other dark material to protect everyone's night vision. See map and directions on back page or at the website. ❖

Night Sky Tour Guides Wanted

WANT TO LEARN HOW TO OPERATE A REALLY LARGE TELESCOPE? WANT TO know more about what's in the night sky? If you're comfortable in an outdoor environment, like to stay up late, can follow instructions, and like to work with people, here's a golden opportunity to experience the night sky from a new perspective. We're always looking for new Tour Guides to help with the public tours at PMO Fridays and Saturdays during the summer. You don't need any prior experience or knowledge about astronomy or telescopes, as we offer extensive training.

If you're interested, contact Greg Hogue, Tour Chairman, ghogue@bendcable.com, or (541) 771-6987, or just show up at PMO Friday evening if you can stay for Saturday, or come up Saturday afternoon, and contact the Crew Chief. We'll be doing some training most Saturdays, 2-5 PM. If you have a telescope, all the better, bring it along. No pay, but lots of fun and learning! ❖

A Brief Encounter With Johannes Kepler and Tycho Brahe in Prague



Photos courtesy John R. Bakkensen, 2005.

*Tycho Brahe and Johannes Kepler met in Prague in 1600.
This statue of the scientific stars stands near Prague Castle.*

by John R. Bakkensen

IN MARCH 2005, MY WIFE ANN AND I TRAVELED TO Prague, the capital of the Czech Republic, with Jerry and Irena Cerny, the parents of an exchange student who lived with our family several years ago and attended Wilson High School in Portland. She has since graduated from college and received a master's degree from the London School of Economics and will be enrolling in a Ph.D. program at Oxford University later this year. Before leaving for Europe, I read several historical accounts of the meeting in Prague in 1600 between Tycho Brahe, then Europe's greatest observational astronomer, and Johannes Kepler, a young but brilliant mathematician. One of the more readable stories of their collaboration is Kitty Ferguson's book *Tycho & Kepler: The Unlikely Partnership that Forever Changed Our Understanding of the Heavens* (Walker & Company, 2002). We arrived in Prague on March 13,

and Jerry Cerny, who knew of my interest in astronomy, had arranged for some surprise encounters during our weeklong tour of this ancient city.

Although Prague was occupied by the Nazis during World War II, the city was spared the heavy Allied bombings that destroyed so much of nearby Germany. Prague has many famous historical sites to which tourists are constantly drawn from around Europe and the United States. These include Prague Castle that was founded in the Ninth Century and greatly expanded in the Fourteenth Century during the enlightened reign of Charles IV (1346-1378). Within the enormous Castle grounds sits one of the greatest Gothic Cathedrals of Europe, St. Vitus's Cathedral, the construction of which began in about 1344.

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Kepler and Brahe in Prague ————— continued from pg. 2

Photos courtesy John R. Bakken, 2005.



Prague's Astronomical Clock started ticking in 1410.

One of the most popular tourist attractions is the astronomical clock in Prague's Old Town that began keeping time in 1410. The outermost ring shows Bohemian time with Gothic numerals. The next circle displays modern time in Roman numerals. Roman numeral XII at the top represents noon. See if you can figure out the other features of this complex time piece.

Notice the long hand with the bright sun and the other hand displaying the moon. At the beginning of each hour, the two windows on top open to reveal a parade of the twelve apostles followed by a rooster crowing and a bell.

Tycho Brahe, the famous Danish astronomical observer, moved to Prague in 1599, as a result of legal problems in his native country and loss of financial support from the new Danish King Christian IV. King Frederick II of Denmark, the father of Christian, had loyally supported Brahe's study of the planets and stars for many years. In 1576, the Danish King had granted title to Brahe to the Island called Hven from which he conducted his research. His first recorded observation at the island was a conjunction of the moon and Mars in the foot of Orion on February 22, 1576.

With the aid of excellent equipment (principally quadrants and sextants of his own design) and many assistants including university students, Brahe compiled the best collection of naked eye observational data that existed in Europe in the final quarter of the

sixteenth century. Kepler was anxious to meet Brahe and to gain access to Brahe's closely guarded planetary data. Brahe was aware of Kepler's work including his first book *Mysterium Cosmographicum* printed in 1596, which theorized that the orbits of the known planets could be described by reference to five Platonic solids (i.e., tetrahedron, cube, octahedron, dodecahedron and icosahedron).

Kepler and Brahe met in Prague in 1600, where Brahe had in 1599 found another royal patron to support his scientific work, Emperor Rudolph II of the Holy Roman Empire. With Brahe's help, Kepler was appointed the Imperial Mathematician for Rudolph II in 1601. Prague now celebrates this remarkable alignment of two scientific stars in its city with a statue located near Prague Castle.

Brahe died in Prague in October 1601, a few days after his attendance at a palace dinner where he allegedly drank "over generously." Kepler was eventually given access to Brahe's planetary data, after initially being restricted to data for Mars only. This information led Kepler to his laws of planetary motion. During his years in Prague, Kepler wrote *Astronomia Nova* (New Astronomy) (1609) that contains his arguments and demonstrations supporting his first two laws of planetary motion. His residence in Prague for approximately five years was on Karlova Street, which is located near historic Charles Bridge and Vltava River. A simple plaque above the doorway commemorates Kepler's residence on Karlova from 1607 until 1612.

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Kepler's residence is marked by this plaque.

Kepler and Brahe in Prague ————— continued from pg. 3

Nearby Kepler's residence is Prague's Klementinum, a university founded in 1556 by the Jesuits. The university has an old astronomical tower including a Baroque Library that was built in about 1722. The old mural quadrants and other observing equipment fell into disrepair during the Soviet occupation of Czechoslovakia but following the Velvet Revolution of 1989, when the country once again achieved independence, the astronomical tower was restored and reopened to the public in 2000.

A highlight of the trip was the time I spent at the Strahov Library, which is part of the Strahov Monastery that was founded in the twelfth century. It contains a marvelous collection of rare manuscripts and early printed texts. For example, there is a copy of Al-Sufi's *Stellar Atlas* that dates to the mid-fourteenth century. Jerry Cerny had made arrangements for me to inspect an original edition of Nicolaus Copernicus's classic *De Revolutionibus Orbium Coelestium Libri Sex* (Six Books

on the Revolutions of the Heavenly Spheres) that was published in 1543, the year that Copernicus died. The copy that I reviewed had worm holes in the pages, a testament to the book's antiquity. For those who enjoy reading about the history of astronomy, I highly recommend the new book by Owen Gingerich, *The Book Nobody Read: Chasing the Revolutions of Nicolaus Copernicus* (Walker & Company, 2004). Dr. Gingerich is now senior astronomer emeritus at the Smithsonian Astrophysical Observatory and research professor of astronomy at Harvard University. I had the pleasure of taking a course from Professor Gingerich during my undergraduate days.

I also reviewed on the library's restricted website a digital copy of Tycho Brahe's beautifully illustrated book *Astronomiae Instauratae Mechanica* (1598), a copy of which Brahe personally delivered to Emperor Rudolph II on his initial visit to Prague in 1599. This book shows in exquisite detail the various instruments that

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The Strahov Monastery and Library entrance. Home to numerous rare scientific manuscripts and other documents of interest.

Photos courtesy John R. Bakkensen, 2005.

Questions? Answers?

HAVING JUST RETURNED FROM GIVING A PRESENTATION TO SIX THIRD GRADE CLASSES IN GLADSTONE, OREGON, I am amazed, thrilled, and entertained by their many questions. I am sharing some of them with you today. I am not sharing the answers though. It is up to you to answer the questions. If you get stuck, you may e-mail me or Dr. Greg. We will be glad to help you, especially on the last one.

The #1 most often asked question concerned black holes. Kids love black holes.

What is a black hole? Do you have a picture of one? Where is the closest one? If I was swallowed by a black hole would I pop out in another universe? (Loved that one)

#2 concerns aliens.

Have you ever seen a UFO? An alien? Do you think there are aliens somewhere out there? Smart ones? Where? Can we ever visit another star? Will we find life of any kind there?

#3 concerns speed and distance.

How come we can't go warp speed? How far is far? Can we send a probe to the nearest Star? How long would it take? How come we don't have a good picture of Pluto and yet we have great ones of galaxies very far away? If I look through a telescope will I see what I see in pictures?

Last but not least;

Are you a scientist? Do scientists make lots of money?

(Gobs and Gobs)

Mary Hill, President FOPMO ❖

Public Education Activities and Outreach Report

by Rick Kang

OUR COLLABORATIVE EFFORT (UO-FRIENDS of PMO Electronic Universe, NASA Oregon Space Grant, and local Astronomical Societies) has once again provided on-site visits to several hundred K-14 classrooms around Oregon this past school year. There has been fairly even distribution amongst Elementary, Middle, and High School classes. The good news about High Schools is that although most have dropped Astronomy/Earth Science from their curriculum, there are still several offering actual Astronomy courses. Recently I got to meet several high school teachers around the state who have a personal interest in teaching astronomy and who are conducting in-depth classes. At the college level, I visited classes at Lane, Portland, and Rogue Community Colleges.

This is the first year where I've received so many invitations from schools that I've only had to contact additional schools to fill in intermediate stops for some of the long distance trips. Due to funding and time constraints I've had to defer several invitations to next year.

My program about the Cassini-Huygens current mission to Saturn has seen increasing demand, and I've produced a number of variations on our popular Sun-Earth-Moon program based on the virtual reality software developed by Oregon Research Institute. After attending Professor Slater's training sessions in San Diego in January, I've conducted a number of successful

sessions in the "collaborative learning" mode. Students in these classes have the opportunity to develop scientific concepts within small groups and gain greater understanding through the development process. In April we held a well attended Teacher Workshop in Central Oregon, jointly sponsored by Oregon Science Teachers Association and the Bend School District. In mid-May we did another very successful demo of our remote data acquisition/downloading capabilities. This time we were at the Science Works in Ashland, arranged by the Southern Oregon Skywatchers group. Allan Chambers was on-site at PMO that evening, helping us as we connected via Internet to take images with the COWCAM, and to view and work with archived data.

The classroom outreach programs generate increased interest in space topics for most of the students, prompt interest in science for students who haven't shown much prior interest, and always generate a career oriented major interest in a handful of students at each school. We need to start thinking more seriously about holding summer camps at PMO for these very interested students.

There is a major national conference on Education/Public Outreach, in Tucson, this September, where we'll be represented. I'm chairing a panel discussion about strategies, pitfalls, and recommendations for remote data acquisition, this has been a challenging area for

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Education Report ————— continued from pg. 5

most groups who have envisioned and attempted to establish observatories where remote imaging/data acquisition could occur. We have had this capability at PMO for a number of years now and continue to be perplexed by the very low demand and frustrated by the numerous network, software, and hardware incompatibilities that thwart those who want to make use of our resource.

I invite Friends to attend outreach classes (contact me if you're interested, I'll let you know when I'm teaching in your area), and to encourage Friends to submit candidate classrooms for me to visit. The success of the program is tied closely to the collaboration mentioned at the outset of this article; I thank all the supporters and look forward to another successful year of classroom outreach in 2005-2006. ❖



Go Digital ❖ Observer PDF Available Online

<http://pmo-sun.uoregon.edu/~pmo>

contact V.P. Bob Ewing

bewing@pcc.edu or (503) 614-7324

if you wish to cancel your hardcopy edition

Perseid Meteor Shower Info For August 2005

by Rick Kang

THE BEST VIEWING TIME IS PRE-DAWN, FRIDAY, August 12th.

Meteor showers happen when Earth plows through the stream of tiny debris left behind by a comet. Comets are icy, dirt-filled snowballs of the Solar System, left over from the formation era. These snowballs typically travel in very elliptical (stretched-out) orbits that take the comet far beyond Pluto, then very near to the Sun many years later.

Of course the Sun's heat begins to dismantle the comet, and the comet ejects tiny pebbles and dust grains, leaving them behind in a trail, sort of like Little Red Riding Hood left her breadcrumbs behind her.

The Earth, by chance, may cross through some of these trails of comet dust, once each year, as Earth orbits the Sun. The particles, technically called "meteoroids," impact our atmosphere at relatively high speeds, some near 40 miles per second. The tremendous friction with the air molecules heats the particles, and their temperature ionizes the surrounding gas, thus a two-fold bright glow, the hot particle itself plus the surrounding activated air. This is what we see as the "shooting star," or "meteor," and often the bright trail left behind. Indeed not at all a star, this meteor would properly be designated as a "shooting dust grain" or "shooting pebble."

The few larger pebbles or rocks may become very bright and break apart, these are called "bolides" and once in a while some of the actual rock may survive and land on Earth, found as a "meteorite." Most of the debris ends up gently floating down as minute dust particles. If you have a dusty old shelf, some of the dust is probably meteoric in origin, several tons fall to Earth each day. The comet responsible for creating

the Perseid Meteor Shower is called Swift-Tuttle and is still in orbit, renewing its trail of dust every 130 years or so. Originally observed in 1862, the comet's recent passage through the inner Solar System in 1992 wasn't very spectacular, but probably renewed the reservoir of particles, thus making showers potentially better. Swift-Tuttle is expected to return in 2126. See

<http://antwrp.gsfc.nasa.gov/apod/ap960219.html> for more information about the comet and an image of the comet.

Since lots of these particles randomly impact the atmosphere, to **observe** a meteor shower, you don't need any instruments other than your eyes. A telescope does you no good at all, **which is why PMO isn't open** to the general public for the shower as we have insufficient staffing and parking to handle a large crowd.

You do want to be in a location that is as dark as possible, away from city sky glow, and that has open horizons in all directions. Out in a safe place in the desert would be ideal. Bundle up and sit out on a reclining lawn chair, you'll see meteors anywhere in the sky. Generally, more meteors are visible after midnight and just prior to dawn because then, our side of Earth is facing "forward" in our orbit around the Sun, and thus, our location is plowing directly into the swarm of particles, sort of like bugs hitting your auto windshield.

This year (2005), viewing the Perseids is better than average since the Moon will only minimally interfere (waxing crescent that sets relatively early). The predicted peak is actually after daylight on the 12th for the West Coast, but predictions are not that reliable. Note that since the cloud of debris is so large, the shower actually ramps up and down over more

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Kepler and Brahe in Prague ————— continued from pg. 4

Photos courtesy John R. Bakkensen, 2005.



St. Vitus's Cathedral is a magnificent example of Europe's fourteenth-century Gothic architecture.

Brahe designed and used for his planetary and star observations at Hven. The librarian at the Strahov Library subsequently furnished to me a CD containing the digital images of Brahe's various instruments. Because of restrictions on their usage, unfortunately I am not able to include any of the images in this note. Each image of Brahe's instruments appearing in the book was separately colored by hand. The copy that I reviewed was actually signed by Tycho Brahe as part of a personal dedication to the intended recipient.

For those who are interested in reading further about Kepler, I suggest a partial translation of Kepler's *Astronomia Nova* by William H. Donahue (Green Cat Books, 2004) and James R. Voelkel's new book *The Composition of Kepler's Astronomia Nova* (Princeton University Press, 2001). ❖



One of the mural quadrants that has been restored.

Spring 2005 Meeting Minutes

FRIENDS OF PINE MOUNTAIN OBSERVATORY

APRIL 02, 2005

Minutes taken by Sean McGonigal

Meeting was called to order by President Mary Hill at 12:12 pm.

Attending

- **Executive Committee Members:** President Mary Hill, Vice President Bob Ewing, Secretary Sean McGonigal, Treasurer Mark Dunaway, Greg Hogue, Bob McGown
- **Board Members:** Dr. Greg Bothun, Lauri Crandall, Frank Crandall, Fred Domineack, Dave Hill, Rick Kang, Dareth Murray, Karl Oestrich, Sig Peterson III
- **Guests:** John Bakkensen, Gloria McCauley Girard

Previous Meeting Minutes

- The winter 2004 meeting minutes were approved as written.

Treasurer report - Mark Dunaway

- Report handed out*.
- Most expenses so YTD were from the AAS trip.
- No changes in budget from the winter meeting.
- Monies beginning to come in for the 20-year plan. New form handed out - Mark will have copies at the mountain.
- Mark doing several talks for fundraising.
- Several other funding sources were discussed.
- Don't forget go come to Mark with expenses.

Membership report - Bob Ewing

- Same # of people (275) on mailing list.
- Current newsletter is posted on the PMO web site. Bob will work with Dr. Greg to get a PMO emailing address. Need to snail-mail once per year so people get envelope for donations, or possibly just the annual letter.

Visitor Program report - Greg Hogue

- Training sessions - 4 Saturdays starting in May.
- Looking for more people to be crew chief and cover the whole weekend.
- Discussion to limit tours to Saturdays only? Factors: Daytime + nighttime, more extensive tour and program on the 1 day. Lower attendance, lower # of guides. As the Education Center gets up and running, then this might be good practice for better tours. We would have to phase out the Friday program (not do it immediately). From an education aspect, a more 1-day comprehensive program is the right way to go. Some down sides include: unable to implement this year as people are used

to coming up on Fridays. Weather was discussed. Putting together several programs that we can repeat throughout the summer was discussed. Lots of comments on multimedia vs. live presenter.

Dr. Greg

- Dr Greg: Intent was to present information on multiple areas of the mountain, whether in person or multimedia or whatever. Eliminating Fridays make sense when there is a crew from Bend and they have to drive up both nights, not for other crews.
- Saturday workshops for digital camera amateur photography.
- We won't close on Fridays, but will begin to shift our focus to a more formal Saturday program

Gift Shop report - Norma Leistiko

- No report

Observatory report - Mark Dunaway

- Gravel grading around the 32" within a couple of months, prepping for the Radio telescope.
- Trees beginning to be removed. 3 work parties in May.
- Proposal submitted to paint the 24".
- Lift off 24" dome to replace the rubber (likely in Sept.) and other fixes.
- FS slow for the Fuels Management program. Mark is still working on a categorical exclusion for area around PMO.
- Meade 12" is functional.
- Issues with the 24" PC. Mark will buy a Starry Night upgrade s/b less than \$100
- \$600 approved by board for new computer for the 24". Sean will look at purchasing.

Radio Telescope Report - Bob McGown

- Some items covered in telescope report above.
- Lightning protection - Disconnect during the winter. Lightning engineer will look at it. May need larger lightning rod for more than just this scope.

Education Report - Rick Kang

- Rick handed out report.*
- Outreach - YTD - 24 events for 2119 students.
- Financials: Changing to sliding scale for school visits: \$10-\$100 for FOPMO. Roughly doubled FOPMO income.
- OSG not paying for travel expenses at the moments. Schools have been reimbursing.
- Astronomy Day is April 16. Several astronomy groups are doing events.
- July 4 Deep Impact encounter with Comet Temple 1.
- ITS proposed for July 23rd @ MHCC.

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Big Telescope, Big Universe Observing on the 82" Otto Struve

by Bob McGown and Dareth Murray

AFTER HEARING STORIES OF THE CLEAR, DARK skies of West Texas, we decided to experience first hand the famous McDonald Observatory on the summit of Mt. Locke, at 6,800 feet. With a lucky search on the Internet, we found the last two spots in the private winter observing group on the 82" Otto Struve classical Cassegrain telescope. This was



the second largest telescope in the world when it was built. The high performance 27', 45-ton telescope was completed in 1939.

McDonald Observatory has an outstanding visitor center with a huge amphitheatre for outdoor summer presentations. The road to the observatory is not like most observatory roads. This one was Texas speed limit all the way!

Picking up our car in the morning after coming into El Paso the night before, we stopped by Hueco Tanks State Park to view the petroglyph masks rock art and the unusual hollows (huecos) in the rocks that fill with water and stay wet year round. We climbed the chain trail to the summit and bouldered around the picturesque rocks. It was a beautiful desert oasis, lush and green in the Texas winter. After an hour we headed down to McDonald Observatory, about 2 hours south. We checked into the Astronomer's Lodge, located directly below the Harlan J. Smith 107" scope. We spent an hour in the amazing gift shop before being called for dinner.

Oregon Star Party 2005

REGISTRATION FOR THE 2005 OREGON STAR PARTY is now online and available. Scheduled for the weekend of September 1-5, 2005, OSP offers a great lineup of speakers, events, and of course, the dark central Oregon skies.

The Oregon Star Party Committee invites you to tour the official website at <http://www.oregonstarparty.org> where you can obtain more information, register, and plan for a great Labor Day star party. ❖

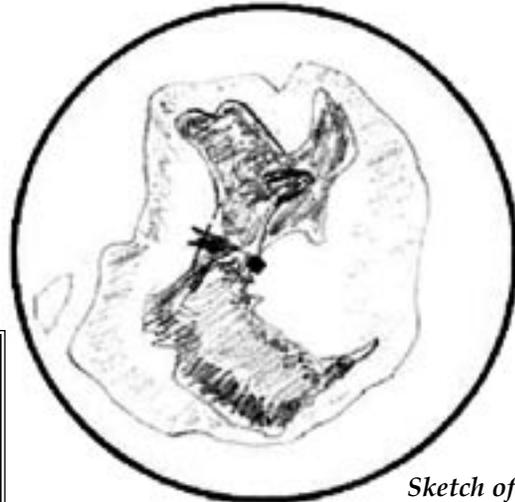


McDonald Observatory amphitheatre.

The observing session price included a tour of the observatories and grounds, a fine catered dinner and 3 hours of observing time on the 82". Over the course of the evening Public Affairs Specialist Frank Cianciolo and celestial mechanic David Doss shared the technical complexity of this marvelous equipment along with their expertise on deep sky navigation.

The evening's list of observations on the 82" included:

- M-79
- IC 418 - Spirograph Nebula
- M-42 - Orion Nebula
- NGC 4440 - Planetary Nebula
- NGC 2158 - Open cluster in Gemini
- NGC 2392 - Eskimo Nebula
- Saturn at 1,300 power
- NGC 2903 - Sa-Sb galaxy, edge-on
- and many more...



*Sketch of NGC 4440
planetary nebulae.*

The objects were stunning at 890 to 1200 power under sub-arc-second seeing. The light from the entire 2.1 meters was focused through the 22mm Takahashi

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Big Telescope ————— continued from pg. 9

eyepieces. The telescope floor was able to be raised up in two sections to accommodate viewing and instrumentation. The telescope was able to slew rapidly from object to object as the telescope floor was separated from the observer's floor and could be raised independently. We were warned to be careful as the two floors could crush an unwary toe! The heated control room had an



Bob observing on the 82 inch scope.

Spring Meeting Minutes ————— continued from pg. 8

- ASP Annual Conference in Sept. Rick proposing \$1000 for travel expenses.

Publicity Report - Rick Kang

- With gas prices on the rise, proposed we should concentrate our efforts in Central Oregon as it is expected that many people from the valley will likely travel less this summer.
- Draft of plain-paper brochures. Less expensive than the current ones.
- If anyone wants to draft articles or has other media/ideas/graphics that you can put into final form, please go for it.
- Full time publicity chair-person needed.

Next Meeting

- The summer 2005 Board of Directors meeting will be Saturday, August 13, 2005, 12:00 noon at Pine Mountain Observatory. Please send agenda items to President Mary Hill at visions@pacifier.com. All members and guests are welcome to attend.

New Business

- Bob E. - would like a report from RCA. Dareth and Bob M. Several dark sky start parties. Messier marathon at Kahneeta recently. Astronomy day star party at OMSI.
- Dareth - April 12th celebrating Yuri Gagarin night at McMenamins.
- Bob M. showed slides of his McDonald Observatory visit.
- Article deadline for next newsletter is May 7. Send articles to Amy McGrew at a.mcgreww@comcast.net.

Meeting was adjourned at 2:42pm ❖

* All handouts on file with the secretary. Copies provided upon request.

under floor raceway and the unused mainframe casing. Now visiting astronomers use their personal laptops so the old computers have been dismantled.



Wide angle HET, new technology telescope.

During the course of our two days at the Observatory, we were especially interested in the new 11-meter segmented mirror Hobby-Eberly Telescope (HET). The HET was dedicated October 8, 1995 and is operated by a consortium of universities including University of Texas, Penn State, Stanford, and two German universities.

The HET is fixed at 55 degrees and uses a movable secondary mirror that allows it to scan 70% of the sky. The frame of the telescope was built by a bridge maker, the dome was built by a radar dome manufacturer and the segmented mirror is zerodur low expansion glass. This unique design is so successful it allows for a relatively low cost large telescope with sealed up versions to 35-100 meters in diameter which has been proposed for a sister facility in South Africa.

An unusual mushroom tower next to the telescope dome houses lasers and equipment to align the 91 mirror segments. Among some of the other research in progress at McDonald Observatory is the McDonald Laser Ranging Station (MLRS.) Astronomers bounce the lasers off the Moon to study relativistic effects between the Earth-Moon system and a dozen orbiting satellites.

Among some of the other research projects that the HET is involved in include:

- Measurement of stellar distances and velocities
- Chemical composition and evolution of galaxies, stars, gas and nebulae
- Searches for planets around stars, dark matter and black holes

When we got up early the next morning to continue our journey to seek the Odessa Meteor Crater and Carlsbad Caverns, we got a prime Texas sunrise. Yes, west Texas can be mighty purdy! ❖



Photos courtesy B. McGrew, D. Murray 2005.

The Ubiquitous Photon The Key to Astrophysical Data

by Rick Kang



Photos courtesy R. Berry 2001.

Visitors viewing photons indoors and out at Pine Mountain Observatory.

WE TAKE A LOT OF WHAT WE KNOW FOR GRANTED. How do you know where you are, what's going on around you, who's there? Most of us rely heavily on our sense of sight, but what does that really mean? We need input to our eyes, the light, the tiny packets of energy, photons. (from ancient Greek: phos or photos meaning light) We don't see very well in the dark, in absence of those photons!

Where do those photons come from? From stuff (matter). How? The matter is "excited", typically heated, like the Sun, lamp filaments, flame, or in a sense, the gas in a fluorescent tube. Very technically, the tiny electrons of each atom get "excited" by the added energy. Then, when they "relax", they cough up their excitement energy in the form of light, or photons (technically, electro-magnetic radiation). That's why the light contains information about the type of stuff involved in its production, the temperature of the stuff, and other bits of information that can be teased out by physicists who examine the photons with spectrometry and photometry.

For objects and phenomena in our backyard, we can also rely on other senses such as taste, smell, touch, and sound to furnish additional information. But, for distant objects in deep space, we are pretty much restricted to the sight option, we don't have the luxury to visit most of these places and we generally don't naturally receive any physical samples from them.

Thus, photons are the name of the game for astrophysics, as I often tell my students, "The Photons are the Data" is the mantra for today's lesson. The good news is that out in space there are lots of hot stars and hot clouds of gas emitting lots of photons. The bad news is that these objects are very distant, hence the photons spread out and we don't get many that land at our Observatory. Also, many photons are gobbled up or bounced aside by stuff between their source and us, including Earth's atmosphere. And, many photons come in energies, like Gamma and X-Rays, that require special technologies for humans to observe them.

So, the technical challenge of doing astrophysics is the capability to collect and detect enough photons, and to separate the desired actual "signal" from the "noise" that mingles in along the way. What we know about distant objects depends solely on our ability to obtain sufficient "clean" data. We don't have machines that directly tell us size, distance, temperature, composition, age, and other physical characteristics of distant objects. Our machines only tell us the amount of incoming photons (flux), their energy (wavelength-color), and their origin direction. That's it, then we become the "detectives" to glean the information we really want.

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An Apache Point Adventure Sacramento Peak Observatories

by Bob McGown and Dareth Murray



Apache Point Observatory. Photo courtesy Sloan Digital Sky Survey.

IT WAS JUST AFTER DAWN WHEN WE DESCENDED the 800 feet through the awesome natural entrance of Carlsbad Caverns in New Mexico. After a great experience touring the King's Palace and other wonders and our guide talking about possible caves on other worlds, we returned to the surface and onward to Apache Point Observatory. We headed up north into the Sacramento Mountains, through the resort town of Cloudcroft to tiny science community Sunspot and the observatories on the summit.

Apache Point Observatory is privately owned and supported by the Astrophysical Research Consortium whose members include: the Institute for Advanced Study, University of Chicago, University of Colorado-Boulder, Johns Hopkins University, New Mexico State

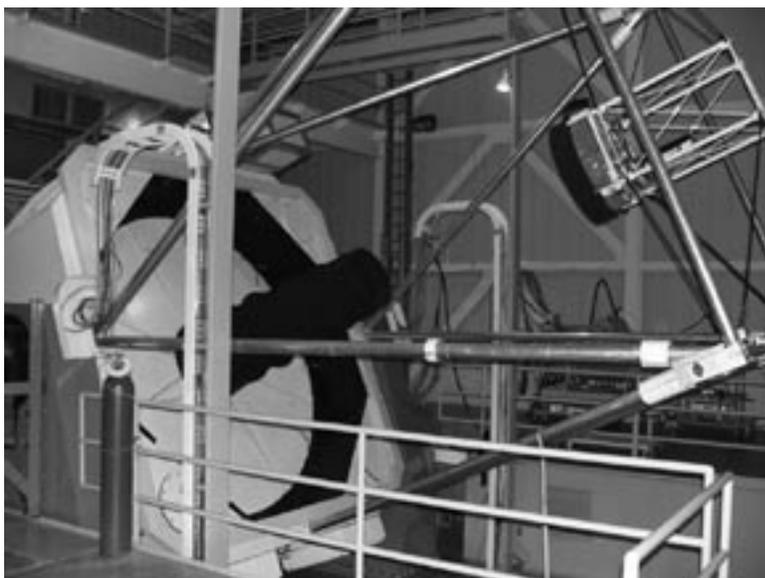
University, Princeton University and University of Washington. NM State University operates the observatory site for the consortium.

We wound up the steep road through snow and pines to the summit of Sacramento Peak at 9,200 feet elevation. We had emailed ahead to our friends on the mountain but weren't sure if the road would be clear of ice, so had no set time of arrival. As we came into the observatory site, electrical technician Dave Woods greeted us and offered a tour of the 3.5 facility while we discussed optics and cryogenics. We marveled at the roll-off roof suspension of the enclosure of the Sloan Digital Sky Survey telescope and the suspended domes on piers to get above the dwarf pines living on the summit.

Our main focus was the 3.5-meter telescope "ARC" new technology telescope owned by the consortium. The primary mirror is a spun mirror from the University of Arizona, Stewart Observatory Mirror Grinding Lab. The design of mirror makes the telescope lightweight and easy to use, with a large aperture for highly accurate targeting. This scope has been used to track missile events from nearby Holloman Air Force Base. Mounted on the frame of the telescope is the Next Generation Lunar Ranging.

The telescope is designed at the Nasmyth focus to quickly be able to switch from any of the six instruments owned by various universities in the consortium. With seven ports, the change from one instrument to another is made in about 30 seconds! There is a light

continued on pg. 13



*ARC, 3.5 meter
new technology telescope.*

Apache Point Adventure ————— continued from pg. 12



Bob inspects the spectrometer.

shroud with a circular suit with tertiary mirror to reflect the image to the equatorial focus. Targets of opportunity include gamma ray bursts and supernovae.

On the floor below is the cryogenic facility for the cooling of the instrument. Dave was fine-tuning the instruments at the time for the evening's data acquisition and for other evening projects. Several of the universities can use the 3.5-meter on the same evening due to the quick transition time. Dave was called back to duty to work late but before leaving, he let us out on the catwalk perch of the ARC dome and we were able to see the National Solar Observatory, a mere half-mile away on a neighboring peak.

As we drove up the road to the National Solar Observatory, we chuckled as we saw the street signs - "Solar Physics Drive" and "Corona Avenue." We knew we had come to the right place! At the summit we toured many of the solar telescopes and facilities. The highlight was the Richard B. Dunn Solar Telescope (DST), which specializes in solar high resolution imaging and spectroscopy. The tower portion rises 13 stories above ground level. Like an iceberg, only a part of the telescope's bulk is visible above ground. Approximately 220 feet of this telescope lie out of sight underground. The whole building from top to bottom is a single instrument. The telescope's entire optical system - from the top of the tower to the base of its underground portion, plus the 40 foot diameter observing room floor - is suspended from the top of the Tower by a mercury float bearing.

The entire optical and mechanical structure of the telescope is longer than a football field and weighs over 250 tons. The DST is quite a simple instrument,

consisting of three principal mirrors, two windows and an evacuated optical path. A unique instrument at the focus of the DST is the Universal Birefringent Filter, or UBF. (There are only three other similar filters in the world.) It can be tuned to look at any particular visible color in the Sun's spectrum.

It was exciting to help out the visiting solar physicists set up the optical bench and diffraction gratings in order to observe reversals of the magnetic Zeeman lines on the sun. Working on this project was a graduate student from who was from UH and had worked at Haleakala High Altitude Observatory Site on Maui. He was kind enough to show us around. It was interesting to see a large version of the Swedish solar telescope similar to the one I helped calibrate for the Transit of Venus

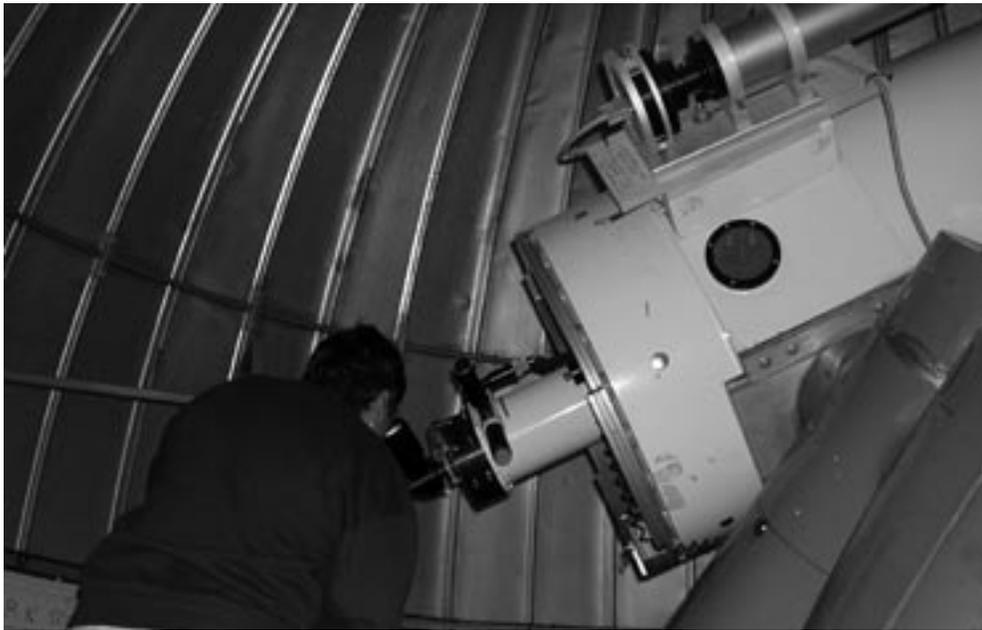
in La Palma, Canary Islands.

The Apache Point and National Solar Observatories were the one of the high points of our New Mexico astronomy adventure. The weather cooperated and the view was spectacular from the top of the mountain. How could it get better than this? Well, our next destination was the Very Large Array near Socorro, New Mexico, the largest radio telescope in the world. Just think... 10 years after *Contact!* ❖



National Solar Observatory tower rises thirteen stories above ground level.

Photos courtesy B. McGowan, D. Murray 2005.



Touring the heavens inside PMO's dome.

Photo courtesy R. Berry 2001.

Perseid Meteor Shower ——— continued from pg. 6

than a week, so you'll see more than average sporadic (random) meteors if you gaze at the sky several days or even a week either side of the peak. If you visit PMO the weekend just after the peak (evenings of 12th and 13th), you should still see plenty of meteors. If you come up the week before, you might see quite a few extra meteors than usual, the week after won't be as good because of bright Full Moon.

The name for the shower designates the area in the sky (at the constellation, Perseus, to the northeast later in the evening) from which all the meteors appear to "radiate." This means if you see a meteor elsewhere in the sky (just as likely), and trace its trail backwards, the meteor appears to have originated from Perseus. This is only an optical illusion, due to Earth's motion into the stream of particles, sort of like when you drive into a snowstorm. Be on the lookout for meteors **anywhere** in the sky, often the ones with the longest, most spectacular trails occur far from the radiant origin constellation.

In summary, the *best* way to observe the Perseid Meteor Shower:

1. Find a site with dark skies and low horizons.
2. Go out between 2-4 AM, August 12th.
3. Scan entire sky with your eyes, don't use instruments.

Remember, Pine Mountain will be **CLOSED** to the public on August 11th and pre-dawn August 12th, but please do come up on Friday or Saturday evenings near those times/dates!

Various Planetariums and Astronomical Societies around the State will be scheduling programs and public events, check with your local facility for details. ❖

Summer Meeting Notice

THE SUMMER BOARD OF DIRECTORS meeting is Saturday, August 13th, noon, at Pine Mountain Observatory just east of Bend, Oregon. Need directions? Refer to the handy map on the back side of this newsletter. Please e-mail Mary Hill any agenda items at visions@pacifier.com. All members and guests are welcome to attend. ❖

Ubiquitous Photon ——— continued from pg. 11

I was astounded recently while talking to several science teachers prior to doing outreach classes for them, that their students had no background at all about photons although the classes were already deep into their astronomy units. Before we leap off into exploring the details of the science, it behooves us to be aware of the data source and the challenges of obtaining and analyzing the data!

Those little photons are certainly one of the amazing features of nature: Crossovers between matter and energy, displaying dual sets of properties (particle and wave) depending on what experiment you put them through, and the fastest speed and the speed limit that nature has established. When you read about the next major discovery in space (or anywhere), consider how those persistent photons may have traveled for eons through all kinds of conditions to bring that information to us, or possibly just traveled across the room to let us know that dinner is ready! ❖



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About the Friends of Pine Mountain Observatory

Friends are citizens across the globe who help PMO by contributing voluntary labor, materials, and/or funds. You are welcome to join the more than 200 current Friends by sending the attached form, with your check, to the address below.

Benefits of Membership and Activities of Friends

Friends may visit PMO free of charge. Members receive several copies of the newsletter each year. The newsletter describes current **Friends** projects, the status of the Observatory's operations, occasional technical articles about ongoing research, and informs

members about upcoming activities. Various **Friends** are directly involved with upgrading telescopes, improving educational programs, organizing publicity, and producing fact sheets, brochures and documents.

The **Friends Board of Directors** meets three times per year, usually in Portland, Eugene, and Bend. All members are welcome. There is also the tradition of a **Special Star Party for Friends**, at Pine Mountain, each summer. Check your newsletter. Contact any Friends officer about meetings. Get involved!

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