

New Views of Jupiter from New Horizons

Dr. Jeffrey M. Moore, NASA Ames Research Center

July 26, 2007

Doors open at 6:45 p.m.

Concord Police Association Facility 5060 Avila Road, Concord

The spacecraft sent back its vacation photos, stunning scientists with never-before-seen perspectives of the giant planet's atmosphere, rings, moons and magnetosphere.

NASA's New Horizons spacecraft is on its way to Pluto, scheduled to arrive in 2015. However, it recently interrupted its journey by taking a side trip to visit the Jupiter system.

Join us on July 24th when Dr. Jeffrey Moore shares with us these new views which include the closest look yet at the Earth-sized "Little Red Spot" storm churning materials through Jupiter's cloud tops; detailed images of small satellites herding dust and boulders through Jupiter's faint rings; and of volcanic eruptions and circular grooves on the planet's largest moons.



New Horizons came to within 1.4 million miles of Jupiter on Feb. 28, using the planet's gravity to trim three years from its travel time to Pluto. For several weeks before and after this closest approach, the piano-sized robotic probe trained its seven cameras and sensors on Jupiter and its four largest moons, storing data from nearly

700 observations on its digital recorders and gradually sending that information back to Earth. More data are to come, as New Horizons completes its unprecedented flight down Jupiter's long magnetotail.

Dr. Jeffrey M. Moore is a research scientist at NASA Ames Research Center. As the Chairman of the Jupiter Encounter *(continued on page 4)*

Upcoming Programs:

August 28: R. Jay GaBany: "Remotely Possible" Adventures with Remote Telescopes.

September 25: Vic Maris owner of StellarVue Telescopes.

"Every child needs the January sun."

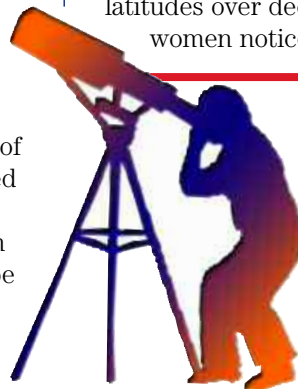
By Jim Scala

Thirteenth century folk wisdom from Weistar, Germany

Folk Wisdom and Sunlight

In 13th century Northern Europe folk wisdom taught that every child needs the January sun. During that time, young mothers in Weistar, Germany exposed infants, toddlers and young children to the winter sun. Indeed, infants were placed completely nude in the January sun whenever weather permitted. Careful analysis of church birth and death records, along with analyses of exhumed skeletons proved the important survival value of this seemingly innocuous ritual easily dismissed as "an old wives tale." The record proves this simple ritual prevented death and deformity in children. Weistar, Germany just happened to be a medieval city where church records were unusually complete and the cemetery was really a vault, so bones were easy to identify.

Records show that children born in late fall and early winter were more likely to either grow up with mild to severe bone deformity and at worst die. Most common was simple bowed legs, but there are many skeletal records of malformed feet, arms, hands and sunken chests. This happened to children who couldn't get the January sun either because they were too young or too fragile. We can speculate that in northern latitudes over decades, if not centuries, women noticed that *(continued on page 6)*



What's Up

By Dr. John Westfall

The Total Lunar Eclipse of August 27-28, 2007

August 28th will provide observers with the first central lunar *(continued on page 8)*

President's Corner Yosemite

By Nick Tsakoyias

“To trace the history of a river or a raindrop, as John Muir would have done, is also to trace the history of the soul, the history of the mind descending and arising in the body. In both, we constantly seek and stumble on divinity, which, like the cornice feeding the lake and the spring becoming a waterfall, feeds, spills, falls and feeds itself over and over again.”
— Gretel Erhlich, on Yosemite.

Sunlight beams through a small hole in my tent. Gazing out, I see mist wisping in the high branches of the evergreens, I feel the chill of the early-morning air. The mingled scent of mist, firs, wet pine needles and freshly made coffee through the campsite. A little ways from my tent I see a couple of raccoons inspecting a fallen pine trunk, they stop – noses twitching – study me, and continue on their way, another morning at Bridal Veil camp site, another morning at Yosemite.



After a long night of stargazing up at Glacier Point I stretch and wipe the sleep from my eyes, throw some water on my face and prepare myself for my next excursion in Yosemite for that day and anticipate the evening when I'll be back at Glacier Point with my telescope and club members stargazing under the celestial heavens. Those are just some memories that come to mind of Yosemite, which for the past three years

in a row I've been going there for our club's Yosemite star party.

This year our club's Yosemite star party is on July 20th and 21st. If you've never been to Yosemite, I highly recommend it. Yosemite and Yosemite Valley are so majestic and so awe inspiring I feel that I can't do it justice in describing it. The closest I can do is

to say that Yosemite Valley reminds me of some place that is part heaven, part fairytale, part Eden. All that in just seven square miles, no where on earth will you find so much natural beauty packed in such a small area. And as a bonus if you stargaze, you will be in for a wonderful treat. Sharing the night sky up at Glacier Point with the public and club members is something that one does not easily forget. The first year I went up to Glacier Point to stargaze I was lost, there were so many more stars in the sky than what I was use to up here in the feeble night sky of Mt. Diablo, that I couldn't make out any of the constellations, it took me almost a



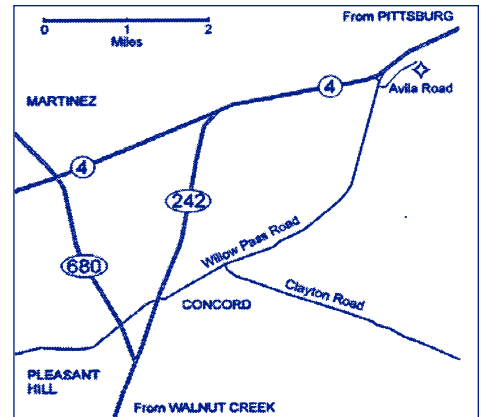
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MDAS meetings are held on the fourth Tuesday every month, except on the third Tuesday in November and December. Refreshments and conversation are at 6:45 p.m. What's Up? at 7:15 p.m. Speaker at 8:00 p.m. The Concord Police Association Facility at 5060 Avila Road is at the top of the hill east of Willow Pass Road, just south of Highway 4. Everyone is invited.

Please consider receiving *the Diablo Moonwatch* by email instead of the Postal Service. Saving in printing and postage is more than \$5.00 per member. You will receive your issue sooner, view it in color, and if you wish can be printed as well on your own printer. Please send a request by email to inquiries@mdas.net.

full night for me to adjust and find my way.

Last year I brought up my five inch refractor up to Glacier Point, I spent

President's Corner *continued from page 2*

hours looking at nebulas, and dozens of globular clusters just in the constellation of Sagittarius. That is something that I wouldn't be able to do here on Mt. Diablo due to all the light pollution, my little five inch scope acted more like a ten inch reflector, so even if you have a smaller aperture telescope you will see far more objects at Glacier Point than you would with the same telescope around the Bay. In fact some deep space objects can even be seen naked eye, our Milky Way galaxy is so obvious and

bright up in Yosemite that it casts a shadow on everything, I've seen people read their star charts without a flashlight. I cannot say enough about my stargazing experience up at Yosemite it's something that one has to experience for themselves.

In closing, I hope that everyone from the club who has the opportunity to make it to this year's Yosemite star party will do so. It's a unique and incredibly rewarding experience that one would not soon forget. I leave you now with a couple of impressions, from two gentlemen who experienced

Yosemite.

See you at Yosemite!

"The air up there in the clouds is very pure and fine, bracing and delicious. And why shouldn't it be?-it is the same the angels breathe."

— *Mark Twain*

"The tranquil uplands where exhilarating air and a free far outlook are combined with the loveliest of the flora. In that zone below the ice and snow and above the darling woods...perfect quietude is there, and freedom from every curable care."

— *John Muir*

Chew on This

by Diane K. Fisher and provided by the Jet Propulsion Laboratory, California Institute of Technology



The Mars robotic rovers, Spirit and Opportunity, are equipped with RATs, or Rock Abrasion Tools. Their purpose is to abrade the surface patina off the Mars rocks so that the alpha x-ray spectrometer can analyze the minerals inside the rocks, rather than just on the surface.

But future robotic missions to Mars will be asked to go even further below the surface. Scrapers and corers will gather rock samples of substantial size, that, in order to be analyzed by a spectrometer, will need to be crushed into a fine powder.

Crushing rocks on Mars? Now there's a problem that brings to mind a multitude of possible approaches: Whack them with a large hammer? Squeeze them until they explode? How about just chewing them up? It was with this latter metaphor that the

planetary instrument engineers struck pay dirt—so to speak.

Thanks to NASA's Planetary Instrument Definition and Development Program, a small group of NASA engineers came up with the Mars Rock Crusher. Only six inches tall, it can chew the hardest rocks into a powder.

The Mars Rock Crusher has two metal plates that work sort of like our jaws. One plate stays still, while the other plate moves. Rocks are dropped into the jaw between the two plates. As one plate moves in and out (like a lower jaw), rocks are crushed between the two plates. The jaw opening is larger toward the top and smaller towards the bottom. So when larger rocks are crushed near the top, the pieces fall down into the narrower part of the jaw, where they are crushed again. This process repeats until the

Looking down on the jaws of the Mars Rock Crusher, we see a magnetite rock get crushed into smaller and smaller particles.

rock particles are small enough to fall through a slit where the two plates are closest.

Engineers have tested the Mars Rock Crusher with Earth rocks similar to those expected to be found on Mars. One kind of rock is hematite. The rusted iron in hematite and other rocks help give Mars its nickname "The Red Planet." Another kind of rock is magnetite, so-called because it is magnetic. Rocks made by volcanoes are called basalts. Some of the volcanoes on Mars may have produced basalts with a lot of a mineral called olivine. We call those olivine basalts, and the Rock Crusher chews them up nicely too.

IMPORTANT REMINDER

Just a reminder to all MDAS members, when driving up or down Mt. Diablo State park for a Public Astronomy Event or a Society Night please obey the speed limit on the mountain which is 25 MPH. Not only will you get a speeding ticket if caught by the rangers it is also unsafe to exceed that limit, being that the mountain has a very winding road and exceeding that speed may cause a serious accident to yourself and others including wildlife.

Thank you, Nicholas Tsakoyias, MDAS President

New Views of Jupiter *continued from page 1*

Sequencing Team and the Imaging Node Leader for NASA's Pluto-Kuiper Belt mission, Dr. Moore has helped design cameras, plan observation sequences, and has analyzed the acquired images.

Dr. Moore's presentation will cover a number of Jupiter

system studies—observations such as Jovian meteorology, studies of the great and little red spots, auroral studies, magnetospheric sampling and dust sampling, and ultraviolet mapping of the gas ring around Jupiter's volcanic moon, Io. Surface mapping, compositional mapping, and atmospheric studies of Jupiter's largest moons are to be covered as well.

Back on Track

ESO News

New Technique for Observing Faint Companions

Observing the image of a faint object that lies close to a star is a demanding task as the object is generally hidden in the glare of the star. Characterising this object, by taking spectra, is an even harder challenge. Still, thanks to ingenious scientists and a new ESO imaging spectrograph, this is now feasible, paving the way to an eldorado of many new thrilling discoveries.

These very high contrast observations are fundamental for directly imaging unknown extra-solar planets (i.e. planets orbiting a star other than the Sun), as well as low-mass stars and brown dwarfs, those failed stars that are too small to start burning hydrogen into helium.

Looking for Faint Companions

Astronomer Nirranjan Thatte and his colleagues developed a new method for exactly this purpose. The basis of the concept is relatively simple: while the positions of most of the features associated with the host star and artefacts produced by the telescope and the instrument scale with the wavelength, the location of a faint companion does not. So if the image has an internal reflection of the star masquerading as a planet, this phantom planet will be in one location in the image when looking in red light, and another when looking in blue; a real planet will stay at the same place no matter what colour of light one examines. Therefore, with the combined detection of spectra and position, one can see what is scaling, subtract it, and be left with what is fixed, that is the target dim object. Such observations can be done with specific instruments, called 'integral field spectrographs', such as the SINFONI instrument on ESO's VLT. This technique, termed Spectral Deconvolution (SD), although first pro-

posed in 2002 for space-based applications, has never been applied to obtain spectra of a real object until now.

"We applied our new technique to a puzzling very small stellar companion - about twice the size of Jupiter - known as AB Doradus C and the outcome was surprising," says Thatte.

Using SINFONI and this new technique, the astronomers could for the first time obtain a spectrum of the object that is free from the light of the brighter companion and that contains all the information necessary for a complete classification.

The new observations lead to a new temperature for the object and change the results that some of the same scientists derived in 2005 (ESO PR 02/05).

"This is how science progresses," says Laird Close, leader of the science team. "New instruments lead to better techniques and measurements, which often lead to new results, and one must happily change course."

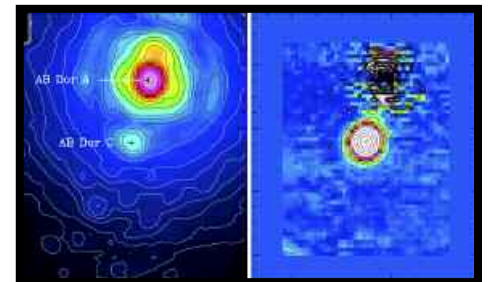
Orbit of AB Doradus C

The SINFONI observations were complemented with previous data obtained on ESO's VLT with the NACO instrument, which were stored in the ESO archive.

AB Doradus is a system of 2 pairs of stars (four stars in total: a quadruple system), lying 48 light-years away towards the Doradus constellation (the Swordfish).

AB Doradus A is the young major member of this system and has a faint companion, AB Dor C, just 3 astronomical units (AU) away, or three times the distance between the Earth and the Sun. In our Solar System, this would be within the asteroid belt between the orbits of Mars and Jupiter.

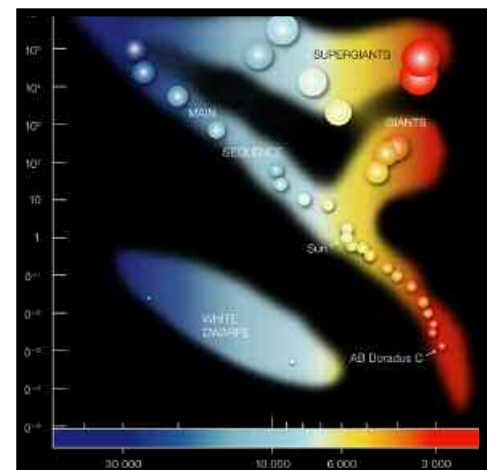
AB Dor C was imaged for the first time, thanks to ESO's VLT, in 2005 (ESO



The left side shows a raw image, while the right side shows the result after the newly developed technique was applied. AB Doradus is the closest faint companion ever detected by imaging.

02/05). The other members of the system are the pair AB Doradus BaBb (also first imaged in the previous work of 2005) located 133 AU from AB Dor A. While AB Doradus A has a mass about 85 % that of the Sun, AB Doradus C is almost 10 times less massive than AB Doradus A and belongs to the category of cool red dwarfs.

Red dwarfs are extremely interesting because their mass is at the border with that of brown dwarfs. A precise knowledge of these stars is therefore a necessary tile in our understanding of the evolution of stars. If AB Doradus C were only slightly less massive than its 93 Jupiter-mass, it would have failed to



In the Hertzsprung-Russell diagram the temperatures of stars are plotted against their luminosities.

Back on Track *continued from page 4*

become a star, being instead a brown dwarf. As it is, the centre of AB Doradus C is slowly heating up, and in about a billion years its core will become hot enough to begin fusing hydrogen into helium, something a brown dwarf will never do.

"This red dwarf is 100 million times closer to its brighter companion than the whole system is from us and about 100 times less bright. It is thus a perfect example where our very high contrast technique is required," says team member Matthias Tecza.

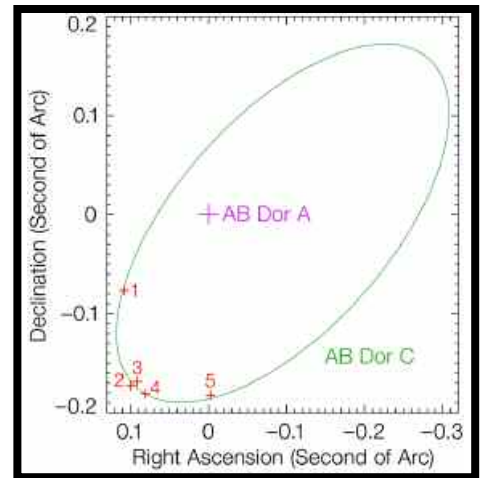
From the previous observations this unique star seemed to be cooler than expected for an object of such a mass and age. The new, more precise observations show that this is not the case, as the observations are in good agreement

with theory, in particular with the models developed by the group of Gilles Chabrier from Lyon, France.

With a temperature of about 3 000 degrees (about half as hot as the Sun) and a luminosity about one thousand times dimmer than the Sun, AB Doradus C lies on the exact track expected for a 75 million year old star with 9% the Sun's mass. AB Doradus C is the only such star (young and cool) with an accurate mass, hence the determination of an accurate temperature is critical for validating these models.

In the future one can thus use these tracks to extrapolate the mass of small young stars, once its temperature and luminosity are precisely determined.

"Small stars are back on the expected track," concludes team member Roberto Abuter.



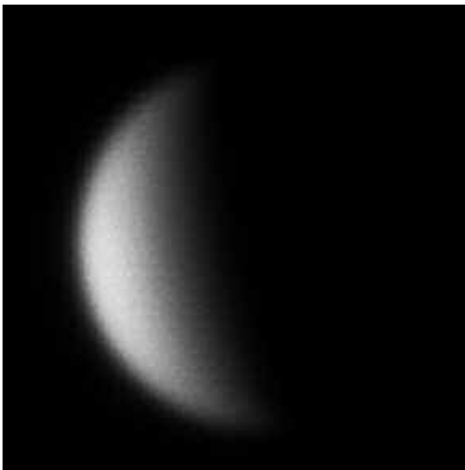
The orbit of AB Doradus C around its more massive companion, AB Doradus A, is shown as a green ellipse. AB Doradus takes 11.75 years to make a full orbit, the separation on the sky being only ~0.2 second of arc. This orbital solution (which implies a mass of 0.09 solar mass for AB Doradus C)

Solar System Notebook

Venus Grows Rapidly as it Pulls Alongside

By Jim Scala

Look west in the early evening and you'll notice that Venus is lower in the sky than it was just a short time ago and it's getting brighter. It's sinking lower because it's catching up to us at about 17, 000 MPH. Since Venus get nearer daily, it puts it closer to the sun



Venus as it appeared in an 80 mm telescope on June 21, 2007. The field of view is one arc minute (FOV=1'X 1') in images one and two.

from our line of sight. The closer it is, the faster it seems to move, very much like a car that's close. Given that it



Venus as it appeared in an 80 mm telescope on July 1, 2007. Notice how its change in size can be observed in just ten days. FOV is 1'X 1'.

passes us on the inside (closer to the sun), it sinks lower every evening because we're looking back in our orbit and it's gaining. Venus gets brighter because brightness is a combination of distance (inverse square law), area and intrinsic brightness. Images one and two show how rapidly it's growing in size, so the rest follows. Venus reaches maximum brightness on July 12th when these three factors; especially area,

come together and optimize its brightness. After that the crescent becomes increasingly slender, decreasing its area, which trumps the other factors and it gets dimmer. However, we're talking 10ths of magnitude, so it remains very bright.

Images one and two show Venus on June 21st and July 1st as captured in an 80 mm telescope. I stopped my 228 mm telescope to 80 mm for these images proving that a small telescope does very well with an object as big and bright as Venus. Indeed, I can easily see its phases in my 10X binoculars.

Venus will soon require daylight observing because it will be so close to the sun that it becomes lost in the haze and glare that often prevails in the western sky at sunset. Whenever you observe an object close to the sun, take great care so you don't get the sun in the field of view. It can cause immediate blindness.

If you'd like to have a look at Venus through my telescope, just call and we can arrange a time. Venus is a beautiful sight as a slender crescent seen through a telescope against a deep-blue summer sky.

"Every child needs the January sun." *continued from page 1*

children who didn't get serious and regular exposure to the winter sun were more likely to get seriously ill, wind up mildly crippled or seriously deformed or die. These findings show how folk wisdom gets started and if it doesn't have any survival value, it usually disappears.

Being conceived right after the May Pole celebration or as folk wisdom taught, being born in the "white" months, was a distinct disadvantage; in contrast, being born in the spring through summer was a distinct advantage. It's simple, a child born in the warm months got plenty of sunlight and entered the winter (white months) months with a liver rich in vitamin D. Consequently, another outcome of this need for sunlight was also "mating" rituals found among people of most northern climates. Indeed, more than one Indian tribe in Northern California had a mating ritual in late summer insuring that their children would be born in late spring. Hence, they had the best survival and were least likely to have bone deformities.

Records from deep southern latitudes aren't nearly as complete when they exist at all. However, anthropological records from skeletal remains found the high southern latitudes show conclusively that a similar problem existed. Interestingly, at least one tribe in Tierra del Fuego used nudity as a ritual which suggests they had happened on the same need for sunlight. However, records are too incomplete to do anything except speculate.

"Choose a wife with straight legs, good ankles and a strong chest."

14th century Scotch folk wisdom about choosing a wife

Selecting a wife with the above criterion traced back to early Scotch folk wisdom. It was an outcome of the January sun ritual, but was expressed as a way of choosing a daughter-in-law that could produce enough children to

help on the farm and act as "old age" insurance. The approach identified a girl that never had rickets, simple vitamin-D deficiency. If that wasn't enough, they chose the period from May through June for marriage to nurture the process along. On average, conception followed marriage by about 3 months. Hence, spring births were the norm that prevented rickets. Although you'll find other explanations for the "June Bride" ritual, I submit that avoiding rickets has clear survival value and "survival" trumps everything.

Industrial societies didn't



escape; even buildings were called rickety.

Tiny Tim, the character created by Charles Dickens, would have been a product of inadequate sunlight which prevailed in England during the Industrial Revolution. In those cities with large buildings and smoke darkened skies, many children developed bowed legs, poorly formed arms, hands and feet. Tiny Tim was so fragile he had to be carried around. Dickens was an astute observer of the human condition, so he was probably telling us how it was for kids at that time.

Twenty percent of Detroit school children between 1910 and 1920 showed clear evidence of rickets. About this time another saying emerged in the USA that relates to the problem. Ever hear some say, "That building looks

rickety?" It's a way of saying that building is not firm, just like a person who had rickets.

"Oh! Dem Bones."

Bones consist of calcium and phosphorus in a protein matrix called collagen, a word whose root means "glue." A boiled bone literally yields glue, so the word is quite descriptive. Vitamin D (really more of an endocrine hormone) is absolutely essential for calcium absorption. Vitamin D starts as cholesterol. Sunlight striking the skin activates it and it's finally converted by other organs into a form that transports dietary calcium across the intestine into the blood stream. The active form also facilitates phosphorus absorption and regulates calcium distribution. So, if there's insufficient sunlight, in the absence of vitamin-D fortified foods, young children's bones don't form correctly and in severe deprivation, death follows. An equivalent problem, Osteomalacia, occurs in adults who experience a prolonged vitamin-D shortfall which is another story.

Sun and cancer prevention in the 21st century.

While the history of sunlight and rickets prevention in human survival is important, vitamin D has emerged as an important factor in the reduction of cancer risk. Many recent epidemiological studies have conclusively shown that people who have low vitamin-D blood levels have greater risk of several types of cancer. So, while we shouldn't overexpose ourselves to the sun to avoid skin cancer, what often goes unsaid is that we need some sun to maintain healthy vitamin-D levels. I guess it echoes the old Greek advice, "All things in moderation."

Acknowledgement:

I used the original concept from my book, Making the Vitamin Connection (Harper & Row 1982) and much help from UCB Anthropology Librarians.

MDAS 50th Anniversary Star Party

Robert (Rob) Haitzma

At the June 2007 MDAS Public Night, there were other events going on besides the satellites buzzing around the Earth and the heavens unfolding overhead. That night we celebrated our 50th Anniversary with many of our members and public present.

In 1957, the Society was formed to accurately calculate the timing of man's first satellites as part of the National "Moonwatch" program and we've never looked back since...

The Society will be also celebrating the Anniversary at a private (members & guests only) event during an upcoming General Meeting, but the Public Night was our time to brag and gloat.

I am not sure of an exact figure, but I estimated the number of people in

attendance was probably a little over two hundred. Refreshments (including cakes decorated with the MDAS logo, soft-drinks and a generous contribution of Peet's Coffee) kept the crowd in a great mood along with the speeches by Nick Tsakoyias and Jack Borde.

During the night many items were also raffled off, such as the obligatory "Squishy Stars" (stress relievers), MDAS caps, patches and t-shirts. Pam Cowart was the voice behind the raffle and kept everyone anxious for the next number to be pulled.

The Outreach events for the night were hosted by Jim Head and Marni Berendsen, who gave everyone a chance to hold at least for

a brief time, their own little Solar System. This "Pocket Solar System" was great fun and educational as well.

Inside, the newly opened Warming Room was a display showcasing the Society's accomplishments and history.

By the way, we also snuck in some peeks here and there towards the night sky and we were happy to show it to anyone who cared to wander by our scopes and binoculars.

On the whole, it was a successful and very fun event. Take a bow MDAS, you deserve it!

Rob Haitzma



2007 Public Program

Month	Date	Month	Date
July	21	September	15
August	18	October	13

2007 Society Nights

Month	Date	Month	Date
July	14	November	3
August	11	November	10
September	8	December	1
October	20	December	8

What's Up *continued from page 1*

eclipse since 2,000 and it will be entirely visible from the Bay Area. The Moon will appear large because it's near perigee enters the outer limits of the Earth's

shadow at 11:53 PM PDT on August 27th and totally begins at 0152 PDT August 28th. At -5° declination the Moon will be very high in the sky making for an easily observed eclipse. Since

the Moon's center will pass south of the Earth's shadow axis, the Southern part of the Moon will be somewhat brighter making for some interesting effects. This is expected to be a colorful eclipse.

AANC Conference 2007: **Reach for the Stars**

**September 29, 2007 — College of San Mateo
1700 West Hillsdale Boulevard, San Mateo CA**

Join us for a fun-filled day and night of astronomy events.

From workshops, talks and telescopes to raffles and kid's activities, there are stellar treats for everyone!

Astronomy clubs from all over northern California are bringing their enthusiasm, know-how and telescopes to share with the public. Equipment vendors will demonstrate the latest astronomy products to everyone, including people seeking to get started in astronomy.

Planetarium shows, updates from NASA scientists, hands-on astronomy activities for all ages, a raffle of great astronomy gear, telescope making, solar telescopes, and finishing the night off...

"Jazz Under the Stars" Star Party hosted by the San Mateo County Astronomical Society and KCSM from 7:45 until midnight.

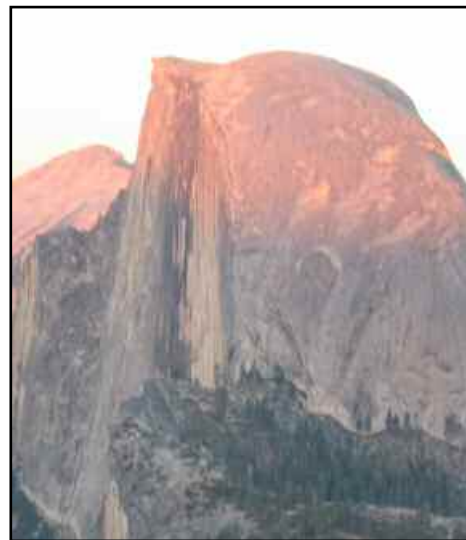
The "Reach for the Stars" conference is sponsored by the following organizations:

*The Astronomical Association
of Northern California
The Astronomy Department
of the College of San Mateo
The San Mateo County
Astronomical Society*

M D A S

YOSEMITE STAR PARTY

JULY 20—21 2007



FOR MORE INFORMATION: PLEASE EMAIL INQUIRIES@MDAS.NET

Diablo Moonwatch

July 2007

**Mount Diablo Astronomical Society
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