BPAA Newsletter

Battle Point Astronomical Association, Bainbridge Island, WA

ISSUE 51 JULY-AUGUST 2002

JULY-AUGUST-SEPTEMBER CALENDAR

(Unless otherwise noted, all events are at the Edwin Ritchie Observatory, Battle Point Park)

July

July 2: Last-quarter Moon 12:10 a.m.
July 4: Grand Old Fourth in Winslow
5th Anniversary (1997) Mars Pathfinder Landing on Mars
July 6: 315th Anniversary (1687) Isaac Newton's *Principia* published
July 8: 10th Anniversary (1992) Comet Shoemaker-Levy 9 Near-Jupiter Flyby
July 10: New Moon 4:21 a.m.
July 11 – 13: **Table Mountain Star Party** www.tmspa.com
July 17: First-quarter Moon 1:24 p.m.
July 20: Star Party Battle Point Park. Beginner session 8 p.m. Paul Below & Bruce Muggli
July 21: Observatory tours 2 to 4 p.m. Gena Ritchie
July 24: Full Moon 8:43 p.m.
July 25 - 27: FIELDSTAR-2000, Vernonia Peak Observatory www.nwag.portland.or.us

August

August 1: Last-quarter Moon 11:29 p.m.
August 8: New Moon 4:25 a.m.
August 8 – 11: **Oregon Star Party** www.oregonstarparty.org
August 14: BPAA Board Meeting 7 p.m.
August 15: First-quarter Moon 1:50 p.m.
August 17: Star Party Battle Point Park. Beginner session 8 p.m. Paul Below & Bruce Muggli
August 18: Observatory tours 2 to 4 p.m. Gena Ritchie
August 22: Full Moon 7:39 p.m.

September

September 4: BPAA Board Meeting 7 p.m.
September 6 – 8: **Royal Astronomical Society of Canada (Victoria chapter) Star Party**
http://victoria.tc.ca/%7erasc/RASCStarparty/rascstarparty2002.html
September 11: Member Meeting 7 p.m. Harry Colvin
September 14: Star Party Battle Point Park. Beginner session 7 p.m. Paul Below & Bruce Muggli
September 15: Observatory tours 2 to 4 p.m. Gena Ritchie

Calendar Notes:

The summer sky is back, dominated by the Summer Triangle of Vega, Deneb and Altair, the brightest stars in their respective constellations, Lyra, Cygnus and Aquila. To locate the Summer Triangle, start with the Big Dipper, in the northwest. The two bowl stars nearest the handle point out of the open end of the bowl, about 60 degrees, to an area about midway between Vega and Deneb. Vega, at zero magnitude, is the brightest of the two. The triangle is completed by Altair. It is a first magnitude star, as is Deneb, but is somewhat brighter than Deneb.

Altair is the nearest, 17 light-years away, and is 10 times brighter than the Sun. Vega, the brightest member of the Summer Triangle, is estimated by astronomers to be 58 times brighter than the sun. Its surface temperature is twice as hot as the Sun's; the star shines bluish white. Deneb, the dimmest star in the Triangle, is the same bluish white color. It is 1,600 light-years from the Sun. Astronomers estimate that its power output is 60,000 times that of the sun's and that if Deneb were in the Sun's place, Earth could be as far away as Pluto and still receive several times more heat and light than it now does.

Presumably we can look forward to improving weather to enjoy the Summer Triangle and the other prominent features of the summer sky. If backyard viewing fails you, there are plenty of opportunities for viewing in dark skies. The Web addresses for the Table Mountain Star Party, the Oregon Star Party, and other star parties in the region are provided above. And there are our local star parties, held at the Observatory once each month. In addition, we can always schedule last-minute star parties via our email yahoogroup. Any member who plans to observe can invite others to join in by sending an email to bpaa@yahoogroups.com. To join our email group, send an email with your name to bpaa-owner@yahoogroups.com and we can enroll you. If you want to also have web access to the messages and files, you can join the yahoogroups by clicking the register link for new users on http://groups.yahoo.com/ , and then you can request to join our group on this page: http://groups.yahoo.com/group/bpaa/. The system will send us a message, and we'll approve your request after we verify your membership.

Diane Colvin
(dcolvin@bainbridgeisland.net)

NEWS BRIEFS

OREGON STAR PARTY

The 15th Oregon Star Party (OSP) will be held this year from August 8 to 11 in Indian Trail Spring, Ochoco National Forest, Oregon. This is 25 miles east of Prineville and is characterized by its 5,000' altitude, excellent sky transparency, steady air, and low light glow. Among the speakers are Ron Wodaski ("The New CCD Astronomy," also the title of his book), Dr. Michelle Larson ("Cosmic Rays"), and Dr. Shane Larson ("The Dark Side of the Universe"). Mel Bartels will conduct a "Telescope Walk-About," Dan Gerhards will talk about "Constellation Lore," and with the event coinciding with the Perseids, there will be two lectures on meteors, one by Wes Stone, the other by Bob McGown. (Check out the OSP web site for updates and registration information at: http://www.oregonstarparty.org

A Star Party, whether at Battle Point Park or Table Mountain or in Oregon, is an adventure in astronomy. From those who enjoy the dark skies from their lawn chairs to those who are logging Messier objects, to those who have the know-how to use their sophisticated equipment, this is a place and time for all to enjoy the dark skies and the companionship of like-minded observers.

THAT ONE GOT AWAY

Ooops—there it went. Did you see it? Lincoln Near Earth Asteroid Research (LINEAR) scientists almost missed it.

According to CNN.com/SPACE on June 20, Asteroid 2002 MN zipped past the Earth June 14 only 75,000 miles (120,000 km) away—just a third of the distance between us and the Moon. It was going 6.2 miles (10 km) a second (light goes 186,000 miles—300,000 km a second). It wasn't the closest near miss recently; Asteroid 1994 XL1 came within 65,000 miles of us December 9, 1994. (Cont. on p. 3)

This June's asteroid was only about the size of a football field, something like what exploded over Siberia in 1908. It could have caused a major fire had it hit (the Siberia event flattened 77 square miles of trees), but it was not nearly big enough to equal the one that is thought to have extinguished the dinosaurs 65 million years ago.

In relation to some other asteroids sailing around between us and Mars that are more than 0.6 miles (1 km) in diameter, this one was not a "killer." While relatively small asteroids aren't infrequent visitors, what does give one pause about this one is that even the scientists who were looking didn't see it until several days after it had gone past. A.G.E.

HELLO,

This is in reference to your article on page 12 of the May-June 2002 *BPAA Newsletter* about Goldendale Observatory. There is some information that needs to be corrected. Jim White is NOT a member of the Washington State Parks and Recreation Commission. Jim is President of the Friends of Goldendale Observatory. He sent a notice to all Astronomy clubs late last year in which he mentioned State Parks budget cutbacks and possible park closures. At that time the Goldendale Observatory was on a list for consideration for closure because of the cutbacks. However, since then the legislature has finished its session and the State Parks Commission has finalized a list of parks to consider for closure. The Goldendale Observatory was taken off this list at the end of March 2002. Budget cuts and closure of parks may be an issue again in the near future, but as for now the Observatory is open with its regular star viewing programs. Clear Dark Skies and Good Seeing to You!

Stephen R. Stout
Interpretive Specialist
Goldendale Observatory
<goldendale.observatory@parks.wa.gov>

TABLE MOUNTAIN STAR PARTY

This year's 22nd annual Table Mountain Star Party will take place July 11-13. Located 20 miles northwest of Ellensburg, it promises to be three days and two nights of exceptional observing. About 1,200 people—among them members of BPAA—are expected for the star-gazing, lectures, workshops, vendors, door prizes, and general fun. Speakers will include John Dobson, Craig Zerbe and John Benham. There will be a telescope maker's contest with categories including optical excellence, workmanship, and design.

The deadline for late registration is July 5, and space is not guaranteed for late-comers. A registration form can be printed from the Table Mountain website, http://www.tmspa.com/ For next year's event, the plan is to conduct the registration solely online. More information about that and about this year's activities can be seen on that web site.

REPORTS AND ARTICLES

ARE YOU AWARE of all the BENEFITS available to BPAA Members ?

As I mentioned in the last *BPAA Newsletter*, we have a selection of telescopes that are available for members to check out or use. This provides you with the ability to learn to use a scope as well as try before you buy. Currently, we have: a 4.5 and a 6-inch Dobsonian reflector; an 8-inch Schmidt-Cassegrain; a 16-inch string-truss Dobsonian; and more in the works. These are capped, of course, by the 27.5-inch Ritchie Telescope permanently mounted in our dome. These scopes make excellent stepping stones if you want an inexpensive way to learn your way from simple to more complex.

Of course, every two months we mail the *BPAA Newsletter* to all members who do not have internet. For the rest of us, we post the newsletter on our web site and send out an email announcement to let you know that it is available. (By this, you will be able to have links to get high resolution pictures in color.) You can help us stretch our dollars by letting our Secretary know your email address (and letting us know if your email address changes) so we can print and mail fewer issues.

Also, if you have email, join our Yahoogroup (see our Events Director's report for instructions). Many times we hear about regional happenings at the last minute, or hold impromptu Star Parties. Email provides the best way to get the word out.

As a supporter of BPAA, you enable a number of educational activities including the very active Robot Club, Project ASTRO on the west side of the Sound, guest speakers and classes, and special events for school and scout groups. It is always very gratifying to see an excited class of youngsters visit our facility as the highlight of a school year spent studying astronomy and the other sciences.

(Cont. on p. 4)

Did you know that we obtain discounted subscriptions to *Sky & Telescope* magazine? This program is coordinated by our hardworking Treasurer.

We have a library collection of donated astronomy books and magazines available for your use. Stop by and look them over.

As a BPAA member, you also become a member of the Astronomical League and receive their much-improved magazine, *Reflector.* The League provides a number of benefits, including the observing programs, discounted insurance, and the amateur space telescope. The League also provides a discount on science books, and *Sky & Telescope* provides a discount on items purchased directly from them.

BPAA has plans for the future, some that will require us to raise additional money. The priciest of these is to place a planetarium projector and dome in our meeting room, which would be a great resource for the local schools. We also intend to build more telescopes (would you believe 20- and 28-inchers?), obtain a hydrogen-alpha solar filter for daytime public events (to show flares and details on our Sun), and install a sun dial on the pedestal south of the dome.

As you can see, $25 a year (family rate) is quite a bargain. In fact, we could not operate relying on dues alone, which is why we solicit additional donations for large capital projects, as well as keep the donation jar out. I would also take this opportunity to encourage you to do whatever you can to support the Bainbridge Foundation which provides 2/3 of our operating budget and the BI Parks Department which provides us the raw facility and electric power at no charge. Our organization would not exist without them.

And, as we are a nonprofit, remember that your donations to BPAA and BF are tax deductible.

Thank you, and dark skies! Paul Below, President

FACILITY DIRECTOR'S REPORT

By John H. Rudolph

Activities during May and June for facilities were few but important. To fulfill our collective promise to bring the 27.5" up to full operational status, meaning that we can use it to take images both with film camera and CCD, Dave Warman, Paul Below, Don Trantow, Harry Colvin and I worked on the big instrument on two separate nights.

Having cut loose the support tower from its inadvertent connection to the building, we concentrated on seeing if the RA tracking stepping motor caused any vibration. We found that there was some trouble with the tracking motion, presumably in the computer drive program. Dave Warman is going to solve this glitch and we will be going at it again when clear nights and available wizards are in syzygy. We are getting there!

The keyed light switch for turning off the majority of the Battle Point Park lights is now in place and operational, thanks to Jim Vaughan's design and Paul Geotsch, of Rolling Bay Electric, who installed the switch and relays. The minority of lights will still be controlled by throwing breakers in the baseball field house.

Behind the scenes, work is progressing on the planetarium. Mac Gardiner and I visited with Matt Watson in Bellevue, WA, who is a world class optical systems designer. It was a fascinating and enlighting trip for both of us as Matt has much more to teach than we students could absorb. Watching the effects of various systems of lenses changing configuration before our eyes on Matt's computer screen was like watching a magician at work. Mr. Watson believes that a system can be achieved that will suit our needs. When he has the design perfected, we have Bob Mathews who has agreed to do the lens grinding and polishing. Mac Gardiner may be retired from the presidency but he has not lost his touch to encourage experts to help BPAA reach its goals. He has encouraged me to get the lead out and get the dome designed and fabricated for the planetarium that will be deployed in the observatory meeting room, and also to complete the Planetarium Report that is complete except that it has not been written up yet. (I learned that line from Frank Lloyd Wright.) So keep tuned to this frequency and don't hesitate to nag.

Early in June, Dr. Louise Baxter, now teaching "across the board" science to six 9th grade classes, invited me to present a slide show and talk on archaeoastronomy. I put together 80 slides that began with Stonehenge in southwest England, moved on to Newgrange, Ireland, then to the Ancient Observatory near Susanville, CA and finally to the Haleets, the Agate Point Petroglyph Stone on Bainbridge Island, WA. It was a Monday, so several students tried to grab a nap in the dim light until Dr. Baxter stopped the show to remind them of their manners, but most of the students were very attentive and asked some quite pertinent questions during and after the presentation. After six classes, I was wrung out and convinced that teachers are not (Cont. on p. 5)

paid enough. I was greatly rewarded when a delightful card arrived later in the week, signed by the students, with comments. Dr. Baxter is very excited to have our observatory available to augment her teaching. She has determined that the various sciences can be best taught by using astronomy as a framework to connect the various other disciplines. More power to you, Dr. Baxter, and count on us to help you in your efforts.

ASTRONOMY IN ARIZONA

By Anna Edmonds

On our recent trip to Arizona we visited two important astronomy workshops, the Lowell Observatory in Flagstaff and the Steward Observatory Mirror Lab at the University of Arizona in Tucson.

For the delight that our 5-year-old granddaughter found in the displays, the Lowell Observatory ranks high on our "must experience" list. The interactive exhibit hall there kept her exploring with her mother the many programs on the computers. Then she danced up the "Pluto Walk," stopping only to be sure we were following. We'd already shown her the rare display of five naked eye planets in the western sky. She will remember the fun, but I doubt that she will associate the night sky with the brass markers in the walk.

The Mirror Lab, located underneath the U. of Arizona football stadium, gave us a more specialized study. There we were treated to a presentation on the Lab's projects of casting and polishing large, lightweight mirrors. We were guided in part by Bob Crawford, an undergraduate optics major who had helped with BPAA's exchange of the large Zerodur blank for a working telescope.

Most of Arizona's mirror blanks are honeycombed rather than solid glass giving them a number of advantages: 1) The borosilicate glass (similar to Pyrex) is affected only minimally by changes in temperature. 2) It can be molded at a relatively low temperature. 3) It is less expensive than Zerodur. 4) It is not damaged when the reflective metallic coat is cleaned off and renewed every year. That means it does not have to be repolished frequently.

The honeycombed substrate 5) makes the glass both remarkably stiff and relatively lightweight. 6) With less mass, the glass adapts more quickly to changes in temperature. Also, 7) conditioned air circulates quicker and more completely through the honeycomb than around a solid piece, making it easier to keep the temperature of the glass balanced.

The mold of the mirror blank is made in a pattern of hexagonal ceramic core boxes fixed in a cylindrical tub. Twenty and a half tons of borosilicate glass in five pound chunks are melted in the tub to a temperature of 1180° C. At the same time, the tub is spun so that the glass not only fills the area around the boxes, it also laps up evenly on the edge, forming a parabolic upper surface. When the blank has been molded (more than two years of heating and cooling), the boxes are washed out with a high pressure water spray. What is left is first, to give it the final polishing and lapping to an accuracy of more than one millionth of an inch, and then to aluminize it to give it the reflective surface.

Two additional ideas for telescopes are being developed in Arizona. The Large Binocular Telescope involves a collaboration among 13 communities, among them four in Arizona, six in Germany and one in Italy. The LBT on Mount Graham northeast of Tucson is a combination of two 8.4-m mirrors on a common mount which gives the equivalent resolution of a 22.8-m telescope.

The second is the use of liquid mercury as the reflective surface of a mirror. Although this mirror is able to point only directly overhead (the liquid cannot be tipped) the Earth's tilt and rotation permit a reasonable fraction of the celestial sphere to be viewed. Its focal length can be changed as desired in minutes by merely changing the speed of its rotation. As with the glass mirrors that are spun, the rotation gives the mercury its paraboloidal surface.

With its high mountains and many nights of clear skies, it's obvious why Arizona is a Mecca for astronomers.

THE HUBBLE PROGRAM

By Mac Gardiner

Why Hubble?

For many years, astronomers have wanted to study celestial objects that are further away and dimmer. The finite speed of light means that all we see coming from further objects are emitted at an earlier date, and it turns out that cosmic events in those earlier times are more interesting and beautiful than recent ones. On Earth, the limitation has been the background brightness of the sky, and the shimmer of the image caused by differential refraction through the Earth's atmosphere. A location in space eliminates both, and permits an order of magnitude improvement in resolution and sensitivity. The exciting new development of Charge Coupled Devices permits astrophotography to be coupled with telemetry downloading, to permit unlimited use without film replenishment. It was felt that the system could be made to last as long as ten years in orbit.

History

At last NASA had a program that would be a worthy successor to the Apollo Moon program. The cost appeared to be about right, $2 billion (the cost of the Manhattan project). Other countries would contribute equipment, instruments, advice and cash. In return, they would receive (reluctantly) recognition, and, more valuable than gold, guaranteed time on the Hubble, with priority on celestial objects, including the right to delay distribution of raw data until after publication.

What was built was actually an observatory with five telescopes, including a Wide field/planetary camera, a faint object camera, a Faint object spectrograph, a high resolution spectrograph and a high speed photometer. All shared the same primary and secondary mirrors, but occupy separate areas in the image plane.

The Challenger catastrophe in 1986 added four years to the schedule delay of three years (of 20 years), and this was used to clean up the Hubble. However, the 94.5" mirror system was never "system tested" end to end.

The big mirror was ground so accurately that a ground test to verify that accuracy would have cost tens of millions of dollars and subjected the system to possible damage from manipulation. Senator Gore had suggested that it be given a quick "Sea Trial" end to end test but his advice was ignored. In retrospect, the simplest of Foucault tests (flashlight and razor blade!) would have shown that the system had spherical aberration to a devastating extent.

The launch and deployment of the Hubble was technical and political hype at its utmost. Never had so many millions of people waited so breathlessly and confidently to see the "First Light" images. They waited and waited. After hiding the fact for about a year, NASA finally admitted the problem. The technicians simply couldn't focus the system. There were other problems, bad ones, but correctable or capable of being worked around. All of the positive feelings of the press and the public turned into ugly, negative ones, and Congress nearly killed the program. The scientists didn't want to use their valuable "priority time" on a weakened system. There was concern about suicides by key personnel.

Finally, the scientists got good pictures and data and made discoveries. The resolution was fantastic, as it was possible to "deconvolute" and remove the defocused "halos," but the process meant throwing away 85% of the precious photons and thus losing "magnitudes" of sensitivity. One could discern lovely details, but couldn't probe into the distant dim past. The glass was then half full, or half empty.

The first repair mission, undertaken a year ahead of schedule, installed a corrective eyeglass for the myopia, at the cost of one of the camera systems, and restored most of that vital sensitivity. Also, it and a subsequent mission replaced failing gyros, and attempted (unsuccessfully) to correct vibration problems caused by the fluttering solar power panels.

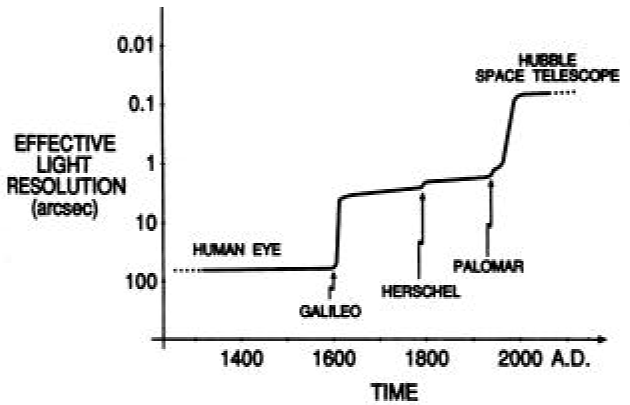
The result was a flood of discoveries and solid data that vindicated the investment, and restored the Hubble to the preeminent position it currently holds. It still is a cranky system, calling for the coordinated action of hundreds of people, at a cost of $250 Million/year. Like the venerable DC3, it has its faults, but the personnel know what to do to compensate.

This last mission is different. Finally, instead of fixes, we are getting upgrades! The "Advanced Camera for Surveys" has both a wider field of view and higher sensitivity, particularly in the blue end of the spectrum. The "window shade" solar panels have been replaced by smaller solid panels of higher efficiency, meaning more power, less drag, and the fact that ten minutes of vibration at each crossing of day to night (45 minutes) is eliminated. A satisfactory non-replenishing cooling system for the Near Infrared Camera and Multi-Object spectrometer means the availability of those essential tools for the rest of the mission

(Cont. on p. 7)

What is unique and important about Hubble?

There are several ways to address this question. The simplest is shown in the figure below



What this says is that man could see detail down to about 1.5 arc minutes of arc all the years up to Galileo in the 17th century. He jumped man's effective light resolution up to around 5 arc seconds and got himself house arrest for the remainder of his life. Herschel gave resolution a ten percent kick 200 years later with his big refractors, and Palomar gave it another nudge of a few percent toward 1 arc second in the 1930's. Then Hubble came along and raised it 10/1 to 0.1 arc sec!

Cold numbers follow. The NASA spec said:

Given the following:
Nominal Parameters of Hubble Space Telescope

Primary D = 2400 mm, R' = -11040 mm, f/2.3, K~ = -1.0022985
Secondary R2=-1358mm, K2=-1.496
Overall m = 10.43 5, '3 = 0.2717, k = 0.1 11 2, scale = 3.58 arc-sec/ mm = 279 ~m/ arc-sec
The image quality must meet the following requirements: The optical image, including effects of optical wave-front error, pointing stability, and alignment of the scientific instruments to the Optical Telescope Assembly, should satisfy the following on-axis requirements at 6,328 angstroms and be a design goal at ultraviolet wavelengths: Image resolution using the Rayleigh criterion for contrast of 0.10 second of arc. A full-width half-intensity diameter of 0.10 second of arc, 70 percent of the total energy of a stellar image must be contained within a radius of 0.10 second of arc. After correction for astigmatism, these specifications shall apply to the image quality over the entire usable field of Space Telescope.

This has been met, though it took more than a little time and effort to achieve it.

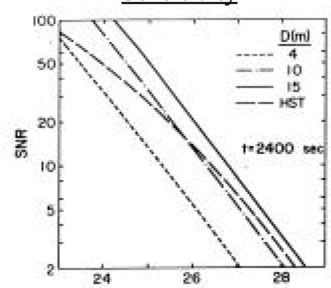
How sensitive is it? Again, given the following:

Detector and Telescope Parameters

Detector	**? = 15 µm, *R*= 10 counts/pixel, *C* = 0.01 count/(pixel sec), ? = 0.8, *Q* = 0.5**		
Telescope	**t = $(0.9)^2$ = 0.81**		
Filter	**t = 0.8, ?? = 100 nm (*V*-band)**		
Relay optics	**t = 0.5**		
Other	**m´ [mag/arc-sec)^2]**	**ø (arc-sec)**	***F***
WFPC	**23**	**0.2 2.9**	
Ground	**22**	**1.0**	**2.5**

It should be this good:

Sensitivity



Left side: (SNR) Signal Noise Ratio
Bottom: Celestial Magnitude (m)

What this says is that the current system can get adequate signal/noise ratios of celestial imagery down to 28th magnitude stars, given a single exposure maintained for the duration of time that the earth could not occlude the image. That is significantly better than what is obtained with a 15 meter (49.2 feet) diameter terrestrial reflector under optimum conditions! Then the Hubble guys took successive multiple images in those delicious dark skies, stacked them and went way out further!

So what is new?

The key factor of gain is in the Quantum Efficiency of the CCD detector element, rising from 0.5 to 0.85, with a major gain in efficiency in the blue region of the spectrum. This change, in an element 2 inches on a side, is the equivalent of increasing the big mirror area by 70%. This results in much shorter exposures, and a corresponding increase in the throughput of the telescope system. The other change is (Cont. on p. 8) the increase in the total pixel count on the detectors. This gives more serendipity in the collateral images obtained, and also reduces the incredible precision required to acquire and track the dimmest images. Right now, the faint object camera has 0.02” resolution within a 11” field, implying that acquisition cannot be assured unless the system is pointed to within 5” of dead center.

So all looks good, but still, the proof is in the pictures taken, and here the new system is showing itself off in grand style.

The first breathtaking pictures have been released. We have every right to expect many more beautiful pictures. We also expect exploration into much earlier eras of cosmic development. We can now access the NASA Web site and browse through the beautiful, incredible images that are now pouring out. Just use the following: <http://hubblesite.org/news> and <http://hubblesite.views/pr.cgi.2002+11>. As Diane Colvin emailed: “Wow”.

And we wonder if they mean it when they say that the Hubble’s life is coming to an end. Will we have the “Next Generation” telescope ready by that time? Will the ISS Amateur Telescope be the only picture taker in space?

Keep up your membership in BPAA, attend Paul Middents’ lectures, read the *BPAA Newsletter* to find out. And, hold your breath for the next 6 years.

Financial Statement for May 2002

BALANCE SHEET:	**$**	
Current Assets	16,258	
Fixed Assets	241,725	
Total Assets	**257,983**	
Liabilities	-0-	
Equity	257,983	
Total Liability/Equity	**257,983**	
PROFIT & LOSS:	**$ May**	**$ YTD**
Income:		
Contributions	83	4,315
Membership Dues	245	1,865
Other	295	1,325
Total Income	**623**	**7,505**
Expense:		
Administration	184	1,359
Program	1,338	1,587
Utilities	48	461
Total Expenses	**1,570**	**3,407**
Net Income (Loss)	**(947)**	**4,098**

Eric Cederwall, Treasurer

SEEING STARS Astronomy 0.001

By Anna Edmonds

July and August are good times to look for shooting stars. If you’re patient and watch carefully, you probably can see one any clear night. They are ideal for naked-eye observing. And July’s better than January when you don’t have to wear winter clothes waiting outside for one to appear.

Astronomers usually call shooting stars “meteors.” They are grains of dust burning from the friction with our air. Most of them start about 60 miles above us, and they burn up in a wink. Sometimes they’re “fireballs” brighter than the planet Venus. If they explode, they’re called “bolides.” The few that are so big that there’s still something left to reach the ground are “meteorites.”

Meteors and meteorites are bits of debris that the Earth bumps into. The debris could be from the Moon, or from Mars, or maybe it’s left over from when the Solar System was being formed. That makes it old—about 4.5 billion years. Much of it seems to be what blew off the tails of comets when they whizzed around the Sun. The Earth gets a lot of such stuff—over 100 tons rains down every day. By studying meteorites from outer space astronomers are learning about the inner spaces of Earth. They suggest that we got some of our water originally from comets. And men from Mars?

Summer is the time of two big meteor showers, the Delta Aquarids around July 29 and the Perseids around August 12. Aquarids can average about 20 meteors an hour; the Perseids are usually more numerous—80 or so an hour. You have a better chance of seeing them after midnight than before. It’s like walking with the rain or into it: The earth gets more in its face when it’s facing into the shower.

Some people keep a record of the meteors they see. They list the day and the hour, the brightness, the name of the shower, how clear the sky is, and comments on unusual features. If there’s a chance that it has become a meteorite, they try to give directions to where it might have landed so it can be found.

Look up on a clear night this summer. You might see an ancient Martian wink at you.

ASTROBIOLOGY – Subsurface Water on Mars

By Bill O'Neill

The news is just too exciting for me not to write about it. ***The initial results from the Mars Odyssey spacecraft indicate that a lot of water (ice) lies just beneath large expanses of the Martian surface.***

Mars Odyssey was launched April 7th last year, and six and half months (292 million miles) later it began to spiral into a two-hour orbit to survey Mars for the next two years. Its instruments were turned on at the end of February and, within a month (before their sensitivity was enhanced in June), the data astonished investigators, some of whom had waited 15 years to see it.

Measurements of the neutron fluxes emitted from Mars in various energy regimes, along with spectra of gamma-ray emissions (induced by neutron capture reactions) make it possible to map the distribution of hydrogen to a depth of about one meter in the Martian soil. Analysis and modeling of the first month's data, reported in the form of three publications authored primarily by scientists at U. Arizona, Los Alamos Nat. Lab. and the Institute for Space Science in Moscow, were submitted to the journal *Science* May 8th, peer-reviewed, and e-published May 31st. The papers are still only available on the Web, but until June 27th anyone can access the full text at www.scienceonline.org. It's a free opportunity to check out the internet version of the *AAAS Journal*.

In this space, and with my limited knowledge, I can only summarize what can be digested in detail at that web site, and one can obtain more information about the methods through links at NASA's, www.mars.jpl.nasa.gov .

The suite of three instruments, collectively known as the Gamma-Ray Spectrometer (GRS), had previously been included in the Mars Observer spacecraft, but it stopped working 3 days after entering Mars orbit in 1993. GRS consists of a Neutron Spectrometer, a High Energy Neutron Detector and a Gamma Ray Subsystem. Cosmic rays striking the Martian atmosphere and surface give rise to neutrons by various nuclear reactions. The neutrons then lose energy by collision with surrounding nuclei and, in the process, excite some nuclei to emit gamma rays. Neutrons with relatively low (thermal) energy can be captured by nuclei, which in turn generate novel gamma rays.

These processes reflect the chemical composition of the surface and atmosphere, since different elements possess different cross sections for capture and vary in their ability to moderate neutrons. The composition of the layer of rocky debris that covers Mars (the regolith) will affect both neutron and gamma ray fluxes, but they differ with respect to their depth dependence. Epithermal and thermal neutrons can reflect processes 2-3 times deeper than gamma rays. Hydrogen is an especially effective moderator of neutrons due to its mass being near that of a neutron. The gamma emission line of hydrogen, resulting from capture of thermal neutrons, was strong in the spectrum from the Martian south polar region (where it was late summer), but nearly absent in mid-latitudes.

Over most of the planet that hydrogen gamma signal was weak, but increased as the pole was approached, in parallel with a declining epithermal neutron flux – an independent indicator of high H levels. Relating these data to the distribution of H in the upper meter of surface requires computer modeling, for which a two-layer model appears to best fit the data. (It was assumed that the distribution of all elements other than H was similar to that measured by the Alpha Proton X-ray Spectrometer on the little Pathfinder robot, and water was assumed to be the only reasonable host molecule containing the hydrogen atoms.)

These initial analyses suggest a thin (few inches) upper layer with water content of about 1% near –40° latitude, doubling by –6o°, and a lower layer (at least 3 feet deep) containing 35±15% water by weight (40-73% ice by volume, substantially higher ice content than terrestrial permafrost). A similar H-rich region was observed in the north, although it was obscured near the pole by its seasonal frozen CO_2 cap.

Earlier evidence indicates the regolith could exceed a kilometer in thickness, suggesting that the subsurface ice detected by Mars Odyssey's GRS may be only the tip of an iceberg, or a vast frozen water table, that could host life and also prove vital for human exploration of Mars, and beyond.

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