BPAA Newsletter

Battle Point Astronomical Association, Bainbridge Island, WA

ISSUE 61: JANUARY – FEBRUARY 2004

JANUARY – FEBRUARY – MARCH CALENDAR

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

January

January 3: Quadrantids Meteor Shower Peak
January 4: Mars Exploration Rover-A (Spirit), Mars Landing
January 7: BPAA Board Meeting 7 p.m.; Full Moon
January 10: **Star-Spangled Dixie Concert, Benefit for the John H. Rudolph Planetarium Fund**, at the Playhouse, 6:30 p.m. Social Hour & 7:30 p.m. Concert
January 11-15: American Meteorological Society Meeting, Seattle
January 14: BPAA **Annual Meeting** 7 p.m. (See President's Message, p.3) **ALL MEMBERS INVITED!**; Last-quarter Moon
January 17: Star Party Battle Point Park. Beginner session 6 p.m. Paul Below & Bruce Muggli
January 21: New Moon
January 22: Lecture Series 2004 7 p.m. Paul Middents; Solar System Overview, at Bainbridge High School (BHS), Room 311. (See article on p. 3)
January 25: Mars Exploration Rover-B (Opportunity), Mars Landing
January 28: First-quarter Moon

February

February 1: 5th Anniversary (1999), Galileo, Europa 19 Flyby
February 4: BPAA Board Meeting 7 p.m.
February 5: Lecture Series 2004 7 p.m. Paul Middents; Gravity and Orbits I, at BHS
February 6: Full Moon
February 7: Astronomical Society of the Pacific, 115th Birthday (1889)
February 11: Member Meeting 7 p.m. Paul Middents, ASP Survey
February 12: Lecture Series 2004 7 p.m. Paul Middents; Gravity and Orbits II, at BHS
February 13: Last-quarter Moon
February 14: Star Party Battle Point Park. Beginner session 6 p.m. Paul Below & Bruce Muggli
February 15: Galileo Galilei's 440th Birthday (1564)
February 19: Lecture Series 2004 7 p.m. Paul Middents; The Terrestrials, at BHS
February 20: New Moon
February 26: Lecture Series 2004 7 p.m. Paul Middents; Earth and Moon (What's So Special About Us?), at BHS
February 27: First-quarter Moon

March

March 1: Comet Shoemaker-Levy 4, Closest Approach to Earth (1.662 AU)
March 3: BPAA Board Meeting 7 p.m.
March 4: Jupiter at Opposition
March 6: Full Moon
March 10: Member Meeting 7 p.m. Leif Karlsen, Secrets of the Viking Navigators
March 11: Lecture Series 2004 7 p.m. Paul Middents; The Gas Giants (What Is Cassini Telling Us?), at BHS
March 13: Star Party Battle Point Park. Beginner session 6 p.m. Paul Below & Bruce Muggli; Last-quarter Moon
March 14: Albert Einstein's 125th Birthday (1879) (Cont. on p. 2)

March 18: Lecture Series 2004 7 p.m. Paul Middents; Asteroids and the Gravitational Mixmaster, at BHS
March 20: New Moon
March 28: First-quarter Moon

Calendar Notes:

It appears that we're having a normal winter: nary a clear night for viewing the universe. At least we can be glad we don't live on Neptune; it takes forty years for spring to arrive there.

To compensate for the lack of viewing opportunities, BPAA has a number of important and interesting events on its calendar. **On January 10, we should all be at the Playhouse in Winslow. The Bainbridge Island Kiwanis Club is sponsoring a benefit for BPAA's John H. Rudolph Planetarium Fund.** John's very own band, The Intensely Vigorous Revolutionary Volunteer Dixieland Band, will be performing. The event starts at 6:30 p.m. with a social hour featuring complementary hors d'oeuvres. The concert, entitled Star-Spangled Dixie, begins at 7:30 p.m. Tickets ($20 per person) are available at Winslow Drug and from Kiwanis Club members.

BPAA's Annual Meeting is scheduled for **January 14**. All members are invited.

Starting January 22 is Paul Middents' lecture series. (See article p. 3) This year Paul is focusing on the solar system. The series is entitled Keeping It Together, A Solar System Tour with a Dynamic Emphasis. As many of you know, Paul's lectures are always well worth attending. The lectures will be held at Bainbridge High School, as they were last year, in Louise Baxter's classroom. The school proved to be an excellent venue for the lectures, and we thank Louise for making the space available.

Paul Middents will also be at the Member Meeting in February when we will be discussing the survey conducted last year by the Astronomical Society of the Pacific. We will review the survey questions and answers; Paul will be providing cogent explanations and amplifications where needed. This will be of keen interest to all of you who participated in the survey, and a learning experience for those of you who didn't.

At the member meeting in March, Leif Karlsen is the featured speaker. His talk will cover the feats of navigation achieved by the Vikings, who had no magnetic compasses, charts, sextants or even accurate timepieces. It is believed that they used a sunstone and some sort of a bearing board. Leif has been researching the sunstone for years. He will share with us his knowledge about the sunstone and the other techniques and tools that the Vikings used in navigating the North Atlantic, including the Sun, stars, landmarks, and seamarks.

Finally, should some viewing opportunities arise, don't forget our star parties, scheduled monthly to coincide with the third-quarter moon. Additional star parties may be scheduled at any time 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

December Member Meeting

The member meeting held on December 10 included a number of topics. I set up my 10" LX200GPS Meade Schmidt-Cassegrain Telescope with a Starlight Express MX916 CCD camera. I also presented Alt/Az mount error data I obtained from stacking 100 images at 10 second intervals.

In addition, I described the observatory I will be constructing in my backyard. The first step has been taken: excavation for a cement pier. The observatory will be a roll-off roof shed design, which will house the 10" Meade and feature remotely controlled CCD equipment. Plans for the shed may be found at www.skyshed.com.

At this same meeting, David Warman demonstrated BPAA's SBIG ST8 CCD camera and filter wheel. Harry Colvin hcolvin@bainbridge.net

2003 Winter Solstice at Ritchie Observatory

by Vicky Saunders

Near noon on December 21, six people stood in the darkened meeting room of the Ritchie Observatory, staring at a bland square of light on a white board.

Like Stonehenge and Willow Creek, Ritchie Observatory is a working calendar. On and near the day of the winter solstice, when the Sun is at its apex, a shaft of light enters through a small aperture high on the south wall and displays an image of the Sun on the north wall of the meeting room.

After some minutes the disc made its entrance, and proceded across the square. At the solstice, the observatory works like a pinhole camera, and not only could we see the disc of the Sun, but the

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clouds that swirled around it--but, as in a pinhole camera, the image is upside-down and backwards, and moves from west to east.

The disc moved at a stately pace, robed in vapors, across the white board. The phenomena that inspired builders of standing stones, step pyramids, and passage tombs was still fascinating. We gathered round and took pictures.

Beagle, Spirit, & Opportunity on Mars !

NASA's Jet Propulsion Laboratory scientist Dr. Ron Hobbs will give a multimedia presentation at the **Museum of Flight** on Saturday, January 10 at 11 a.m. as part of an all-day **Mars Fest '04** there. Dr. Hobbs, JPL's Solar System Ambassador, will talk about "Return to Mars," recounting the almost 40 years of Martian exploration. The event, requiring the regular Museum admission, includes a panel discussion among local Mars experts and the keynote address at 3:00 p.m. by Dr. Robert Zubrin, founder and current president of the Mars Society. For more information, call the Museum of Flight (206)764-5700. A.G.E.

President's Message

This is a very short President's Message, to remind you to attend the Annual Meeting at 7 p.m. on January 14. This meeting is required by the State, for the election of officers, but we also use this meeting to celebrate the past year and briefly look ahead to the coming year (sort of the BPAA equivalent of making New Years' resolutions!)

We are always looking for people who want to become involved with the Club, in all subject areas. Currently, we have special needs in such wide ranging areas as Facilities, Archives/Library, Education, Publicity, Docents and Telescope Operations. Please contact any Board Member (our contact information is on the last page of this Newsletter) if you are interested.

Paul Below

ARTICLES AND REPORTS

BPAA Lecture Series 2004

Keeping It Together
A Solar System Tour with a Dynamic Emphasis
Paul Middents, Lecturer

Lectures:

1. Solar System Overview – January 22
2. Gravity and Orbits I – February 5
3. Gravity and Orbits II – February 12
4. The Terrestrials – February 19
5. Earth and Moon (What's So Special About Us?) – February 26
6. The Gas Giants (What is Cassini Telling Us?) – March 11
7. Asteroids and the Gravitational Mixmaster – March 18
8. Comets and the Gravitational Mixmaster (How Did Pluto Ever Get Out There?) April 15
9. Henri Poincare and the Chaotic Solar System – April 22
10. Other Planetary Systems – April 29

References:

Newton's Clock, Chaos in the Solar System, Ivars Peterson, W.H. Freeman 1993

Rare Earth, Don Brownlee and Peter Ward, Springer 2000

Once again, Paul Middents will be offering a series of lectures for our members, teachers, and the interested public. Paul strives to offer something new for us each year with content suited to all levels of expertise.

Is our solar system unique? How do the mathematics of Einstein, Poincare, and recent ideas of chaos theory attempt to explain the solar system we observe? What will the Mars explorers of the new year reveal about another terrestrial planet? Recent, high resolution observations have found gravitational perturbations about other stars leading to the conclusion that star – planetary systems are fairly plentiful in our Milky Way neighborhood. Come and learn about recent discoveries in planetary science.

Teachers can earn up to 20 clock-hour credits through Central Kitsap School District and ESD 114.

Tuition for the complete lecture series is $100, or $12 per each single lecture. The BPAA is a non-profit educational organization. Funds received for this course in excess of the professor's honorarium will support BPAA activities, including the John Rudolph Planetarium project.

The place is Bainbridge High School, Rm. 311. Please contact: Michael Walker at michaelw@cksd.wednet.edu or (360)638-1576 for advance registration or further information.

ASTRONOMY RESOURCES at KRL
by Mike Walker, Education Director

Our Kitsap Regional Library continues to keep its popular astronomy, cosmology, and physics collection up-to-date. I'm sure the quality of the collection lies in the requests made by local amateur astronomers. If you know of a favorite astronomy book which the library doesn't hold, ask a librarian if they would add it to the collection.

A few years ago I received a brochure from **The Teaching Company** advertising their courses taught by renowned professors. The astronomy course taught by Alex Filippenko caught my eye, and the library ordered it. Professor Filippenko was part of a U.C. Berkeley team which discovered the current acceleration in the expansion of the universe.

This isn't highly polished filmmaking, but straightforward thoughtful teaching from a lecture hall. Though you'd be hard-pressed to view the whole 30-hour course in the lending time the library allows, you could customize your study over a period of time. The course outline below was taken from the library catalogue:

UNLOCKING THE SECRETS OF THE HEAVENS: Lectures 1-3 on tape 1: 1. A grand tour of the cosmos. 2. Journey through space and time. 3. Light--the supreme informant. Lectures 4-6 on tape 2: 4. The fingerprints of atoms. 5. Tools of the trade. 6. Space telescopes and the celestial sphere. Lectures 7-8 on tape 3: 7. Our Sun--the nearest star. 8. Lunar phases and glorious eclipses - pt. 2.

THE SOLAR SYSTEM: Lectures 9-11 on tape 1: 9. The early history of astronomy. 10. The Copernican revolution. 11. On the shoulders of giants. Lectures 12-14 on tape 2: 12. One small step--the Earth and Moon. 13. Paradise lost--Venus and Mars. 14. Planetary behemoths--Jupiter and Saturn.Lectures 15-16 on tape 3: 15. Distant worlds and solar system debris.16. Comets and catastrophic collisions pt. 3.

THE STARS AND THEIR LIVES: Lectures 17-19 on tape 1: 17. Distant suns. 18. Social stars--binaries and clusters. 19. Nature's nuclear reactors. Lectures 20-22 on tape 2: 20. The fate of our Sun. 21. Exploding stars--celestial fireworks! 22. The corpses of massive stars. Lectures 23-24 on tape 3: 23. Hearts of darkness. 24. The quest for Black Holes -- pt. 4.

A UNIVERSE OF GALAXIES: Lectures 25-27 on tape 1: 25. Starting at home--the Milky Way. 26. One giant leap--other galaxies. 27. The dark side of matter. Lectures 28-30 on tape 2: 28. The birth and life of galaxies. 29. Quasars--cosmic powerhouses. 30. In the belly of the beast. Lectures 31-32 on tape 2: 31. Are we alone? :The search begins. 32. Communicating with extraterrestrials -- pt. 5.

THE BIRTH AND LIFE OF THE UNIVERSE: Lectures 33-35 on tape 1: 33. The expansion of the universe. 34. The age of the universe. 35. The geometry and fate of the universe. Lectures 36-38 on tape 2: 36. Einstein's biggest blunder. 37. Echoes of the Big Bang. 38. In the beginning. Lectures 39-40 on tape 2: 39. The ultimate free lunch. 40. A universe of universes.

SEEING STARS Astronomy 0.001
Anna Edmonds

"For we have seen his star in the east…"

Have you ever tried to puzzle out what this part of the Christmas story means? If so, you're one of many over the centuries, children and bearded scholars, kings and shepherds. So let me join the crowd.

The first of many points that I think need to be acknowledged are some confusions in this simple statement:

1. Who were the "we?" Were they astrologers, or astronomers, or both?
2. Was this an actual, unusual astronomical event, or was this a figure of speech, the introduction to an allegory? What kind of a "star" were they following?
3. Does this event identify a specific date?
4. Where was "the east" in relation to the speakers?

1. The men speaking (it's unlikely that a wise woman would have talked to King Herod about stars) were called "wise men from the east." In another translation they are "magi" or priests from Chaldea—the fertile basin stretching north and south between the Tigris and the Euphrates Rivers. These priests were considered wise because they studied the earth and the sky so that they could interpret the relationships between humans and the divine and thus save people from harm. Considering the tools that they had two thousand years ago, and the care they exercised, I'm willing to accept that magi were first-class scientists.

2. Historians have taken it for granted that only an unusual event would have started magi on their journey which was presumably a long one. So, it wouldn't have been the yearly rising of a bright star like Sirius or Vega. Less usual events might have been the appearance of a nova, or a comet, or a big meteorite, or an asteroid. Astronomers have considered each of these, among them Johannes Kepler in the 17th century who was pretty sure that it had been a nova. However, nothing has been found in either contemporary records or in leftover evidence to support any of these. No dust clouds from a nova, no huge holes in the earth from an asteroid collision, no comet that might have visited the Sun in the possible years. And a meteorite lasts too short a time to excite wise men.

This seems to leave the most likely unusual—although natural—event to have been the appearance of a bright planet. We know from this summer that a planet such as Mars can attract a lot of attention.

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Two thousand years ago planets were called wandering stars; they were associated with specific qualities: The "Day Star" probably was Venus; the reddish color of Mars linked it to wars; and Saturn was related to the ideas of a desert or the underworld. Above all of these, Jupiter was kingly.

3. That brings up the question of the date of the birth of Jesus, a date not pinpointed yet. The bible says in several places that he was born during the reign of King Herod the Great. But historians aren't certain when Herod died. The best calculation so far puts his death about 4 BCE. The other problem is that the first Christians weren't concerned with Roman dates. It wasn't until the 6th century that Dionysius Exiguus tried to figure back, not realizing among other things that he needed to account for Year 0 between 1 BCE and 1 CE.

It happens that there was an unusual natural astronomical event in the year 6 BCE that should have attracted astrologer/astronomers' attention. The kingly planet Jupiter entered the constellation of Aries the Ram as the morning star. Aries for the magi was the zodiacal sign of the Jews; therefore this could have said to them that a new king was being born to the Jews. Could this have been Jesus? The event became even more significant to the magi because Jupiter was in conjunction with the Moon—its power was multiplied by that association. On April 17 in 6 BCE Jupiter not only rose in the east, it was occulted by the Moon, an event serious enough to stir wise men to action. If that wasn't enough, because of its retrograde motion, Jupiter stayed in Aries most of the year—and "stood still" twice!!!—long enough for men to make their preparations and travel to Jerusalem. (A recent PBS program about this was based on the book, *The Star of Bethlehem: The Legacy of the Wise Men*, by Professor Michael R. Molnar of the University of Indiana,)

4. One of my puzzles about the literal interpretation of Matthew is deciding where "the east" was for the wise men, and where it was for the star. If I were to start out to follow a star that I saw at its rising with the Sun in the east, I would travel east, at least at first. But if the homeland of the wise men was Chaldea, people going east would have ended up in India or Cathay. No wonder they had to ask for directions when they got to Jerusalem. (Maybe the magi traveled only at night, by which time Jupiter would have pulled them around westward.)

My other questions, which are more serious, are of how much importance to the essential meaning of the account, or allegory, are the identities of the star and of the actual date. Are the questions appropriate for scientists to consider? Astronomers certainly are expected to give serious answers around Christmas every year.

Perhaps in the long run it helps to remember that St. Matthew wasn't trying to be an astrologer/astronomer; he was writing about an event that he considered miraculous. Maybe that's enough.

BELLA LUNA

by Ted S. Frost, U of W, class of '54 & '04

Having time to pursue one's real interests instead of schlepping around making a living is one of the benefits of retirement. In my case, that's biology. For the past three years I've been attending biology orientated college courses. My previous college attendance was in the early 1950's, so it's been a culture shock. Not only in terms of the students of today (exposed belly buttons, pierced body parts, appearing young enough to be in grade school and, irrespective of that, their extreme brightness), but more importantly the enormous, incredible, inconceivable increase in knowledge that has accumulated since I was in school. The exponential expansion of facts, data, hypotheses, technological devices, and information boggles my Rip Van Winkle brain. It is, indeed, a great time to be alive if one is turned on by such things.

The University of Washington's football team may have fallen on hard times, but its Earth & Space Sciences Department has assembled an outstanding faculty. People of international reputation such as professors David Catling, Roger Buick, Peter Ward, etc. This past year, I've had the privilege of attended two upper division classes and a graduate class presided over by these gentlemen, to whit: Astrobiology 437, Geobiology 313, and Astrobiology 502.

Ever hear tell of those subjects? I hadn't, because they're of recent origin and still emerging. *Geobiology* is the study of the effect life has had on Earth and, conversely, the effect Earth has had on the development and evolution of life. *Astrobiology* is the study of the origin, distribution, and destiny of life in the universe. Since pursuit of these disciplines is associated with the Earth, the Moon, and the stars, I thought all you astronomy buffs might be interested in a few of the tidbits I've learned this year.

Every knowledgeable person now knows that Earth is a very special place with very special attributes. It has to be, since intelligent life as we know it requires special environmental attributes in order to exist. Those who've read Peter Ward and Donald Brownlee's book *Rare Earth* or have perused the *Drake Equation* know what I'm talking about. What I didn't realize, though, is just how special, special is. How extraordinary the circumstances were that made this the place it is.

Take the Moon, for example. Like the girl next door, we frequently see the Moon but take it for granted. But we shouldn't. The Moon should be appreciated not only for its romantic appearance, but more

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importantly because it is a big factor why Earth is such an agreeable place for life to exist and evolve. We should be particularly appreciative because it turns out its creation was an anomaly with several strange attributes.

First off, we are the only terrestrial planet in our solar system to have one. Well, that's not exactly true. Mars has two itty-bitty moons, Phobos and Deimos, but they are peewees - about 20 kilometers in diameter compared to our 3,476 diameter Moon - and are thought to be irregularly shaped asteroids that happen to have been captured by Mars rather than "real" moons. Other than Earth, the outer Jovian planets are the only ones with moons. In addition, ours is a single moon whereas the other moon systems are multiple. Another oddity is the Moon's humungous size relative to us – a little over one quarter Earth's diameter. Other moons in our solar system are tiny relative to the planets they orbit around. And our Moon is less dense than Earth *(3.34 g/cm^3 vs. 5.52 g/cm^3)*, whereas other moons are denser than their associated planets. Finally, we know from being there that the Moon's geochemical composition is the same as Earth. We are cut from the same cloth, as it were. Moons of other planets are compositionally different animals. *(Note: With regard all the foregoing, let the record show I'm considering Pluto and Charon to be Kuiper Belt objects rather than a planet and a moon.)*

How did all this come about? Why is it even there? Current thinking abetted by computer simulations has it that our Moon is the result of a highly unusual and stupendous collision involving Earth and a Mars-sized planet occurring some four billion years ago. It was an oblique collision rather than a glancing or retrograde type of blow that resulted in Earth and Planet "X" exchanging body fluids. They merged, in other words, with tossed-out lighter debris from the collision coalescing into our Moon. So, rather than Earth and the Moon being mere cold accretions of solar nebular matter, they are largely the result of a violent celestial train wreck.

That is all very interesting, but why was this chance event critically important to our being here? Consider the following laundry list of consequences:

First, we wound up with a bigger proportion of heavy materials than ordinary accretion of solar matter would have given us. Earth is the densest of all the planets. Second, kinetic energy *(½ x m x v^2)* from the collision caused a big melt down of the merged material. This allowed the materials to differentiate into density layers rather than stay in a homogeneous or semi-homogeneous condition. Heavy metals like iron and nickel sank to the core, basalts to the mantle, and lighter granite stuff to the crust. Third, residual kinetic energy plus radioactive decay has kept part of the Earth's core in a liquid state as well as maintain a temperature gradient in the mantle. Fourth, the collision knocked the Earth cockeyed. We have about a 23° obliquity *(that's "tilt" to us laypersons)*. Fifth, Moon and Earth are locked in a gravitational embrace so Earth doesn't wobble. It pretty much maintains its slant. Sixth, the gravitational attraction between the two causes the tides to ebb and flow. And seventh, it is important what the collision did not do. Luckily, it did not knock us out of our mildly elliptical Goldilocks orbital distance from the Sun. We stayed far enough away from the Sun to avoid water evaporation and run-away greenhouse like Venus, yet close enough to avoid Mars-like freezing.

So, here we are today. Sitting fat, dumb and happy as multicellular eukaryotes of Subphylum Vertebrata miraculously possessing the cognitive powers to analyze and contemplate it all. What benefits do we enjoy from the fortuitous birth of the Moon?

Well, for starters, the stupendous kinetic energy *(probably about 6x10^{31} Joules, or 10^{16} times a one megaton nuclear bomb)* of such a collision would have resulted in Earth possessing considerable residual heat. Enough to liquefy its mantle and facilitate fractionalization of its materials and possibly even partially offset the faint early Sun paradox. Concentrated differentiation of Earth's materials plus the high temperature gradient of its mantle and core set the stage for plate tectonics. The concentrated differentiation of Earth's materials plus the high temperature gradient of its mantle and core together with liquid water are essential for plate tectonics, something Mars and Venus don't have. With plate tectonics we have upwelling of magma in ocean ridges and the so-called "black smokers" which are thought to be the environmental womb for creation of life where energy, chemicals, and protection necessary for creation of life came together. With plate tectonics, we have the subduction of heavier ocean crust under lighter continental crust. We have substantial volcanism. We have weathering and erosion of crust materials into the oceans and the carbon-silicate cycle. The interplay of all these things leads to stirring the Earth's geobiochemical pot which aids weather stabilization and temperature control and the recycling of elements essential to life.

The liquid portion of Earth's core gives us a strong magnetic field which protects us wimpy land animals from the deleterious effects of radiation from space. The gravitational embrace of Earth and Moon locks the Earth into a stable position. If it weren't for this, Earth's tilt would vary in a topsy-turvy manner causing chaotic climatic flip flops, making it hard for complicated life forms to adjust. Yet, Earth's permanent 23° ± tilt allows rotisserie-like distribution of the Sun's warmth throughout Earth and, at the same time, seasonal weather changes which stimulate evolutionary diversity by moderately varying environmental situations. As does the Moon-caused ocean tides which create

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a mixing of essential nutrients as well as a favorable air-water ocean beach habitat. A very recent hypothesis theorizes that the impact creating the Moon left Earth with an enrichment of heavy metals in the form of workable ore deposits. Hence, the raw materials of our technological civilization and a way to escape the Stone Age.

It all adds up to the Moon's existence giving us a stable and benign platform for the creation and continued existence of life, yet, not so stable and benign as to not give evolution something to work against. So, the next time you look up at Old-Man-In-The-Moon, how about giving him a tip of your hat, or curtsy, as the case may be, and say: "Thank you, Mr. Moon, for being there."

But all good things must come to an end, so enjoy the Moon while it lasts. Friction from the tidal bulge the Earth-Moon system creates is causing Earth's rotation to slow down. Due to the Law of Conservation of Angular Momentum, Earth's slower rotation is causing the Moon's orbital radius to increase. As a result, Mr. Moon is receding from us at the rate of 3 cm per year. But not to worry. By the time its recession has a serious effect on us, we'll be biomarkers in the fossil record and whatever succeeds us will have plenty of other things to worry about.

LIGO TOUR by Malcolm Saunders

A group of BPAA members and friends drove to Hanford to tour the LIGO (Laser Interferometer Gravitational wave Observatory) site the weekend of Nov. 8 http://www.ligo.caltech.edu/. After touring the LIGO site we drove on to Goldendale, planning to watch the lunar eclipse from the observatory/state park there. We caught a ferry about 8 in the morning and arrived at the Hanford LIGO site about 1 p.m. I have never been to Hanford before. I was surprised to see how open it is. There is not so much as a gate controlling access. But then, there is nothing secret about gravity wave research. We expected a brief talk and tour lasting about 1½ or 2 hours. What we were given was about 4 hours of lecture and tour by the head of the laboratory. He did a very good job.

View of the "corner building", the intersection of the two 4 km arms of the interferometer and the location of the controls.

Dr Raab speaking to the tour group. We are standing on a bridge that crosses over the detector. You can see one arm of the detector (a 10 ft diameter concrete tube) receding into the distance.

The LIGO project is a joint research project by CalTech and MIT. There are two large research facilities, one in Louisiana and one at Hanford. At the heart of each site is a large Michelson interferometer. These are contained in "L" shaped buildings 4 kilometers on a side. The interferometers are really detectors, not observatories. They are designed to detect gravity waves but they can't tell us anything about where the gravity wave comes from and they can't create any sort of image such as we excpect from an observatory telesecope. However, if a gravity wave is detected at each of two detectors, the difference in the time of arrival at the two sites can be used to determine something about the direction the wave is moving. With more than two detectors more information becomes available. As it happens, there are other detectors: one in Italy, one in Germany and one in Japan. There may be a detector constructed in Australia in the future.

At LIGO, a Michelson interferometer (http://en.wikipedia.org/wiki/Interferometer) is used to look for oscillations in space-time as predicted by general relativity. A laser beam is split using a half silvered mirror into two beams which are sent at right angles to each other down the length of the two arms of the building. At the end of their 4 km journeys they are reflected off mirrors and sent back to the origin where they are recombined. If one of those two

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arms has changed size relative to the other arm, the two halves of the laser light beam will no longer be in phase. Out of phase light beams will dim or extinguish each other. This is detectable with a photocell.

The Hanford LIGO instrument is up and running but it has not reached its full design potential yet. The operators have spent months, with more months to come, identifying and eliminating or compensating for noise sources. This is necessary because the instrument is looking for extremely small vibrations, 10^{-18} meters. There are many sources of interfering noise. These include trucks passing on the highway 10 miles away, highway and general industrial noise in the tri-cities about 25 miles away, passing airplanes, tidal distortions of the shape of the Earth (about 6 inches but only twice per day). Apparently the single biggest noise source is ocean waves, even though Hanford is about a 4-hour drive from the nearest salt water. As the operators identify and eliminate successively smaller noise sources the instrument becomes capable of detecting fainter and fainter gravity waves. Ideally, the mirrors at the ends of the long arms stay perfectly still in space, so that any vibration detected is caused by the movement of space-time itself.

Part of the control room. The large displays on the wall are real time monitors of instrument status and data collected. The center image is power vs frequency vibration data. This is the main data output of the instrument. The rest is devoted to monitoring and controlling the instrument. We were told that most of the people in the room were working on identifying interfering noise sources. There are about 1000 data feeds from the instrument to the control room.

Our tour of LIGO didn't end until 5:30. By that time the moon was already more than half eclipsed and was above the horizon. We set out to drive to Goldendale, stopping for a quick supper on the way. It was a beautiful drive over nearly deserted roads with occasional views of the eclipsing moon over our shoulders but it takes about 2 ½ hours to drive from Hanford to Goldendale. We arrived at 8:30 and the observatory closes at 9 pm. We would have enjoyed spending a bit more time touring the Goldendale observatory but, as it worked out, being late didn't cause us to miss any observing. Clouds had been coming and going all evening and they hadn't managed to see anything through the telescope.

LIGO public tours are given on the second Saturday of every month. No reservations are needed and the tours are free. I would recommend this outing for anyone who likes science. Just don't plan on leaving Hanford and driving to Goldendale in time to do astronomy.

OWED TO BILL

Bill is leaving the post of Editor and Publisher of the *BPAA Newsletter* as of this issue, and the first of Jan. 2004. This is a sorrowful time for all of us, and in particular, for Helen Gardiner and myself. We got him into this morass, close to ten years ago, and have witnessed, in awe and admiration, the development of a critical and vital part of the whole BPAA program.

Critical and vital? When things got started, we had tens of members, a few hundred dollars, a derelict building, and million dollar ideas. It rapidly turned out that the one thing we did have, in primitive but evolving form, was an excellent newspaper. I heard from many that the one reason they stayed with the BPAA was its newsletter--newsy, interesting, timely, humorous and accurate. It held the organization together.

Of course it was easy; one just followed seven steps.
1. *Setting the input deadline date, and getting the inputs* The problem is, everyone wants to receive the paper on the first day of alternate months. However, no one has the time to generate the material near the end of any month, around holidays etc. Finally, there were a lot of things going on, with new stuff coming in at or beyond the deadline.
2. *Determining the number of pages (multiples of four), limit 16* Some of our best writers are the most tardy. John Rudolph, always articulate, was always late. Will he get it in, in time, this time? Will it be 12 or 16 pages?
3. *Processing the input.* Most of the inputs had to be retyped and edited. Then, when promised materials don't arrive, something has to be generated--right now. Bill and Anna were the line backers on that play, every time, with short order perfect prose.
4. *Pagination, creating, proofing the paper.* Typography and publishing software were primitive, of the cut and paste vintage, and no one's input-software matched.
5. *Printing.* Our printer was a copier, on the second floor of an unheated building. It was designed for a few copies at a time use, and got balky at long

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printing runs. Every run included the tense anticipation of catastrophe, with painful work-arounds.

6 *Collation and/or stuffing*. This turned out to be fun, a chance to socialize as well, but still one more step in the process.

7. *Mailing.* Our run was around 250, with a mailing of 200. Bulk mailing had to be categorized, with three different mailage rates. The lowest was 11.5 cents and the highest 17 cents. As an alternate, first class was 33 cents. With our budget, it was mandatory that we go bulk, but post office protocols were tricky and changed each year. Depending on whom we dealt with at the post office, the delay from submission to delivery could vary from one day to six!

Now that Bill has introduced email submission of text and pictures, modern pagination hardware and software along with web site distribution of newsletters with color pictures, he has apparently decided that it has all become so easy that he might just as well quit. Or was it the fact that the mailing of one issue is immediately followed by the initiation of the next issue?

He has produced a newsletter that is on the short list of top amateur astronomy newsletters in the country. We are proud of him, and so, at long last, sing the deserved praises of one who has done a top job that is usually unsung.

Thanks, Bill, from all of us in BPAA.

Mac Gardiner

Bill & Anna

THE OTHER SHOE DROPS

Somehow, one simply must accept the fact that this, in many respects, has been a crummy year. However, this is too much, I swear. Anna Edmonds is resigning in January from the Board and the position of Publicity Director! Life is now unfair to those of us who are used to and counted on the wonderful services of those such as Anna, and who now will have to suffer without her.

In certain respects, it would be convenient to address both Bill and Anna in the same epistle, as they have worked so closely and effectively together on so many of the projects and activities of the BPAA. But that would neglect the fact that they are different, and that each has made independent contributions that should be acknowledged.

Anna came to us with impeccable academic credentials, having been awarded a "First" in Astronomy 101 by Paul Middents, who considers her the best student he ever had in his class at Olympic College. She says that if there had been a course like his at her undergraduate college, she probably would have gone into professional astronomy and from there into an entirely different career.

For ten years, she has attended and served at most of the functions the BPAA has been involved in. She has ridden in trucks on July 4th parades, sold BPAA artifacts and memberships on cold and windy "Astronomy Days," and attended innumerable board meetings in which the environment was frigid and the rhetoric exhausting.

Anna has ensured that adequate publicity was obtained, from reader board items on the T&C luminare to notices in all the newspapers and journals, and phone calls to potential contributors.

Finally, her frequent, excellent contributions to the *BPAA Newsletter* are her "monuments." In them, we learn of history, legend and beauty in the evolving story of our universe.

Thank you, thank you, Anna. All of us at BPAA appreciate what you have done, and hate to see you go.

Mac Gardiner.

For Sale

Orion SkyQuest XT6 Dobsonian Telescope. $250. This is a great beginner scope. The XT6 was our first scope and I bagged all 110 of the Messier Objects with it. It is easy to set up and use. The tube is enameled steel; the base is wood, sturdy but light-weight. It has a 150mm-diameter parabolic primary mirror. Included in the price is the focuser, finder scope, Plossl eyepieces and eyepiece rack that came with the original purchase, plus a Telrad and waterproof cover that we purchased separately. The scope is in near-perfect condition, like new. We wouldn't part with it but we're already into our third scope. Lack of storage space on our part translates into a bargain purchase for you. A new XT6 from Orion would cost $329 plus $46.95 in shipping costs, $40 for the Telrad, and $42 for the cover. If you're interested, send me an email, or give me a call at (206)842-6617.

Harry Colvin

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IN THIS ISSUE

We welcome **Vicky Saunders** (ph. 206-780-1905) as the new *Newsletter* editor beginning with the March-April issue. Please send hard copy submissions to her at 1416 Elizabeth Place, Bainbridge Island, WA 98110, and email at saunders@drizzle.com.

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