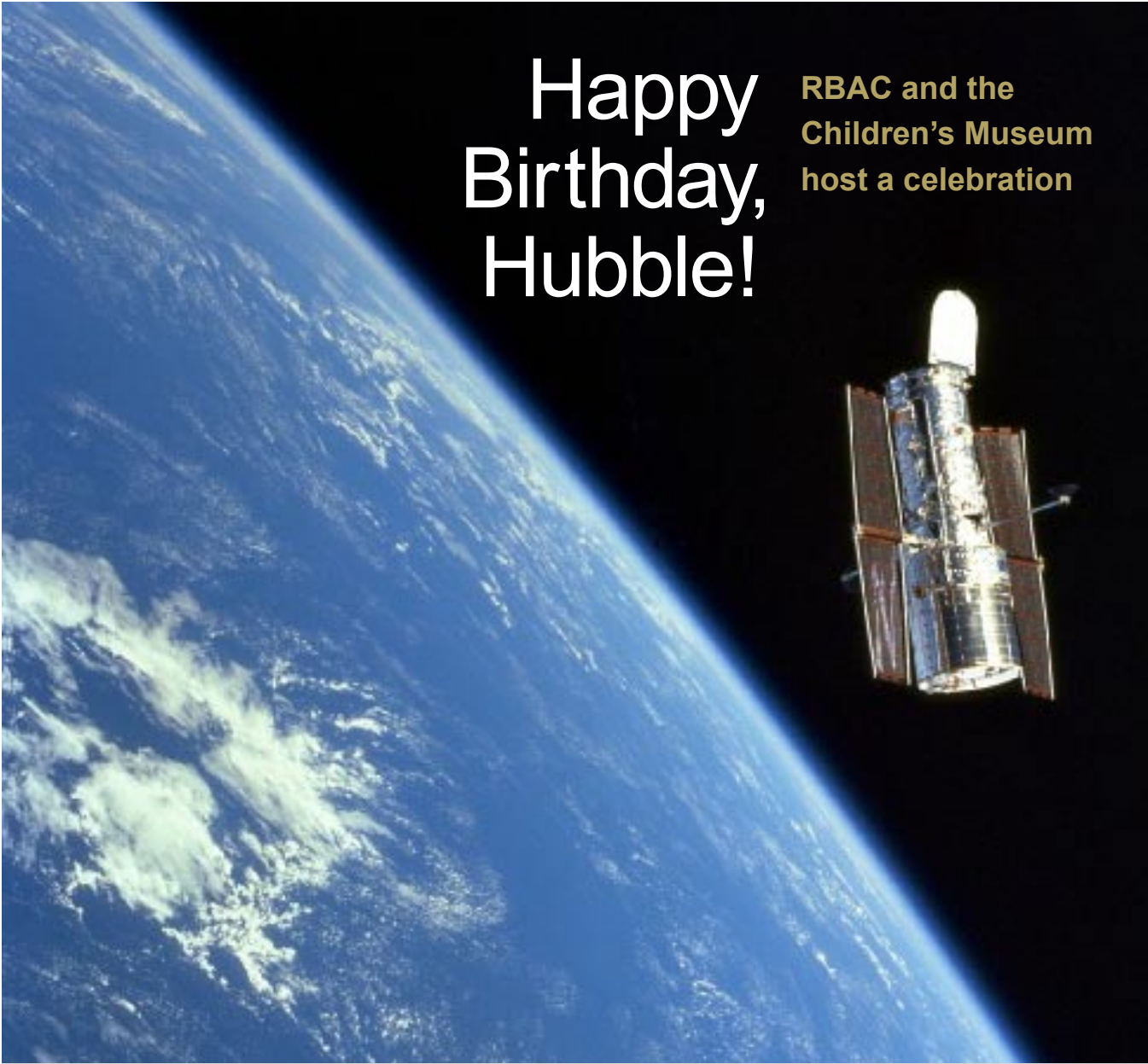




Current
Astronomy

JUNE
2005

RIVER BEND ASTRONOMY CLUB NEWSLETTER



Happy
Birthday,
Hubble!

RBAC and the
Children's Museum
host a celebration



**High overhead the Hubble Space Telescope fathoms space and time.
The club and the Children's Museum helped the Space Telescope Science Institute unveil two
new images honoring the telescope's 15th anniversary of astronomical discovery. IMAGE: NASA**

RIVER BEND ASTRONOMY CLUB

River Bend Astronomy Club serves astronomy enthusiasts of the American Bottom region, the Mississippi River bluffs and beyond, fostering observation, education and a spirit of camaraderie.

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Affiliated with the Astronomical League, dedicated to fostering astronomical education, providing incentives for astronomical observation and research, and assisting communication among amateur astronomical societies.
www.astroleague.org



Affiliated with the NASA Night Sky Network, a nationwide coalition of amateur astronomy clubs bringing the science, technology and inspiration of NASA's missions to the general public.
nightsky.jpl.nasa.gov

Current Astronomy CLUB NEWSLETTER

EDITOR Eric Young
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Monthly Meeting

Saturday, June 4th, 2005 • 7:00 p.m.

Kronk Observatory

132 Jessica Drive, St. Jacob, IL 62281

Looked up lately?

Join River Bend Astronomy Club

Want to learn more about astronomy? The members of River Bend Astronomy Club invite you to join. You won't need expensive tools or special skills — just a passion for observing the natural world.

- Meetings offer learning, peeks through great telescopes and fun under the stars.
- You will receive the club newsletter, *Current Astronomy*, packed with news and photos.
- Get connected with our member-only web site and discussion group.
- Borrow from the club's multimedia library.
- And that's not all! Through club membership you also join the Astronomical League, with its special programs and a colorful quarterly newsletter to enrich your hobby.

We meet monthly, observe regularly, e-mail news and quips constantly, and generally have a good time. Won't you join us?

Name(s) _____

Address _____

City _____ State _____ Zip _____

Phone (Day) _____ (Evening) _____

Email address (to receive club news and information): _____

Where did you hear of our club? _____

How long have you been interested in astronomy? _____

Do you have optical equipment? Telescope Binoculars

Are you afraid of the dark? Yes No (just kidding)

I am submitting my application for:

_____ Adult membership(s) _____ Youth membership(s)
@ \$20.00/year @ \$15.00/year
(18 years or older) (under 18)

I enclose a check for a total of \$ _____
made out to "Mike Veith, Treasurer, RBAC."

Signature _____

Date _____



River Bend Astronomy Club

c/o Gary Kronk, 132 Jessica Drive, St. Jacob, IL 62281

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SEPTEMBER 04

The universe unveiled

Ceremony highlights new images and astronomy's mission

BY ERIC YOUNG • PHOTOS BY JACE PERHAM

Of all the telescopes pointed toward the heavens in the last fifteen years, none had the worldwide impact of the Hubble Space Telescope, launched in 1990. Its seminal imagery reshaped our understanding of the universe.

On April 25th, River Bend Astronomy Club and the Children's Museum participated in a national celebration of the Hubble's 15th year in orbit. The party was bittersweet as NASA debates launching a servicing mission by astronauts, necessary to prevent the fiery extinction of the aging telescope.

Two spectacular new images were released on April 25th by the Space Telescope Science Institute: spiral galaxy M51 (known as the Whirlpool Galaxy) and the Eagle Nebula. (See the following pages.)

Thanks to the foresight and dedication of Mark Brown, educational outreach coordinator for RBAC, and Christy Tinney, executive director of the Children's Museum, the metro-east area got its own up-close look at the new images. No other St. Louis area organization staged a formal unveiling, and RBAC was the only astronomy club associated with the event.

Students and dignitaries gather before the unveiling of new images from the Hubble Space Telescope.



“The Children’s Museum is honored to have been selected as an unveiling site for these amazing Hubble images,” said Tinney. “We are thrilled to be able to bring this opportunity to the Metro area as part of the Museum’s educational outreach.”

“We greatly appreciate Mark Brown’s efforts to coordinate the event, those that participated in the unveiling and the astronomy club for their dedication to the Hubble and strong desire to share the Universe with others,” added Tinney.

Brown felt a sense of mission in staging the event. “RBAC members are passionate about the Hubble Space Telescope and enjoy the many discoveries it has offered amateur and professional astronomers over the years. We were concerned about the prospect of axing the Hubble and sending it to a fiery death. We wrote letters to congress people and state representatives asking them to save this telescope.”

About 130 people attended the event in Edwardsville. The bulk of the crowd came from the Lincoln Middle School, whose students and faculty walked up the street to the Museum. Also on hand were the mayor of Edwardsville, Gary Niebur, who gave a speech. Doug Bugger represented the office of 19th-District congressman John Shimkus. Museum personnel and board members also attended. Club members present included Mark Brown, Tom Foster, Jace Perham, Mike Veith, Deb Wagner and Eric Young.

Local papers ran stories and photos. KSDK-TV did live interviews for its morning show, *Today in St. Louis*,

and taped a segment for its afternoon program, *Show Me St. Louis*.


A highlight of the morning was a talk by Tom Foster, assistant professor of physics, who displayed his sense of humor and professional excitement as he interpreted the images for the mostly young audience gathered on the ballfield outside the Museum.

Gesturing toward the dark cloths draped over the images, Foster said that “If you’re sitting there saying ‘I can’t wait for Star Wars III to come out,’ just wait — the Hubble is better!”

“Through its amazing discoveries,” said Foster, “the Hubble is teaching us we don’t know anything.”

Brown and Tinney removed the black cloths to a round of applause and the crowd gathered for a closer look. RBAC members remarked about the extraordinary clarity and detail revealed in the images.

Later, Foster considered how the middle schoolers had grown up with regular, ground-breaking images from the telescope as a matter of course. “One of the facts that struck me,” said Foster, “was that the children we were showing the pictures to were younger than the Hubble. These kids do not know a world without the Hubble Space Telescope. We grew up without color TVs, but they’re here today. Sadly, someday soon these kids may know a world without the Hubble.”

Visitors to the museum can study the pictures in their large-scale glory. “Feel free to stop in on a day we’re open to see the images,” said Tinney. “They will be on display indefinitely.” 



Lisa Leehy, outreach educator for the Childrens Museum, discusses the image of the Whirlpool Galaxy with Tom Foster, assistant professor of physics at Southern Illinois University Edwardsville. “We’ve never actually taken a photo of our galaxy, of course,” said Foster, “but this is what we think ours looks like.”

Happy Birthday, Hubble

Celebrating 15 years of spectacular images

BY DONNA WEAVER, SPACE TELESCOPE SCIENCE INSTITUTE

When NASA's Hubble Space Telescope was launched in 1990, astronomers anticipated great discoveries, ranging from finding black holes to looking back billions of years toward the beginning of time. Now, 15 years later, the versatile telescope continues to deliver exciting new science, including helping to prove the existence of dark energy, tracing enigmatic gamma-ray bursts to distant galaxies, and sampling the atmospheres of far-flung planets. To celebrate Hubble's 15th anniversary, new breathtaking images will be released of a majestic spiral galaxy teeming with newborn stars and an eerie-looking spire of gas and dust.

The new image of the well-known spiral galaxy M51 (known as the Whirlpool Galaxy), showcases a spiral galaxy's classic features, from its curving arms, where newborn stars reside, to its yellowish central core, a home for older stars. A feature of considerable added interest is the companion galaxy located at the end of one of the spiral arms. The new photograph of the Eagle Nebula shows a tall, dense tower of gas that is being sculpted by ultraviolet light from a group of massive, hot stars.

The pictures are among the largest and sharpest views taken by Hubble. The images, taken by Hubble's Advanced Camera for Surveys, are 20 times larger than a photograph taken by a typical digital camera. The new images are so sharp that they could be enlarged to billboard size and still retain the stunning details.

Mural-sized images of both celestial objects were unveiled at 100 museums, planetariums, and science centers across the country, from Guam to Maine. The 4-foot-by-6-foot image of M51 and the 3-foot-by-6-foot photograph of the Eagle Nebula will be on display at

all the sites. A list of these sites is available on http://hubblesite.org/about_us/unveiling.shtml.

If you cannot see the pictures at a museum or planetarium, catch them on the new "Gallery" at <http://hubblesite.org/gallery>. Views of M51 and the Eagle Nebula, along with more than 1,000 other glorious Hubble images, can be savored from the comfort of



RBAC cake honoring Hubble's sweet achievements.

your home. If you want some Hubble pictures to hang in your home, then go to "Astronomy Print Shop." Choose from a list of Hubble images that are specially formatted for printing. Select the image, the size you want (from 4 inches by 6 inches to 16 inches by 20 inches), and download it. Then take it to your favorite print shop to make a framable copy.

Looking for information about Hubble and its discoveries that is written for children? Then go to the Amazing Space education website at <http://amazing-space.stsci.edu>. Children can read a story tailored just for them on Hubble's 15th anniversary, entitled "Hubble's Picture Book of the Universe." The story is under "The Star Witness," a section of the website offering Hubble news for children.

Hubble was placed into Earth-orbit on April 25, 1990. For the first time, a large telescope that sees in visible light began orbiting above Earth's distorting atmosphere, which blurs starlight and makes images appear fuzzy. Astronomers anticipated great discoveries from Hubble. The telescope has delivered as promised and continues serving up new discoveries. During its 15 years of viewing the universe, the telescope has taken more than 700,000 snapshots of celestial objects such as galaxies, dying stars, and giant gas clouds, the birthplace of stars. Astronomers are looking forward to more great discoveries by Hubble.

Island universe

Stellar image reveals individual stars in the Whirlpool

FROM THE SPACE TELESCOPE SCIENCE INSTITUTE

The graceful, winding arms of the majestic spiral galaxy M51 (NGC 5194) appear like a grand spiral staircase sweeping through space. They are actually long lanes of stars and gas laced with dust.

This sharpest-ever image of the Whirlpool Galaxy, taken in January 2005 with the Advanced Camera for Surveys aboard NASA's Hubble Space Telescope, illustrates a spiral galaxy's grand design, from its curving spiral arms, where young stars reside, to its yellowish central core, a home of older stars. The galaxy is nicknamed the Whirlpool because of its swirling structure.

The Whirlpool's most striking feature is its two curving arms, a hallmark of so-called grand-design spiral galaxies. Many spiral galaxies possess numerous, loosely shaped arms which make their spiral structure less pronounced. These arms serve an important purpose in spiral galaxies. They are star-formation factories, compressing hydrogen gas and creating clusters of new stars. In the Whirlpool, the assembly line begins with the dark clouds of gas on the inner edge, then moves to bright pink star-forming regions, and ends with the brilliant blue star clusters along the outer edge.

Some astronomers believe that the Whirlpool's arms are so prominent because of the effects of a close encounter with NGC 5195, the small, yellowish galaxy at the outermost tip of one of the Whirlpool's arms. At first glance, the compact galaxy appears to be tugging on the arm. Hubble's clear view, however, shows that NGC 5195 is passing behind the Whirlpool. The small galaxy has been gliding past the Whirlpool for hundreds of millions of years.

As NGC 5195 drifts by, its gravitational muscle pumps up waves within the Whirlpool's pancake-shaped disk. The waves are like ripples in a pond generated when a rock is thrown in the water. When the waves pass through orbiting gas clouds within the disk, they squeeze the gaseous material along each arm's inner edge. The dark dusty material looks like



The Whirlpool Galaxy, M51 (NGC 5194)

gathering storm clouds. These dense clouds collapse, creating a wake of star birth, as seen in the bright pink star-forming regions. The largest stars eventually sweep away the dusty cocoons with a torrent of radiation, hurricane-like stellar winds, and shock waves from supernova blasts. Bright blue star clusters emerge from the mayhem, illuminating the Whirlpool's arms like city streetlights.

The Whirlpool is one of astronomy's galactic darlings. Located 31 million light-years away in the constellation Canes Venatici (the Hunting Dogs), the Whirlpool's beautiful face-on view and closeness to Earth allow astronomers to study a classic spiral galaxy's structure and star-forming processes. [AS](#)

Eagle rising

Amazing clarity, breathtaking grandeur

FROM THE SPACE TELESCOPE SCIENCE INSTITUTE

Appearing like a winged fairy-tale creature poised on a pedestal, this object is actually a billowing tower of cold gas and dust rising from a stellar nursery called the Eagle Nebula. The soaring tower is 9.5 light-years or about 57 trillion miles high, about twice the distance from our Sun to the next nearest star.

Stars in the Eagle Nebula are born in clouds of cold hydrogen gas that reside in chaotic neighborhoods, where energy from young stars sculpts fantasy-like landscapes in the gas. The tower may be a giant incubator for those newborn stars. A torrent of ultraviolet light from a band of massive, hot, young stars [off the top of the image] is eroding the pillar.

The starlight also is responsible for illuminating the tower's rough surface. Ghostly streamers of gas can be seen boiling off this surface, creating the haze around the structure and highlighting its three-dimensional shape. The column is silhouetted against the background glow of more distant gas.

The edge of the dark hydrogen cloud at the top of the tower is resisting erosion, in a manner similar to that of brush among a field of prairie grass that is being swept up by fire. The fire quickly burns the grass but slows down when it encounters the dense brush. In this celestial case, thick clouds of hydrogen gas and dust have survived longer than their surroundings in the face of a blast of ultraviolet light from the hot, young stars.

Inside the gaseous tower, stars may be forming. Some of those stars may have been created by dense gas collapsing under gravity. Other stars may be forming due to pressure from gas that has been heated by the neighboring hot stars.

The first wave of stars may have started forming before the massive star cluster began venting its scorching light. The star birth may have begun when denser regions of cold gas within the tower started collapsing under their own weight to make stars.

The bumps and fingers of material in the center of the tower are examples of these stellar birthing areas. These regions may look small but they are roughly the size of our solar system. The fledgling stars continued to grow as they fed off the surrounding gas cloud. They

abruptly stopped growing when light from the star cluster uncovered their gaseous cradles, separating them from their gas supply.

Ironically, the young cluster's intense starlight may be inducing star formation in some regions of the tower. Examples can be seen in the large, glowing clumps and finger-shaped protrusions at the top of the structure. The stars may be heating the gas at the top of the tower and creating a shock front, as seen by the bright rim of material tracing the edge of the nebula at top, left. As the heated gas expands, it acts like a battering ram, pushing against the darker cold gas. The intense pressure compresses the gas, making it

easier for stars to form. This scenario may continue as the shock front moves slowly down the tower.

The dominant colors in the image were produced by gas energized by the star cluster's powerful ultraviolet light. The blue color at the top is from glowing oxygen. The red color in the lower region is from glowing hydrogen. The Eagle Nebula image was taken in November 2004 with the Advanced Camera for Surveys aboard NASA's Hubble Space Telescope. [↗](#)



The Eagle Nebula

BY PATRICK BARRY AND TONY PHILLIPS

Seeing in the dark with Spitzer

Have you ever gotten up in the middle of the night, walked to the bathroom and, in the darkness, tripped over your dog? A tip from the world of high-tech espionage: next time use night-vision goggles.

Night vision goggles detect heat in the form of infrared radiation — a “color” normally invisible to the human eye. Wearing a pair you can see sleeping dogs, or anything that’s warm, in complete darkness.

This same trick works in the darkness of space. Much of the exciting action in the cosmos is too dark for ordinary telescopes to see. For example, stars are born in the heart of dark interstellar clouds. While the stars themselves are bright, their birth-clouds are dense, practically impenetrable. The workings of star birth are thus hidden.

That’s why NASA launched the Spitzer Space Telescope into orbit in 2003. Like a giant set of infrared goggles, Spitzer allows scientists to peer into the darkness of space and see, for example, stars and planets being born. Dogs or dog stars: infrared radiation reveals both.

There is one problem, though, for astronomers. “Infrared telescopes on the ground can’t see very well,” explains Michelle Thaller, an astronomer at the California Institute of Technology. “Earth’s atmosphere blocks most infrared light from above. It was important to put Spitzer into space where it can get a clear view of the cosmos.”

The clear view provided by Spitzer recently allowed scientists to make a remarkable discovery: They found planets coalescing out of a disk of gas and dust that was circling — not a star — but a “failed star” not much bigger than a planet! Planets orbiting a giant planet?

The celestial body at the center of this planetary system, called OTS 44, is only about 15 times the mass of Jupiter. Technically, it’s considered a “brown dwarf,” a kind of star that doesn’t have enough mass to trigger nuclear fusion and shine. Scientists had seen planetary systems forming around brown dwarfs



Artist’s rendering of brown dwarf OTS44 with its rotating planetary disk.

before, but never around one so small and planet-like.

Spitzer promises to continue making extraordinary discoveries like this one. Think of it as being like a Hubble Space Telescope for looking at invisible, infrared light. Like Hubble, Spitzer offers a view of the cosmos that’s leaps and bounds beyond anything that came before. Spitzer was designed to operate for at least two and a half years, but probably will last for five years or more. [↗](#)

For more about Spitzer and to see the latest images, go to <http://www.spitzer.caltech.edu/spitzer>. Kids and grown-ups will enjoy browsing common sights in infrared and visible light at the interactive infrared photo album on The Space Place, http://spaceplace.nasa.gov/en/kids/sirtf1/sirtf_action.shtml. This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

The River's Edge

BY ERIC YOUNG

Look! Up in the sky! It's the Man of Steel!

MAY 7, 2005 Nothing like a backyard full of scopes pointed every which way under a (somewhat) clear sky. Nights like these were made for observing, and talking, and snacking, and relaxing...

GET BACK He's getting back into astronomy, says Frank Steward III of Bethalto. He brought the whole family in hope of clear skies. Back in January, Frank bought the Orion Atlas 10 EQ Reflector, a.k.a. the Bone Crusher. (That Atlas mount is really heavy and rock-solid.) Since then, Frank's been waiting for clear skies. Haven't we all? Frank shot objects such as M13 and the Ring Nebula on 400-speed film using the scope and got good results. See his comment below.

ALL ABUZZ Rita Breeden is thrilled to have observed the "Little Beehive," open cluster M67 in Cancer. "Like diamonds on black velvet," says Rita.

OHIO This is how Mark Brown describes his housekeeping system. OHIO is an acronym for Only Handle It Once: If you get it out to play with, put it away. If Mark (Dad) handles it, it goes in the trash...

FAMILY FUN ON MAY 7th

We had the time of our lives Saturday night. The children absolutely loved it and were disappointed to find out that it is only once a month. I was worried that they would not enjoy the meeting but instead found that they cannot wait for the next. They learned so much in one night and still keep talking about it. That is awesome. Thank you for having us even though we did not contact you ahead of time. We enjoyed ourselves and all of you that were at the meeting.

Thank You,

Frank, Dawn, Hailey, Ian, Darian and Frankie

MR. OUTREACH Most people would call a big, busy Astronomy Day (April 16th) good enough. Only Mark Brown, Man of Steel, would stage a major public event barely two weeks later — the Hubble image unveiling on April 25th. Through it all, Mark was well-organized, even-tempered, and downright inspirational to us and the many folks who attended or heard about the events. Mark saw the potential of the Hubble unveiling to turn people's attention to the wondrous accomplishments we've come to expect from the Space Telescope Science Institute. Thanks, Mark. We're proud of your ongoing efforts to bring astronomy to the people.

INTO THE WOODS The fourth, fifth and sixth grade gifted program at Highland Elementary School attended an astronomy night at Shaw Arboretum. Speakers included Byron Barker and his daughter, Taylor, and Jeff Menz and his son, Simon. Comet ice cream cones helped sweeten a drizzly evening — the rain came down and down and down.

ELECTIONS Deb Wagner and Lois Butler are relinquishing their duties as Vice-President and Librarian, respectively. They've both done great jobs and have logged many hours attending club events and doing volunteer work for our group. Plus, they set a great example through their dedication to observation programs through the Astronomical League. So, those positions are open for nominations/volunteers. Wanna run for office? Write our club president for more information: kronk@amsmeteors.org

DON'T FORGET BUG SPRAY Tim Bucher is hoping to pull some all-nighters this summer, scoping out the Milky Way while he donates life-saving blood to the local mosquito colony. When not dreaming of observing, Tim spends his time watching *Through the Eyes of Hubble*, a collection of Hubble's greatest hits, that is to say astronomical images, through the years.



The transit of Io, Jupiter's inner-most moon, on May 10, 2005, about 9:40 p.m. Mark Brown captured this image through an 8-inch SCT and a Philips ToUcam. Several small ovals or storms are also visible in Jupiter's atmosphere. The planet was about 432,500,000 miles away during this event.


MR. EXCITEMENT A new 20mm Expanse eyepiece has Bill Breeden all excited. Then again, with Bill's usual full-throttle joy for astronomy, new-found enthusiasm can be hard to tell. According to Orion's web site (www.telescope.com), "With their 66° apparent field of view, our Expanse wide-field eyepieces will definitely turn up the Wow! factor in your deep-sky observing experiences!" Yes, that must be Bill's secret.

JAMIE'S BACK Soon, anyway. "Finished class last night, turned in my keys to the observatory," says Jamie Goggin, who's hanging up his hat as instructor of astronomy at Greenville College. "I hope I can now start spending more time enjoying astronomy as a hobby again. They are going to try to get me a new key to the observatory so we'll still have access."

BETTER DEAL All members present agreed to transfer the club's web site to the server at godaddy.com. Only about \$3 a month buys us 500 megabytes of disc space which will allow us to put all the newsletters back online, plus more photos and whatever other goodies we dream up.

STAR SCOUTS "Last night (May 14th) I and some other members of the club had the pleasure of participating in an astronomy program for a group of Cub Scouts at Camp Vandeventer near Waterloo," wrote Dennis Rippelmeyer. "I more or less limited the targets to the brighter recognizable ones (Moon & planets). The excitement these youngsters displayed at the eyepiece was more than obvious. What really suprised me was a similar reaction from some of the parents."

MAGNETIC STORM Deb Wagner attended the scout night. Once the scouts left camp, so did Deb, because she'd heard about a big Coronal Mass Ejection headed our way. The following day she posted this report: "Any of you who stayed in your cozy beds early this morning missed a fantastic auroral display. I went outside at 03:00 and discovered a glowing, green sky. The curtains and pillars appeared at 03:15. At times during the event, the pillars in the northwest extended up through the Coma-Virgo region and Boötes. From the North, the pillars extended up over my head into Hercules where they met up with the pillars from the NE that stretched all the way into Cygnus and Delphinus. At times the display was so bright that it completely obscured the stars behind it. Things started to settle down around 04:30 and I returned to my own cozy bed. This display was not nearly as colorful as the one last November, but it exceeded the November aurora in intensity."

INVESTMENT OPPORTUNITY A 40-inch refractor in a 90-foot diameter dome...historic, turn-of-the-century charm...lakeshore property...who could resist? Believe it or don't, Yerkes Observatory may be for sale. The University of Chicago was reportedly offered about \$10 million for the site. Though moth-balled as a prime research facility, due to the murky air over its location, the observatory still symbolizes the promise of 20th century astronomy. Its past directors include a who's who of space science: Struve, Kuiper, Chandrasekhar... As reported in Science Daily online, "Local residents want to preserve the waterfront site they consider to be the soul of the bay." (For more on this sad story, search skyandtelescope.com for "Yerkes on the block.") 

June 2005



May 2005

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	1	2	3	4

July 2005

S	M	T	W	T	F	S
26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

■ Holidays
 ■ Moon Phases
 ■ RBAC
 ■ Space Mission
 ■ Observing
 ■ Trivia

Sun	Mon	Tue	Wed	Thu	Fri	Sat
29	30 ● Memorial Day ● Last quarter 6:47 a.m.	31	1	2	3 ● Gemini 4 (1965) First U.S. space walk	4 ● RBAC meeting 8 p.m.
5	6 ● New Moon 4:55 p.m.	7	8 ● Giovanni Cassini b. 1625	9	10	11
12	13	14 ● Flag Day ● First quarter 8:22 p.m.	15	16 ● Lyrids peak	17	18
19 ● Father's Day	20	21 ● Full Moon 11:14 p.m. ● Summer Solstice	22 ● Greenwich Obs. founded 1675	23	24	25 ● Hartley-IRAS perihelion
26 ● Mercury/Saturn/Venus cluster	27	28 ● Last quarter 1:23 p.m.	29	30	1	2