



Current Astronomy

FALL
2006

RIVER BEND ASTRONOMY CLUB NEWSLETTER



What's fast, bright, loud and dangerous? Ed Cunnius knows, because he attended the launch of the space shuttle in July. His patience outlasted the delays and rewarded him with a memorable experience — and this stunning photograph.

BY ED CUNNIUS

Galaxy safari: M31 from the wilds of West Texas



Photographed with a Canon 10D through an AP 105mm f/6 refractor and a Tele Vue 0.8x Photo Reducer/Field Flattener and hand guided on a Losmandy GM-8. ISO was set to 200. Composite of a 10-minute and a 3-minute exposure — each with a corresponding dark frame subtracted before they were masked together.

The Andromeda Galaxy has long been a favorite of mine. In the high desert of West Texas, where this photograph was made, Andromeda is a valuable landmark. Out there, skies are so transparent that the familiar constellations are difficult to distinguish from the thousands of visible background stars. Bright diffuse objects like the Beehive and Andromeda are so distinct that they help sort out what is where. You glance about and find Andromeda first — then pick out the stars of her namesake constellation, not the more familiar other way round.

It was a natural target for my first attempt at a deep sky object. Big and bright, I was almost guaranteed to get something. It was also my first try at hand guiding: the practice of using the slew controls on a tracking mount to keep a guide star at high magnification within a little reticle box on a special eyepiece.

I finally got all the exposures I needed — proofing them on the back of the camera in the dark. Only one

was totally ruined when a pack of coyotes ran across me, and gave a startled, raspy bark from about 20 feet away. They had been upwind, and as I had been virtually motionless while guiding, they hadn't detected me until they nearly ran over me. I jumped, and knocked just about everything out of alignment. A white flashlight confirmed what they were, and wrecked my night vision for another half-hour. Since they were just a pack of coyotes, I was too relieved to be angry. Mountain lion populations are coming back in West Texas and they occasionally attack humans. I wanted this shot — just not bad enough to wrestle a big cat for it. In this case the skittish canines were a good sign: it was highly unlikely they'd be anywhere near a puma.

After calming down, I got my shot of Andromeda, plus a good yarn about fighting off a pack of wild animals from the eyepiece. It's not a Robert Gendler, but it made for a great souvenir of a marvelous West Texas night. [↗](#)

The rocket's red glare

Discovery claims her independence on the Fourth of July

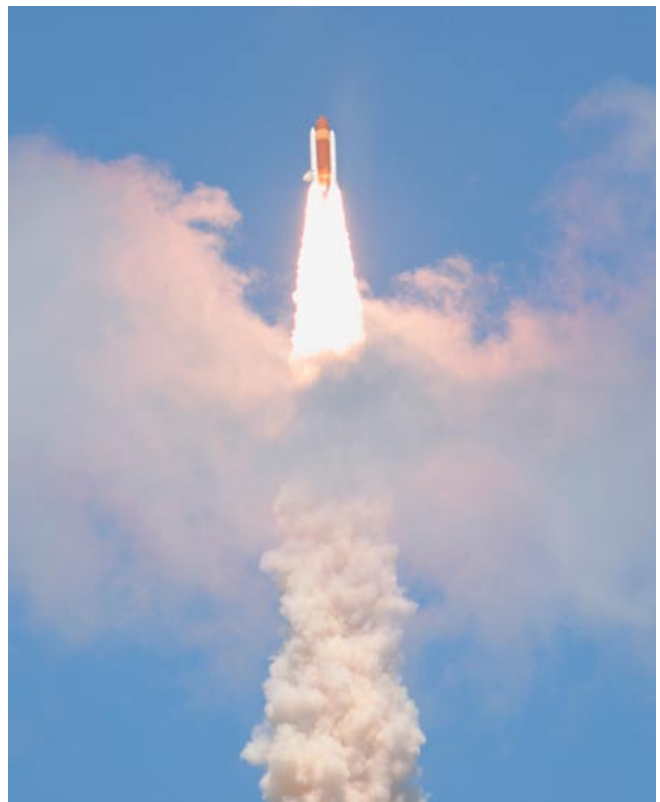
BY ED CUNNIUS

If this club had an Astro Squirrel award, I'd win it hands down this year. I managed to luck my way into a seat only three miles from pad 39B for the first ever launch of the space shuttle on the Fourth of July. Yup, my weather curse lifted for one shining day, and I actually got to see the thing. And I have the pictures and stupid grin to prove it.

Back in June, I got an email from John Schnase, who works at Goddard Space Flight Center, asking if I'd like to try and see the newly re-scheduled Discovery launch on July 1st. As his guest, I could take advantage of one of the seats reserved for NASA employees. He had just gotten the announcement in his mailbox, and we had to decide fast — the roster would fill up in probably less than two hours. We decided to go for it — thinking that we'd probably not see much with all the delays and other problems with the shuttle program. We rationalized that just seeing a shuttle prepped and on the pad would be worth the trip, plus we scheduled in a tour of Kennedy Space Center just so things wouldn't be a total wash.

So what do we do?

Do we call the airline and beg for our seats back, or sweat it out? We finally decided that the worst possible outcome would be if we spent all this time and money only to watch it on CNN in the Orlando Airport.



About 30 seconds into the launch, Discovery rockets through a small cloud after completing her roll.

It was a cliffhanger. It turned out that the Saturday and Sunday launches were scrubbed due to weather, and we were left sitting in our hotel room on Monday getting ready to fly home the next day, July 4th. That morning, the weather outlook for the rest of the week didn't look particularly good: central Florida's typical summer pattern of afternoon thundershowers was expected to hold for weeks — with only a slightly better chance for clear skies on the 4th. After talking it through, we decided to stay one more day. That Monday was a crew rest period, with launch attempts to resume on Tuesday. Even with the weather iffy, we chose to risk it. No sooner had we finished moving the reservations when we heard the announcement that



In less than 2 minutes after launch the 15-story tall Discovery is just a point of brilliant light at the end of a massive exhaust cloud.

they had found foam on the ground, and cracked foam on the fuel tank. Ugh. This was not good. This could not only delay the launch for weeks — it could kill the entire program. So what do we do? Do we call the airline and beg for our seats back, or sweat it out? We finally decided that the worst possible outcome would be if we spent all this time and money only to watch it on CNN in the Orlando Airport. We stayed. Thank goodness. Oh, the wailing and gnashing of teeth had we moved everything back and been in the airport when they finally took off.

Our Goddard group filled four buses on the first day. We'd meet in a mall parking lot miles from the Kennedy Space Center, load onto buses, and then trundle on to a viewing site on the NASA Causeway, about six miles south of pad 39B. By the third launch attempt our group had dwindled to only one bus. The same kind of attrition had happened to all the other NASA Centers in town for the launch. Which turned out to be a good thing...a very good thing. While riding

in to the launch, the guide announced that we were being upgraded to seats at the Banana Creek viewing site (which is also the home of the new Apollo/Saturn V Center). The entire bus let out a very loud cheer.

Banana Creek is only three miles from the pad, and normally reserved for guests of the astronauts, and what NASA refers to as “distinguished guests” (this is where Cheney and entourage had been). This group had gone through the same attrition we had — which meant there was now room for us. And it meant that Kennedy Space Center could sell our old spots out on the Causeway to the general public for a chance to see the history-making Independence Day launch.

Long story short: we squirreled into top row seats in the bleachers with a good breeze — and after days of bad weather and cracked foam, we were at last going to see it go up.

Oh. My. Gosh.

Things that impressed me about seeing a launch in person vs. watching it on TV:

It is fast. It does not locomotive about — slowly building steam, then rising majestically upward. It goes off like a bottle rocket and disappears into space. Oddly there is no sense of flight, or of a craft borne on air — no soaring or anything like that — just raw power. It is sustained cannon fire straight up. You can see the condensation flash when it breaks the sound barrier. It hauls.

It is bright. The long flame streaming out behind the shuttle is like looking into the sun. And that holds along its entire length, not just the area immediately around the engine cowls. Film overloads almost instantly, and digital sensors scream white and quit — neither technology has the dynamic range necessary to reproduce just how intensely bright the thing is. So pictures don't cut it, you have to see it...to see it.


It is loud. Imagine the grand finale of the fireworks over the river in St. Louis when you're in close on the Arch grounds and that's pretty much how loud it is. Only this is constant — a ground-shaking rumble overlain with an odd staccato crackling that you feel in your ribs. I've never heard anything exactly like it. I've heard IMAX reproductions of the launch and even that level of fidelity cannot reproduce how it really sounds. IMAX approaches the volume, but not the quality.

It is dangerous. Once Discovery disappeared from view, an announcement was made to get on the buses...*now*. We were downwind, and a toxic

exhaust cloud the size of a thunderhead was blowing our way. We all made it, but it drove home that there were risks involved this close to a launch, even when things go well. When things don't go well — when they have what Mission Control euphemistically calls “a bad day”—things could go wrong for people on the ground in a hurry. Spaceflight is still incredibly risky, even for spectators.

And finally, it dawned on me as I watched Discovery disappear that I had never watched a thing leave the ground and go directly into space. It's laughably simple, and what I came to see after all, but it didn't really sink in until I actually saw it happen. Again, not the same as watching a video of the launch — there's always a snag of doubt in the back of my mind that it could be a fake...a bit of video magic...but there it was. Or there it went. Incredible. I will remember it all my life.

If you ever get a chance, go to a launch. Tickets to the NASA Causeway Site are available to the general public through the Kennedy Space Center website. Even though the Causeway is six miles away (a little less for pad 39A), it's still a great view. Once a launch is officially scheduled, you should buy your tickets as quickly as possible because they sellout fast. Plan to spend a week to allow for weather or other delays. Be mentally prepared to sweat out a scrubbed launch or two. It is worth all the trouble and anxiety and money. Worst-case scenario, you get to see a shuttle on the pad, then spend a day or two at Disney World. Like those shoe-people say, just do it.

I hope everyone in the club has a chance to see a launch. The shuttle program isn't going to last much longer, and the new Ares I crew lift vehicles aren't going to be as large as the shuttle they replace (in fact, the current design only uses one solid rocket booster for the first stage). The Ares V heavy lift vehicle will be bigger, and certainly fun to watch, but it will be mostly for non-human cargo. There's something special about a launch knowing there are people on board. So if you want to see a *big* rocket full of real astronauts tear off the pad, you better hurry. This show is not scheduled to run much longer, and is always one chunk of foam away from being permanently canceled. Please give it a shot: and may next year's Astro Squirrel be you. 

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BY TONY PHILLIPS

Deadly planets

About 900 light years from here, there's a rocky planet not much bigger than Earth. It goes around its star once every hundred days, a trifle fast, but not too different from a standard Earth-year. At least two and possibly three other planets circle the same star, forming a complete solar system.

Interested? Don't be. Going there would be the last thing you ever do.

The star is a pulsar, PSR 1257+12, the seething-hot core of a supernova that exploded millions of years ago. Its planets are bathed not in gentle, life-giving sunshine but instead a blistering torrent of X-rays and high-energy particles.

"It would be like trying to live next to Chernobyl," says Charles Beichman, a scientist at JPL and director of the Michelson Science Center at Caltech.


Our own sun emits small amounts of pulsar-like X-rays and high energy particles, but the amount of such radiation coming from a pulsar is "orders of magnitude more," he says. Even for a planet orbiting as far out as the Earth, this radiation could blow away the planet's atmosphere, and even vaporize sand right off the planet's surface.

Astronomer Alex Wolszczan discovered planets around PSR 1257+12 in the 1990s using Puerto Rico's

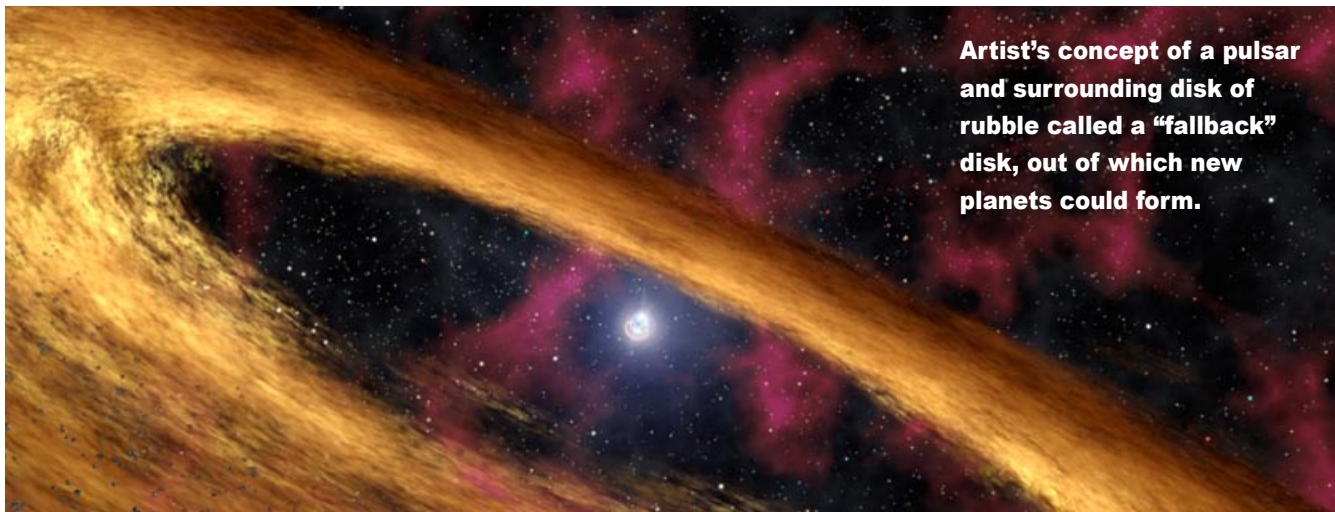
giant Arecibo radio telescope. At first, no one believed worlds could form around pulsars — it was too bizarre. Supernovas were supposed to destroy planets, not create them. Where did these worlds come from?

NASA's Spitzer Space Telescope may have found the solution. Last year, a group of astronomers led by Deepto Chakrabarty of MIT pointed the infrared telescope toward pulsar 4U 0142+61. Data revealed a disk of gas and dust surrounding the central star, probably wreckage from the supernova. It was just the sort of disk that could coalesce to form planets!

As deadly as pulsar planets are, they might also be hauntingly beautiful. The vaporized matter rising from the planets' surfaces could be ionized by the incoming radiation, creating colorful auroras across the sky. And though the pulsar would only appear as a tiny dot in the sky (the pulsar itself is only 20–40 km across), it would be enshrouded in a hazy glow of light emitted by radiation particles as they curve in the pulsar's strong magnetic field.

Wasted beauty? Maybe. Beichman points out the positive: "It's an awful place to try and form planets, but if you can do it there, you can do it anywhere." 

This article was provided by the Jet Propulsion Laboratory, California Institute of Technology, under a contract with NASA.



Artist's concept of a pulsar and surrounding disk of rubble called a "fallback" disk, out of which new planets could form.

The River's Edge

BY SOLAR PLEXUS

Nighttime fun is in the bag

COMING TRANSIT This from a NASA web site: "On Wednesday, 2006 Nov 08, Mercury will transit the Sun for the first time since 2003. The transit or passage of a planet across the face of the Sun is a relatively rare occurrence. As seen from Earth, only transits of Mercury and Venus are possible. There are approximately 13 transits of Mercury each century. In comparison, transits of Venus occur in pairs with more than a century separating each pair." Visit sunearth.gsfc.nasa.gov/eclipse/OH/transit06.html for more information.

SALUTE We congratulate Nathan Goff on becoming an Eagle Scout. We'd be pleased to think that we encouraged this scout's interest in astronomy.

FIVE AND COUNTING RBAC began on a whim by four people who talked astronomy over greasy french fries at Hardees. Five years later, we have a lot to look back on as new friends were made in a spirit of camaraderie. The club gathered on July 22nd to celebrate this milestone occasion with a barbecue at the home of club president, Gary Kronk. Among other treats, we enjoyed Bruce Kryfka's famous mostaccioli. And we didn't even have to dance with the bride.



Noah Perham stands by his Hardin Optical telescope — just the right size for a growing astronomer. When looking through the 6" telescope, Noah says he likes Jupiter, the Moon, and Saturn the best.



Rita Breeden displays her observing equipment — the VLH (Very Large Handbag.) This carryall is SO BIG, the Breedens can't drive it over certain rural bridges. It's SO BIG, the Breedens take a tax deduction for it. It's SO BIG, Rita has to buy an extra airline ticket to carry it on. It's SO BIG... well, you get the idea. It's big.

HITCHED Speaking of the bride, Tim Bucher got married. Maybe that's why we haven't seen him in awhile. He did show for the July meeting, without his wife. You did really get married, right, Tim? The good woman probably appreciates Tim's better qualities — other than staying outside all hours of the night.

PASS THE SYRUP Mike Veith has been seen wearing a "Day of Pancakes" hat. Whatever occasion that was, it was probably one of the highlights of Mike's life, right up there with "Sausage Link Week" and the "Month of Waffles."

FISH STORY Someone who knows how to spend time outdoors one way or another is Jace Perham. He went on a fishing trip to Alaska. Jace doesn't normally fish, but he caught a lot of them (salmon and halibut), had a company there process them for him, and they flew back on the plane with Jace — that's right, flying fish. Jace did no astronomy while on his vacation because "the sun never sets" there. Jace's wife, Lisa, and son, Noah, attended the August RBAC meeting.

Stargazing at Silver Lake

Club members recently took their scopes to the woods to share the night sky. The special event proved very popular.

The audience was comprised of families, couples, and scout troops that had registered for a night hike in the woods at a local park. The club was invited to provide telescope viewing opportunities to participants after the hike. Byron Barker brought his 10" Dob, Bruce Kryfka had his 11" Celestron CST, Simon Menz worked 88mm RA binocs, and Terry Menz ran a 10" Meade CST. Terry and Caroline Menz ran the Night Sky kits.

We learned that registration for this event in prior years was around 15 to 20, while this year's event, the first in which the astronomy club participated, had a total of 120 participants!

Members set up a NightSky demonstration table near the entrance to the trail prior to the event to greet hikers and give presentations in daylight. We were also available to provide demonstrations as hikers completed their walk and to direct them to where the telescopes were set up. We used the Black Hole kit, primarily, and it captured the most attention. We followed with a brief discussion of extrasolar planet detection (wobble), and explained the quarter/U.S. scale model to the audience. We explained the shape, size, and the number of stars in our galaxy and how the Milky Way appears in our night sky. We would have liked to have used the telescope kit; however, most children there were a little too young for this presentation.

The participants were very pleased to have the opportunity to look through the telescopes. They enjoyed the presentations and materials provided. Our club brochure was offered to the scout leaders along with our offer to provide additional presentations to their scout troops.

— Jeff and Terry Menz



Jeff Sjoquist and his daughter Kristin prepare for an evening of stargazing.

NCRAL The Breedens, Bill and Rita, represented RBAC at the North Central Region convention of the Astronomical League (NCRAL). They say they enjoyed the other attendees and the speakers, and brought with them an attractive display that highlighted our club's activities.

THAT'S DIFFERENT One of the companies doing business at the NCRAL convention was "Cosmic Dreams." They create 3-D ceiling murals with stars. Sleep under the stars in the comfort of your bed, they say. The mural is virtually invisible during the day or when the lights are on.

SHAKEUP Apparently, an explosive combination of Mentos and Diet Coke has provided hours of enjoyment for several club members.



Bill Breeden carefully aims his telescope at the backside of the Kronk house. Maybe he was watching the hummingbird who drinks from the feeder at their kitchen window and battles other hummers for the privilege.




Mike Veith keeps all his observing gear — eyepieces, digital controller, and a compass (in case he's abducted by aliens and needs to find his way home) — in this handy dandy toolbox.



ON THE ROAD AGAIN If the stars don't shine in your own backyard due to city lights, then go to the stars. At least, that's Lee Paul's idea. He bought a camper so that he can travel to a dark sky site about once a month. When not stargazing, Lee's got his fishing pole, and can amuse himself with a selection of games. He keeps plenty of astronomy books on hand for those cloudy nights. His next trip will be a whirlwind tour of Arizona to see sky sights there including Kitt Peak observatory.

DOWN UNDER Lee Paul is so cool that he subscribed to *Australian* — that's right, *Australian* — Sky & Telescope. This edition of the magazine covers astronomy from that point of view. Lee simply reads his copy upside down to get the full effect.

PRESSURE'S ON With some other responsibilities wrapped up, Jamie Goggin plans to put down a new floor in his kitchen just in time for the holidays. If he misses the deadline, then he might as well hitch a ride on Santa's sleigh and go live with the elves.

CHANGES The highlight of the September meeting was a tour of the new Kronk Observatory. We've joked about this for years, saying that club meetings were held in Kronk Observatory, even though this meant nothing more than the president's backyard. Now that backyard has a roll-off roof structure, home to his telescope and an insulated observing room, fulfilling Gary's life-long dream of having a home observatory. From all indications, the structure will make it very convenient to do observing — even in cold or windy weather. It's big enough to hold several people comfortably. Gary's waited a long time to have a place like this to call home. And after five years of RBAC, the club finally has a real observatory to call home. 



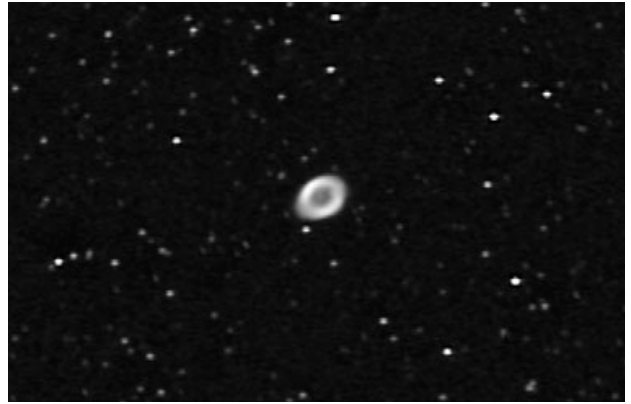
A photo of the old Kronk Observatory, taken at the July meeting. A roll-off roof observatory was built here in September.

The Skies Ahead

WRITTEN BY ED CUNNIUS • PHOTOS BY GARY KRONK

Evenings to enjoy

The endless summer daylight has faded, and we actually have an evening to enjoy at the end of the day. You can get in some observing after work and be in bed at a reasonable hour — especially if one of the season's fronts has just scrubbed the sky of its dust and haze. The nightly procession of the stars combines with the earlier-each-night sunset to create a sort of hold on the night sky this time of year. The summer constellations seem to linger before giving up the stage to winter. Best of all, a frost or two has usually wiped out all the mosquitoes, but it is still warm enough to comfortably observe. It's time for hot chocolate, a light jacket and some of the year's best observing. So put down all those equipment catalogs, and get out the sky charts: you don't have long before the winter wind lands you back beside the fire, wishing for a clear autumn sky.



The planetary nebula M57 is a favorite object of amateur astronomers. It was first discovered by Antoine Darquier de Pellepoix in 1779. Located 2300 light years from Earth, the “Ring Nebula” formed between 6000 and 8000 years ago when its faint central star blew off the outer layers of its atmosphere.

OCTOBER

- 4 World Space Week** begins and lasts through the 10th. The odd dates are to commemorate the launch of Sputnik on October 4, 1957, and the signing of the UN document: Treaty on Principles Governing the Activities of States in the Exploration and Peaceful Uses of Outer Space, including the Moon and Other Celestial Bodies. Hmm...sounds a little like a first run at the Prime Directive.
- 6 Full Moon** Named the Hunter's Moon (also Blood Moon) by colonial Americans.
- 9 Occultation of the Pleiades** The Moon glides through the Pleiades tonight.
Draconids Peak The maximum rate is around 1–2 per hour, but atypical bursts of hundreds or thousands per hour were observed several times during the last century.
- 10 160th Anniversary (1846) of the discovery of Neptune's moon Triton by William Lassell** A businessman and brewer by trade, he was one of Britain's "Grand Amateurs" who was often more productive and better regarded than the professionals of the day.

16 Look for **Mercury** just below Jupiter right after sunset.

21 **RBAC** general meeting at 7 p.m. Kronk Observatory.

Orionids Shower Peak. These meteors have a famous parent: they are bits of debris from Halley's Comet. This shower's maximum hourly rate is around 20 for the Northern Hemisphere.

29 **Daylight Saving Time ends.** Set clocks back one hour and grab some extra scope time. When DST was first implemented, many people actually thought they had to wake themselves up and set the clock back at precisely 2 a.m. For more on the weird history of DST, try *Seize the Daylight* by David Prerau.

31 **Halloween** The moon will be just past 1st quarter: perfect for giving trick-or-treaters a telescopic treat.

NOVEMBER

3 **Taurids Peak** A weak shower with a rich, and at times controversial history. For more info check out Gary's website.*

5 **Fred Whipple's 100th birthday** Whipple is most famous for his cometary research and the development of his celebrated "dirty snowball" theory in 1950. However, the Uber-Nerds among us will also know about "Whipple Shields," the light-weight, multilayered protection he proposed to protect spacecraft like the Stardust probe. He originally called them "meteor bumpers," and first described them back in 1946.

Full Moon Known as the Her Frost Moon by the Wisham Indians.

8 **Transit of Mercury** Greatest transit will occur at 21:41:04 UT (this is a geocentric time, so be sure to check with your planetarium software to correct for our latitude). The last transit of Mercury was in 2003, and there are approximately 13 transits per century.

17 **Leonids Peak** Maximum hourly rates are 10–15, but capable of producing bursts of thousands of meteors an hour. The Leonids put on a fantastic display in 1966 when the sky was saturated with continuous meteor fall — a storm I was lucky enough to see. I was only six, but it triggered a lifetime love of astronomy.

18 **RBAC** general meeting at 7 p.m. Kronk Observatory.

29 **45th Anniversary (1961), Mercury 5 Launch** Carrying Enos the Chimpanzee, Mercury 5 orbited the Earth twice in about 3.5 hours. Enos withstood a peak g-force of 6.8 and was recovered unharmed with the capsule — fairing much better than his Soviet canine counterparts.

DECEMBER

4 **Full Moon** The Moon of the Popping Trees according to the Lakota Sioux.

10th Anniversary of Mars Pathfinder launch (1996). Yup, it's really been 10 years.

13 **Geminids Peak** The Geminids are moderately fast and tend to be bright, with hourly rates close to 80.

14 **Tycho Brahe's 460th Birthday (1546)** Brilliant, bombastic and a serious party animal — Brahe was nonetheless capable of extraordinarily accurate observational measurements of the heavens. His account of the Nova of 1572 made him famous — and thanks to then-new printing technologies (as well as his attention-grabbing lifestyle), he was able to become the media's first scientific superstar.

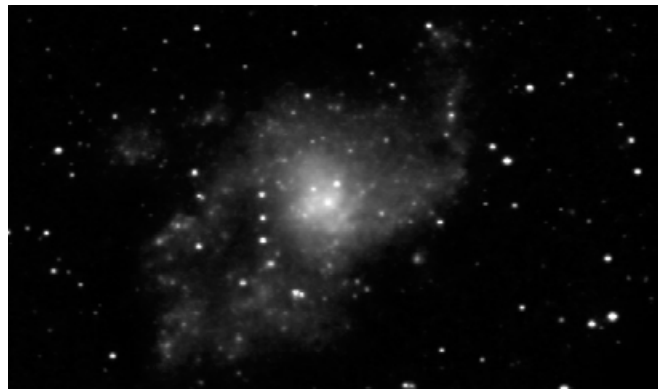
16 **RBAC** general meeting at 7 p.m. Kronk Observatory.

22 **Winter Solstice** Winter begins at 00:22 UT.

Ursids Peak Maximum rates are around 5 to 10, with the occasional outburst of 100 or more.

25 **Christmas Day**

27 **Johannes Kepler's 435th Birthday (1571)** Kepler was the first to understand that planets follow elliptical orbits around the sun, and based his work on the precise measurements of Tycho Brahe. Kepler knew both Brahe and Galileo, and along with these two men essentially founded modern astronomy.



The spiral galaxy M33 might have been discovered by Hodierna around 1654, but it became fairly well known after Charles Messier found it in 1764 while searching for comets. It is situated about 3 million light years from Earth, yet can be seen with the naked eye under dark, transparent skies.

All meteor shower information drawn from Gary Kronk's Comets and Meteor Showers website. Photos of Messier objects and caption information courtesy of Gary Kronk.



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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2006 Meetings

March 4	June 3	Sept. 23
March 25	June 24	Oct. 21
April 1	July 22	Nov. 18
May 6	Aug. 19	Dec. 16

132 Jessica Drive, St. Jacob, IL 62281 Phone 618/644-2308

Looked up lately?

Join River Bend Astronomy Club

Want to learn more about astronomy? 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 members-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

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AUGUST 05