

 **Current** **APRIL**  
**Astronomy** **2004**  
**RIVER BEND ASTRONOMY CLUB NEWSLETTER**

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**Artillery practice? No, it's Jace Perham, aiming his super-size telescope at the heavens as he prepares for an evening of deep-sky observing at the Messier Marathon, which was held at Greenville College Observatory. By the way, nice shoes, Jace. PHOTO BY ERIC YOUNG**

# The asteroid hunters

## Modern technology meets ageless passion for discovery

BY ERIC YOUNG

**T**he night Charles Juels and Paulo Holvorcem first tried their automated refracting telescope in late December of 2002 proved fortuitous.

“We knew this system could find the brighter comets,” Juels recalls. “We never expected to find one the first night this system was being tested.” Thus comet C/2002 Y1 was discovered. For the achievement the team received the 2003 Edgar Wilson Award, which also honored three other amateurs who found comets in 2002–03.

But other rogue wanderers of the solar system are the quarry sought by these dedicated amateur astronomers. Since 1999, Juels and Holvorcem have searched for asteroids and measured the positions of these transient objects using automated telescopes equipped with CCD cameras. A union of technology, skill and friendship, their ongoing quest has netted hundreds of discoveries.

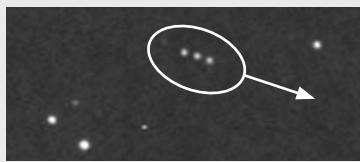
The partnership began when Holvorcem, a young Brazilian with a background in physics, numerical computing and meteorology, met Juels, a retired M.D. with a yen for backyard astronomy living in Fountain Hills, Arizona. “We became good friends,” recalls Holvorcem, “and started to work together on asteroid/comet searches, collaborating over the Internet.”

The ability to communicate instantly through the web allowed the team to put their heads — and equipment — together.

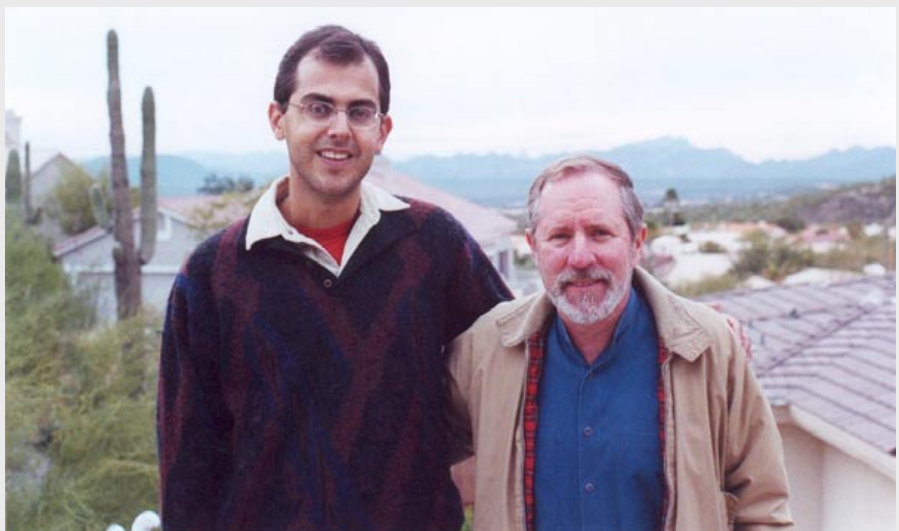
Holvorcem authored part of the telescope scheduling and data analysis software used at Fountain Hills. His handiwork with numerical computing helped catalyze their system and earned Juels’ admiration. “Paulo has become an expert in writing telescope automation and control scripts. Using some excellent commercially available software with his scripts, most of the work can be automated.”

In a paper for the Astronomy in Latin America conference in 2002, Juels and Holvorcem noted that “These scripts are uploaded to the telescope control computer and executed autonomously by the telescope. The resulting images are downloaded in near-real time and analyzed with the help of automated astrometry and asteroid detection programs.”

Holvorcem’s scheduler “automatically allocates the available time of an automated telescope to a set of targets which a group of users wish to observe,” the team reported, and thus “allows the planning of complex observing sessions . . . a short time before the start of a night’s observations.”



**Combining quality telescopes and computing wizardry, Paulo Holvorcem and Charles Juels have made thousands of astrometric measurements of asteroids and discovered hundreds of minor planets, including 48300 (above), later named for comet historian Gary Kronk.**




Under clear skies in Fountain Hills, Juels opens his roll-off roof observatories and soon two telescopes — a 0.5-m f/4.8 standard two-mirror Newtonian and a .12-m f/5 refractor — begin scanning the sky. Juels says of these automated eyes that “We probably operate about two-thirds of the nights that the weather is good and the moon is not bright. The telescopes, mounts and cameras have to be set and started before the run, which takes 15 or 20 minutes. It is possible to program unattended telescope runs lasting for several hours or more.”

Next, Juels compares the images to see if anything moved. Using a classic astronomical treasure hunt called “blinking,” he stares at a photo and rapidly flips it back and forth with another taken of the same patch of sky. A moving object, such as an asteroid, will appear as a shifting dot. “Sometimes I blink processed images after they are taken,” said Juels, “or do it the next day.” A commercial application called PinPoint, which uses Holvorcem’s moving object detection algorithms, aids in this process.

And there’s yet another option. Juels may choose to “send processed images to Holvorcem at high speed via the Internet. The image processing software also has automatic object detection capability, but we visually confirm objects before reporting them.”

“Our primary goal,” notes Juels, “is to find a large bright NEO (near-Earth object) moving several degrees per day, or a small one closer to Earth moving extremely rapidly. And the holy grail would be a big apohele (asteroid orbiting within Earth’s orbit).”

“We were very lucky to find a nice long-period comet with our names on it,” said Juels. “We also were lucky finding a 1-km Apollo asteroid in late October 2002 with a 0.5-m Newtonian.”

More than just lucky with asteroids, Juels and Holvorcem seem very fortunate to have found a long-distance friendship that’s standing the test of time — and space. 

*Astrometry of Near-Earth Asteroids Using Remotely-Operated Robotic Telescopes, presented at the Astrometry in Latin America conference in 2002, profiled the Fountain Hills program and other computerized observing systems.*

*Juels and Holvorcem discovered asteroid 48300 Kronk on June 11, 2002. For more on 48300 and its namesake, club president Gary Kronk, see Current Astronomy, March, 2004.*

## Asteroid hunting how-to

Like Juels and Holvorcem, Dennis di Cicco has good luck to match his considerable skill. When he aimed his telescope — equipped with an electronic imaging system — at the sky in October 1995, he discovered asteroids.

Following that initial thrill, the amateur astronomer and senior editor at *Sky & Telescope* magazine went on to nab dozens more.

His success underscores a new reality that’s quickening amateur astronomers’ blood as data streams through their Internet connections: Linking quality telescopes and inexpensive imaging chips to desktop computers, dedicated enthusiasts are making professional-level contributions to astronomy.

*Current Astronomy* asked di Cicco about amateur prospects for discovery today — or, tonight — from personal observatories?

“It was easier for backyard observers to find asteroids a few years ago,” said di Cicco. “Today, there are several massive professional surveys sweeping the sky and officially logging their data daily. The only survey when I began hunting was Spacewatch, but it sent its data monthly. Thus, I could actually get credit for finding something that Spacewatch spotted a few days earlier because I was the first to send two nights of observations.

“Even today, surveys aren’t going much deeper than my work, but clearly there are less objects to yet be discovered at those limits. When I was hunting, I figured the sky had pretty much been picked clean down to 16th magnitude. Today, a safer bet would be to up that to 18th magnitude.

“There’s still plenty of follow-up work for typical amateurs. But to be a real player in the discovery field you’d need to get somewhat fainter than suggested in my original article. Fortunately that’s possible with today’s CCDs that are as state-of-the-art now as my equipment was to the times back in the mid-1990s.”

*For more information, see Dennis di Cicco’s Hunting Asteroids from Your Backyard at [skyandtelescope.com](http://skyandtelescope.com)*

# On comet!

## Fourth annual Astronomy Day coming April 24th

BY ERIC YOUNG

**T**his April, take a ride around the sun on a comet when River Bend Astronomy Club hosts its fourth annual Astronomy Day (and night) celebration at two locations in the St. Louis metro-east area.

View exhibits and demonstrations at the Children's Museum on Saturday, April 24, from 10:00 a.m. to 3:30 p.m. Then, look through telescopes at the stars, moon and planets at Township Park in St. Jacob from 6:00 p.m. to 10:00 p.m.

Visit the museum at 722 Holyoake Road in Edwardsville, (618) 692-2094, for a chance to win free prizes and discover mysterious travelers in the solar system — the comets.

Among many far-out giveaways are two telescopes, several astronomy books and dozens of other educational items. Attendees can learn about comets and astronomy through interactive displays and activities.

How does a comet behave in space? Members of River Bend Astronomy Club will “cook” a comet to explain. Visitors can also view the sun through filtered telescopes, tell time with a mega-sun dial, walk a scale model of the solar system and color the planets.


**Astronomy Day coordinator Mark Brown, left, (shown at last year's event) will award over a thousand dollars in prizes and educational materials.**



A telescope display will show many ways to capture the cosmos. With the regular \$3 admission fee, children can explore other museum exhibits that stimulate curiosity and learning.

Later that evening, see astronomical wonders like the rings of Saturn and the moons of Jupiter at Township Park, 239 W. Main in St. Jacob. The club plans an evening of stargazing for educational family fun or a romantic evening under the stars.

A comet journeying through space may spawn a sword-like tail of dust and vapor millions of miles long — or not. “They’re really unpredictable,” says Gary Kronk, a comet researcher who will give kid-friendly talks. “You never know what they’re going to do, and that’s what makes them interesting.”

According to Kronk, comets bombarded ancient earth and later made a big impact on human civilization. “Historical figures were associated with and even influenced by comets. Over time, people were either afraid of comets or thought they heralded good things to come.” 

*For more information on Astronomy Day, see pages 5 and 6 of this issue, or visit [riverbendastro.org](http://riverbendastro.org)*



**The grand prize, a 6" Dobsonian telescope donated by Hardin Optical Company, has some club members wishing they could be a kid all over again. Last year the beginner telescope went to Sam Watts, who showed his pleasure with an ear-to-ear-grin.**

# Astronomy Day

BY MARK BROWN

## Bringing astronomy to the people

### SPONSORS

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[hardin-optical.com](http://hardin-optical.com)

**Kalmbach Publishing: Astronomy magazine**  
[kalmbach.com](http://kalmbach.com)

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**Meade Instruments Corporation**  
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**NASA's The Space Place**  
[spaceplace.jpl.nasa.gov](http://spaceplace.jpl.nasa.gov)

**Orion Telescopes & Binoculars**  
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**Pass Systems Group (George Roethemeyer)**  
[www.passecurity.com](http://www.passecurity.com)

**Jace Perham**

**Scope City**  
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**Sky Publishing: Sky & Telescope magazine**  
[skyandtelescope.com](http://skyandtelescope.com)

**The Planetary Society**  
[planetary.org](http://planetary.org)


**W**hat a year in astronomy! So far, we have witnessed two successful space probe landings on planet Mars, and watched another probe enroute and destined to arrive at Saturn in early summer. A new planetoid object orbiting the Sun, called Sedna, was discovered in March. Yes, things are looking up, and so can you...by attending Astronomy Day 2004 at the Children's Museum and/or at St. Jacob Park.

Can you believe it? Astronomy Day 2004 is only a few weeks away and promises to be RBAC's most successful event yet. Once again our main venue is the Children's Museum, and the agenda, exhibits and demonstrations are coming together nicely. The question I have for you is: Will you be there? This is where the rubber meets the road. To ensure our astronomy day event is a success now depends on you!

Have you ever felt like a fifth wheel in not knowing what purpose you serve? RBAC needs your wheel to help educate the public about science and to show and tell others why we enjoy this wonderful hobby. After all, Astronomy Day means "Bringing Astronomy to the People."

As Astronomy Day coordinator, I need to enlist your help in setting up displays, tables and a couple of tents, arriving early (around 8:00 a.m.) at the Children's Museum to put our event in motion. Your volunteer services will be greatly appreciated even if it's only for part of the day.

I encourage you to publicize this event as much as possible. Print copies of the Astronomy Day flyer (see next page) and send them to schools. Give them to science teachers and place them in libraries and other public places.

Several organizations and an individual have generously donated dozens of astronomy related items to be given as door prizes. We need the public to show up so we can give these prizes away. Even if a person doesn't walk away with a door prize, hopefully they will walk away with a feeling that they have learned and seen something impressive. I hope to see you all on Astronomy Day. 

### SCHEDULE

**Saturday, April 24, 2004**

**8:00 a.m.** Set up at the Children's Museum

**10:30 a.m.** Astronomy Day 2004 opens

**11:00 a.m.** Talk: *Comets Currently Visible* and *Cook a Comet* with Gary Kronk

**12:15 p.m.** Door prize drawings: Bushnell 50x150 telescope

**1:30 p.m.** NASA Night Sky Network Presentation *Distant Worlds*

**3:00 p.m.** Door prize drawings: Hardin 6-inch telescope

**3:30 p.m.** Daytime activities at the museum end. Clean up and pack up.

**4:30 p.m.** Meet at Jamie Goggin's home for dinner and socializing.

**6:00 p.m.** Set up for telescope observing at St. Jacob Park.

**11:00 p.m.** Evening observing ends.



# On comet!

**E**very so often, the awesome power of gravity tosses a giant, dirty snowball in space. As it rounds the Sun the snowball becomes a shimmering comet, and spawns a sword-like tail millions of miles long. Although ancient people feared them as omens of disaster, modern astronomers think comets carry the building blocks of life.

This April, take a ride around the Sun — it's a journey you'll never forget.

- **Cook a comet**
- **Safe filtered sun watch**
- **Mega sundial**
- **Planet walk**
- **Interactive displays**
- **Planet coloring station**
- **Tour of telescopes**
- **Telescope help clinic**
- **Kid-friendly fun**

*Win one of two fun telescopes — dozens of astronomy-related attendance prizes will be given away.*



Telescope donated by Hardin Optical Co.

Telescope donated by Pass Systems Group.



## Astronomy Day

**Educational activities and great prizes  
April 24, 2004 • 10:00 a.m. to 3:30 p.m.**

### The Children's Museum

722 Holyoake Road, Edwardsville, IL (618) 692-2094  
www.childrens-museum.net Admission \$3



## & Night!

**Stargazing with telescopes  
6:00 p.m. to 10:00 p.m.**

### St. Jacob Park

239 W. Main St., St. Jacob, IL  
Free admission

Visit [riverbendastro.org](http://riverbendastro.org) for more information. Sponsored by River Bend Astronomy Club.

BY DEB WAGNER

## Deep-sky seekers defy encroaching clouds

### THE GREENVILLE SEVEN (PLUS ONE)

The first RBAC Messier Marathon was held March 19 at the Greenville College Observatory. The following members attended: Lois Butler, Jamie Goggin, Gary Kronk, Jace Perham, Deb Wagner, and Eric Young. A visitor, Tim Bucher (pronounced BOO-ker), who's been into astronomy since he was a kid, also enjoyed the star-hopping and wants to join the club.

We had a chaperone for the night: James Sherrill, a teaching assistant for Greenville's astronomy course. Jim opened the observatory, kept an eye on things, and shared his considerable enthusiasm for astronomy. Jim's out nearly every Thursday evening observing with Greenville students.

The other living creature in attendance was the observatory mouse that scurried under red light all night.



**When the first wave of clouds cleared, out came Jamie Goggin's Discovery telescope, as the group continued to look for Messier objects and watch for meteors while socializing through the night.**

**MARATHON (NOT)** It didn't take long for the marathoners to realize they are better suited to sprints than marathons. They started out strong, but soon decided it is more fun to share favorite objects, visit with friends, and look through other telescopes. It was a perfect way to spend an evening and the group is looking forward to next year's Messier Sprint.

**THE GREEN LANTERN** When darkness fell and the coyotes started to prowl, Jace held the predators at bay with his green laser pointer (while humming a sound like a Star Wars light saber). The frustrated coyotes retreated to a neighboring farm and started planning for the next marathon.

**CLOUD MAGNETS** When the marathoners arrived at Greenville, the wind was gusty, the temperature was mild, and the sky was clear. Two hours later, the entire sky magically filled with clouds. The group battled the elements for a while longer — trying to catch a glimpse of Saturn and Jupiter between the clouds. Finally, everyone conceded defeat and began the time-consuming task of breaking down their equipment and stowing it in their cars. But as soon as the members were packed and ready to leave, the clouds dissipated as quickly as they had formed and the wind gusts diminished to a strong breeze — a beautiful night for stargazing. Go figure.



**After connecting their web cam, Jace Perham and Gary Kronk wrangled the Parks telescope at Greenville College Observatory to image this view of Jupiter.**

### Remembering the Marathon

The Messier Marathon event was exactly what I'm looking for in this club — the proper mix of observing, learning and socializing. I'm glad we didn't give in to the temptation to cancel the event because of bad weather forecasts. For me, M101 and Jupiter were the evening's highlights.

I would't mind trying to do a Greenville Observatory trip a few times a year. That kind of dark sky makes a big difference. A star near M101, which I was able to see naked-eye there, was magnitude 6.89 — and that's about as good as it's going to get in this part of the country.

And I think we might be onto something with the breakfast in the wee hours of the morning...  
— Jamie Goggin, Messier Marathon Coordinator

# Events

## APRIL MEETING

Saturday, April 10, 2004 • 7:00 p.m. •

Kronk Observatory

## ASTRONOMY DAY

Saturday, April 24, 2004

See pages 4–6 for details

**JAMIE TO THE RESCUE** The clouds were gone, the sky was perfect, and the marathoners were faced with a major decision: Should they get all of their equipment out again and continue the marathon? No way! Instead, Jamie came to their rescue. Jamie set up his telescope for the second time that evening and shared it with the entire group. He provided a custom tour of the cosmos, including hard-to-find Messier objects, Jupiter's Great Red Spot, gorgeous globular clusters, and everyone's favorite: Al's Nebula. Thanks, Jamie. You saved the day.

**FAMILIAR OBJECTS** While the members were waiting for their turn at Jamie's eyepiece, they had an opportunity to appreciate some naked-eye astronomy. Backyard astronomers sometimes forget the unique objects that can be seen with the naked eye. Some of the marathoners' favorites included the Ear-Shaped Constellation, the Tail of the Lion, and the Bear's Butt.

**COMET HUNTERS** Equipped with up-to-the-minute star charts, Jamie and Gary diligently searched the southern sky for Comet Young. The search was fruitless, but the comet hunters assured the restless crowd that success could have been attained with a larger telescope. A few members expressed their misgivings about the existence of the

mysterious comet. But, the comet's discoverer, Eric Young, managed to quiet the skeptics with an offering of his wife's homemade cookies.

## BREAKFAST OF CHAMPIONS

What can top-off an evening filled with howling coyotes, beautiful skies, enthusiastic astronomers, mysterious clouds, and elusive comets? How about a late-night breakfast in an all-night diner? When the clouds moved in the second time, the hungry marathoners headed to the Powhatan Restaurant for toast and eggs and more friendly conversation.

**A PERSONAL NOTE** I didn't try to complete the Messier Marathon. I didn't attempt to locate any new objects. Instead, like everyone in attendance, I spent most of the evening sharing my favorite objects and visiting with the group. The marathon didn't materialize, but the evening was a total success.

It has been suggested that we hold several members-only star parties each year — and I certainly hope we do. Like the other star parties I've attended, the memories I will take away from the marathon are mostly about the camaraderie. Yes, the Greenville Seven (plus one) observed some beautiful objects. But, we also shared laughter, knowledge, entertaining conversation, love of astronomy, homemade cookies, and a late-night breakfast. During this type of evening new friendships take root and old friendships grow stronger. I sincerely hope you will join us for our next adventure.

**THANKS, GREENVILLE** RBAC would like to thank the college for use of the observatory, Jim Sherrill for his help and encouragement, and even the mouse, who cleaned up our cookie crumbs.



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

### Officers

**PRESIDENT** Gary Kronk  
**VICE-PRESIDENT** Kurt Sleeter  
**TREASURER** Ed Cunniss  
**LEAGUE CORRESPONDENT**  
Jamie Goggin  
**SECRETARY** Eric Young

### Membership

**ADULT** \$10.00/year  
(18 years or older)  
**YOUTH** \$8.00/year (under 18)

### Contacts

**MAIL** 132 Jessica Drive,  
St. Jacob, IL 62281  
**WEB** riverbendastro.org  
**E-MAIL** riverbendastro@att.net

### Astronomical League

Members of the world's largest amateur astronomical organization.

**WEB** www.astroleague.org

### Current Astronomy

**CLUB NEWSLETTER**  
**EDITOR** Eric Young  
**E-MAIL** younger@wustl.edu  
Submissions to the newsletter are encouraged. Contact the editor for more information.



# April 2004



March 2004

S	M	T	W	T	F	S
29	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

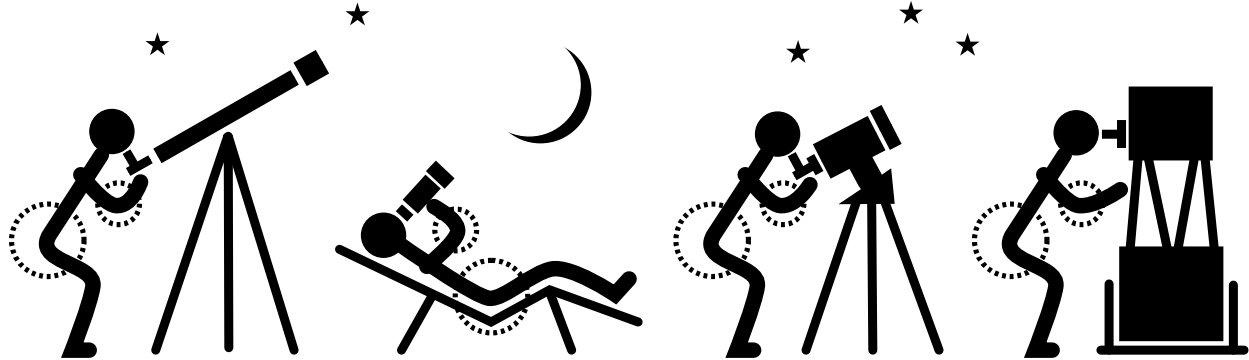
May 2004

S	M	T	W	T	F	S
25	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

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

Sun	Mon	Tue	Wed	Thu	Fri	Sat
28 <ul style="list-style-type: none"> <li>● First-quarter 5:48 p.m. CST</li> </ul>	29 <ul style="list-style-type: none"> <li>● Mercury at greatest elongation</li> <li>● Venus at greatest elongation</li> </ul>	30	31	1 <ul style="list-style-type: none"> <li>● Venus lies due south of the Pleiades.</li> </ul>	2	3
4 <ul style="list-style-type: none"> <li>● Blasted nuisance Daylight Savings Time begins</li> </ul>	5 <ul style="list-style-type: none"> <li>● Full Moon 6:03 a.m. CDT</li> <li>● Passover begins at sundown</li> </ul>	6 <ul style="list-style-type: none"> <li>● Passover</li> </ul>	7	8	9 <ul style="list-style-type: none"> <li>● Good Friday</li> </ul>	10 <ul style="list-style-type: none"> <li>● RBAC Meeting 7 p.m.</li> </ul>
11 <ul style="list-style-type: none"> <li>● Last-quarter 10:46 p.m. CDT</li> <li>● Easter</li> </ul>	12	13	14 <ul style="list-style-type: none"> <li>● Christiaan Huygens 375th birthday</li> </ul>	15	16 <ul style="list-style-type: none"> <li>● Lyrids begin</li> </ul>	17
18	19 <ul style="list-style-type: none"> <li>● New Moon 8:21 a.m. CDT</li> <li>● Astronomy week begins</li> </ul>	20 <ul style="list-style-type: none"> <li>● Comet Tempel 2 Closest Approach To Earth (2.030 AU)</li> </ul>	21 <ul style="list-style-type: none"> <li>● Eta Aquirids begin</li> </ul>	22 <ul style="list-style-type: none"> <li>● Lyrids peak</li> </ul>	23 <ul style="list-style-type: none"> <li>● Comet C/2002 T7 (LINEAR) Perihelion</li> </ul>	24 <ul style="list-style-type: none"> <li>● Astro Day: Museum 10 a.m.</li> <li>● St. Jacob Park 6 p.m.</li> </ul>
25 <ul style="list-style-type: none"> <li>● Lyrids end</li> <li>● Astronomy week ends</li> </ul>	26	27 <ul style="list-style-type: none"> <li>● First-quarter 12:32 p.m. CDT</li> </ul>	28	29	30	1

# We recommend light bending nightly.



Exercise your sense of wonder — join the River Bend Astronomy Club.

**M**eteoroids explode high above the Earth. Comets exhale dusty, million-mile-long tails while hurtling towards the Sun. Galactic collisions rip stellar systems to shreds of stardust. Oh, and don't forget the Big Bang...

These aren't scenes from Hollywood's latest action flick. The drama of the universe plays nightly over your backyard. All it takes to enjoy the show is a little know-how and maybe some modest optical equipment. Popcorn is optional.

While often exciting, astronomy is also a peaceful, deeply meaningful, and some might say spiritual pursuit, a search for a "cosmic connection"—reaching out from our tiny blue world to try and grasp our place in the universe.

The thrilling WOW! of a child's first glimpse of Saturn through a telescope as well as quiet, personal moments are among the many rewards of amateur astronomy. The River Bend Astronomy Club aims high to make your pursuit as rewarding as possible.

Anyone interested in learning more about astronomy may join. Expensive tools or special skills are unnecessary. But space is a big place—it helps to know someone with a road map. Members have maps, and they'll gladly show you around the sky—plus you'll enjoy sharing great sky views using quality astronomical telescopes. Besides, it's more fun to share the night together (and having a friend close by helps ward off night-feeding hungry bears, surprise alien attacks, etc.).

Through club membership, you join the Astronomical League, a national federation of over 240 local astronomy societies. The League's many special programs and quarterly newsletter will 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?



## River Bend Astronomy Club Membership Application

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) @ \$10.00/year (18 years or older) \_\_\_\_\_ Youth membership(s) @ \$8.00/year (under 18)

I enclose a check for a total of \$ \_\_\_\_\_ made out to "Ed Cunniss, Treasurer RBAC."

Signature \_\_\_\_\_

Date \_\_\_\_\_

### River Bend Astronomy Club

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

web: riverbendastro.org e-mail: riverbendastro@att.net