

# The Prairie Astronomer

June 2016 Volume 57, Issue #6

## June: Nearest Star Party

**PAC Member Rick Johnson  
Discovers an Unknown Virgo  
Cluster Galaxy - P. 9**

**Second Gravitational Wave  
Source Found by LIGO**

**Saturn's F Ring**



**Night Sky Network**



The Newsletter of the Prairie Astronomy Club

# ***The Prairie Astronomer***

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**NEXT PAC MEETING: June 28, 6:30pm**  
at Hyde Observatory

## **PROGRAM**

Solar Star Party: solar viewing starting at 6:30pm if weather permits. Regular program starts at 8:00 pm with a club meeting and if solar viewing is not possible, there will be a program on solar viewing instead.

## **FUTURE PROGRAMS**

July: Club dinner at Dinos; informal talk about Apollo space program by Don Eret.

August: NSP Review and “Adventures in Astrophotography” by Mark Dahmke

September: To be determined

October: Club viewing night

November: How to Buy a Telescope

December: PAC Holiday Gathering, “The Thirty Meter Telescope” by Larry Stepp

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The Prairie Astronomy Club:  
Fifty Years of Amateur Astronomy

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[lulu.com](https://www.lulu.com).

COMPILED AND EDITED BY MARK DAHMKE

# EVENTS



PAC Meeting  
 Tuesday June 28th, 2016, 6:30pm  
 Hyde Observatory  
 Solar Star Party

PAC Meeting  
 Tuesday July 26th, 2016, 7:30pm  
 Hyde Observatory

PAC Meeting  
 Tuesday August 30, 2016, 7:30pm  
 Hyde Observatory

Newsletter submission deadline July 16

## 2016 STAR PARTY DATES



Photo by Brian Sivill

	Star Party Date	Star Party Date	Lunar Party Date
January	Jan 1st	<b>Jan 8th</b>	
February	Jan 29th	<b>Feb 5th</b>	
March	Mar 4th	<b>Mar 11th</b>	
April	Apr 1st	<b>Apr 8th</b>	Apr 15th
May	Apr 29th	<b>May 6th</b>	May 13th
June	May 27th	<b>Jun 3rd</b>	
July	<b>Jul 1st</b>	Jul 8th	
<b>NSP</b>	<b>July 31st - Aug 5th</b>		
August	Jul 29th	<b>Aug 5th</b>	Aug 12th
August	Aug 26th	<b>Sep 2nd</b>	Sep 9th
September	Sep 23rd	<b>Sep 30th</b>	
October	Oct 21st	<b>Oct 28th</b>	
November	Nov 25th	<b>Dec 2nd</b>	
December	Dec 23rd	<b>Dec 30th</b>	



### PAC E-MAIL:

[info@prairieastronomyclub.org](mailto:info@prairieastronomyclub.org)

### PAC-LIST:

Subscribe through [GoogleGroups](#).  
 To post messages to the list, send to the address:

[pac-list@googlegroups.com](mailto:pac-list@googlegroups.com)

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### WEBSITES

- [www.prairieastronomyclub.org](http://www.prairieastronomyclub.org)
- <https://nightsky.jpl.nasa.gov>
- [www.hydeobservatory.info](http://www.hydeobservatory.info)
- [www.nebraskastarparty.org](http://www.nebraskastarparty.org)
- [www.OmahaAstro.com](http://www.OmahaAstro.com)
- [Panhandleastronomyclub.com](http://Panhandleastronomyclub.com)
- [www.universetoday.com/](http://www.universetoday.com/)
- [www.planetary.org/home/](http://www.planetary.org/home/)
- <http://www.darksky.org/>



**Night Sky Network**

## **PAC Meeting Minutes**

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Minutes for the meeting of May 31, 2016 President Jim Kvasnicka called the meeting to order, 15 members, 5 guests.

Jim reviewed the upcoming events for the month.

The next PAC star Party is Friday June 3, Branched Oak is also having a star party that night. Brian Sivill mentioned trying to coordinate with Branched Oak to avoid frequent conflicts.

MSRAL, the annual meeting of the Mid-States Region of the Astronomical League will be June 3-5 at the University of Missouri.

Cooper YMCA will be having a Summer camp on June 13-17, and they have asked us to provide a speaker. Volunteer

Coordinator, Dan Delzell will help find someone to do this

The next PAC meeting will be Tuesday June 28, 7:30 at Hyde.

Platte River State Park will be holding a Star Party on July 22. This is a joint event sponsored by PAC & OAS, the Omaha Astronomical Society.

The 2016 Nebraska Star Party will be held July 31 to Aug 5 at Merritt Reservoir.

Jim reviewed membership advantages and dues.

Jim provided his June observing report, including a focus on Hercules.

Club Business

Brian reported on a star party he hosted at West Point, with a

group who has come to Hyde in the past. The group was so pleased with the experience, they donated \$100.00 to the Prairie Astronomy Club.

Brett Boller showed some pictures of his progress on the Boller-Sivill observatory at Branched Oak. Brian reviewed the plans we've had of building a site to do astrophotography remotely. The Boller-Sivill facility is the hopefully culmination of these efforts. Work is progressing well and we will receive updates at meetings while this project continues.

Adjourn to the program, "The Calibration Effort for the Alice Instrument on the New Horizons Spacecraft."

Respectfully submitted by Lee Taylor

## **PAC Board Meeting Minutes**

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Board meeting minutes for June 14, 2016

Members present:

Jim Kvasnicka, President

Beth Jenckes, 2nd VP

John Reinert, Treasurer

Lee Taylor, Secretary

Dan Delzell, Outreach coordinator

Mark Dahmke, newsletter editor

Jim called the meeting to order and presented the agenda. The main reason for meeting being

to make sure we had programs in place for the rest of the year. Beth passed around a spreadsheet of what has been scheduled to date. Jim discussed the June program with Dave Churilla and solar observing. Publicity was discussed, as well as the format for Dave's program. Weather permitting, Dave will have 'scopes set up in front of Hyde to observe the sun as the program, with the regular PAC meeting afterward. In the event of bad weather, Dave will do a program on solar observing for the meeting.

Beth asked some questions about timing for programs, like duration, starting times, etc. The consensus was to try to have speakers end by 8:30-8:45 PM. We discussed several other options for programs. Rick Johnson's photography was discussed. Mark offered to contact Rick.

One suggestion was Brett's idea of a speaker who worked for Teledyne, during an informal meeting with Q & A and refreshments.

Dan recommended Brian and Brett provide updates on

their observatory construction at Branched Oak.

Jim discussed planning for the November meeting on 'How to Buy a Telescope'. Several ideas were discussed. The consensus was to have very little changed from last year. Costs and expectations were Jim's concerns for this.

Jim also talked about the December meeting, turnout, etc. We will check on Larry's availability and ask the membership for consensus on what to do for a December meeting.

#### Telescope Checkout

Jim wanted to know what equipment is where. Beth will look into communications with Mark for a notice in the newsletter about what telescopes are where. We have a dropbox file for records. We still don't have a secondary for the 13-inch. Dan offered to buy a secondary, but we'll decide what to do about it soon.

Mark reported that he will soon have Earl Moser's 8-inch refurbished! His goal is to have a plaque on it noting that it was Earl's. This will be intended for a young member to use while he or she is in the club and passed on to other youth as time passes.

Jim asked about progress on the Zhumell that needs a base. Lee said he needs time and a place

to work. Dan offered to provide the tools, materials, and a worker to do this. Mark offered to provide some spare materials as well. Jim wants this 'scope in circulation.

The sundial memorial for Earl is still being planned. The issue is a base for it. We are discussing costs and designs. Ron Veys suggested to Mark that the mount be something special with remembrance of Earl being the one who planned the alignment for Hyde. John is keeping us honest on spending for the sundial.

#### 2017 Eclipse Update

The committee met and discussed planning with Michael Sibbersen and representatives from the State of Nebraska. We are still receiving requests for representatives/guests from the club. Jim had an idea for presentation on the eclipse before the event to prepare. There was a lot of talk about where we would be and our personal plans.

Dan suggested we provide notice for those officers who have decided to run for re-election or will not be running again next year. We discussed ideas for this.

John reported on communications with the AL and dues. Mark is providing reports on contacts on Facebook and advertising charges from that.

We are having some difficulties contacting members, Lee and John will be making better communications on this.

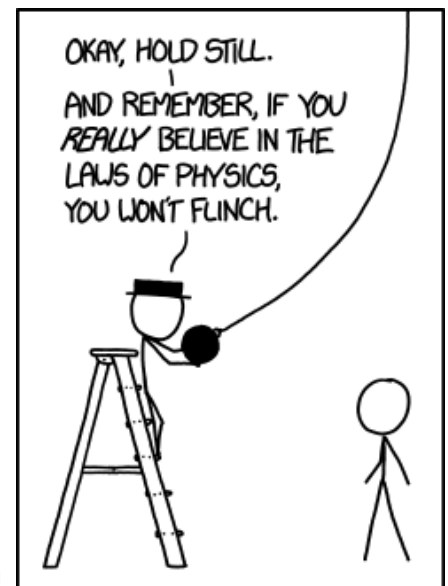
John also reported on accounting for club bank accounts.

Beth wanted to present speakers with something as a thank you and memento from the club. A pen is a suggestion. Lee asked about preparation, accommodation and welcome for outside speakers. Several ideas were talked about. Beth will look into costs for a pen, as well as a thank you note for presenters.

Mark would like to update the website with a new look, links and so on.

There was no other new business, meeting adjourned.

Respectfully submitted by,  
Lee Taylor



xkcd.com

# Boller-Sivill Observatory - Construction Update

Brian Sivill and Brett Boller

Currently, the building's base structure is set, the floor is fully decked, and the column holes are cut. Sonotube column forms and rebar are soon to be in place to facilitate pouring concrete for the telescope piers. The control room walls are standing and the first door is hung in the 8x12 control room.

It's starting to look like a REAL THING!



Brett and his father, Bill, recently located a large amount of steel 'U' channel, which we are in the process of purchasing. The steel will be used for the rolling roof's rails and will comprise the entire external portion of the rolling roof's support structure.

The discovery of this 'scrap' steel is very exciting and precipitous for our project. Without it, a wooden rail system would have been our only alternative, purely due to cost.

The steel isn't free, but we're getting it at scrap value.

Brett has also been communicating with Joe Mize of the Chiefland Astronomy Village in Florida regarding Joe's observatory roof design. His roof us-

The Prairie Astronomer



es a beam designed by an Architectural Engineer. The beams are composed of 2x12's with plywood plates sandwiched on both sides, creating triangular structures which oppose lateral sway. Very simple to build and very strong.

This design has a number of

advantages:

- Stronger and lighter than traditional trusswork.

- Far more overhead clearance, not requiring cross-members and their support.

- Relatively easy to build, on-site or offsite.

- Permits almost any chosen amount of sidewall to be included within the roof design, leaving shorter walls for observing/photographing.

After we solve a few standing technical hurdles, and a few design choices, we won't have too much trouble getting all of the remaining sidewalls erected.

Then on to roof and rail system construction. Much progress, much excitement and anticipation.



# 23rd Nebraska Star Party - 2016

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Mark Dahmke

Photo Credit: Fred Hultstrand History in Pictures Collection, NDIRS-NDSU, Fargo.

## The early registration deadline is June 30<sup>th</sup>!

Join us this summer as we gather families from all over the US and around the world in the sparsely populated sand hills of North Central Nebraska to spend a good week under a galaxy of stars.

NSP Schedule of Events (July 31- August 5):

Sunday: registration and check-in, optional dinner.

Monday: registration and check-in, field school, optional dinner.

Tuesday: registration and check-in, swap meet, field school, free "Cattle Country" hamburger dinner.

Wednesday: (All at Valentine High School) field school, registration, swap meet, speaker program, children's program, dinner on your own.

Thursday: Brewer's Niobrara Canoe or tube float, optional dinner.

Friday: public star party at 9pm.

For more information see the [NSP website](#).

**Register online!**

## ***Hap Griffin Will Be Keynote Speaker at NSP***

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Hap Griffin lives in Sumter, SC and is an avid astrophotographer, owning his own observatory and a small business modifying cameras for better astronomical and infra-red performance. He has had a number of his astronomical photographs published in books and magazines and has spoken at numerous conferences across the country on the subject of astrophotography.

His love for the space program and all things space travel related goes back to his days following the Mercury and Gemini programs as a child. Hap began covering events at Kennedy Space Center at the end of the shuttle era with STS-135 for the South Carolina Educational Television Network, where he spent a 34-year career in broadcast engineering. He

retired in March 2012 after serving the network for 16 years as its Vice-President and Chief Engineer.

Hap has been covering launches at KSC and Cape Canaveral for the major astronomy magazine Sky and Telescope for several years as well as contributing to the imagery team at AmericaSpace.com. He has developed the only known

automatic tracking camera mount in the civilian realm for use at NASA rocket launches. He holds a degree in Electrical Engineering and is an accredited Professional Engineer in South Carolina. His hobbies include ham radio, building electronic projects, offroad riding and camping, and playing guitar in a classic oldies band.





## **Observatory Update: Announcing an Apparently Unknown Virgo Cluster Galaxy**

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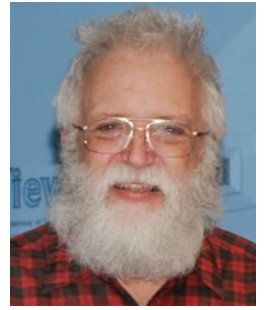
*Rick Johnson*

It's not often an amateur gets to announce a new galaxy. But it appears I have discovered a previously unrecognized dwarf irregular galaxy probably on the edge of the Virgo Cluster some 60 million light-years distant. Considering how well studied this cluster is I never expected there'd be an undiscovered galaxy in the cluster. I'm posting this out of my normal order as some may still have a chance to get better data on it. My latitude makes that impossible for me. Here's the story of its discovery.

Since much of May had horrid skies I broke with tradition and decided to look at the images to see if they needed more data before they got too far west. Unfortunately, thanks to really bad weather here this field had already moved too far west and into trees before I looked at it. In looking at it I found an apparent reflection. The corrector of my SCT creates these all too often. I'd have marked it to redo in a slightly different position to get rid of the reflection but it was too late for that. So I marked the file to note

the reflection needed to be removed.

But there was something "wrong" with the reflection that nagged at me. I went back a few days ago for a second look. Reflections are smoother and usually have streaks through them. This one was mottled with no streaks. Thus I decided it might be real after all. I checked the position against every catalog in VizierR



but came up nearly empty. Sloan reported two essentially point sources in this area but no extended object. I had previously checked the GALEX images for this area and came up empty. But looking at the Sloan image it showed what at first appeared could be stronger noise against otherwise normal level background noise. The three objects it noted didn't match a bright speck in the image but all fell between them. But it didn't appear to be all noise. I decided it was real but not in any catalog I could access. A check of the POSS plates showed something very

faint in the POSS II blue plate. I decided it had to be real. Time to call in my pros. Unfortunately most were getting ready or had already left for the AAS conference running June 12 through the 16th. Those I could reach dismissed it as a reflection even though it was in Sloan and very faintly in the POSS II blue plate. I'm sure they were too occupied with the conference to give me any time. What to do?

When this happens I fall back on Sakib Rasool who some of you know. He has lots of contacts. One is Igor Karachentsev a Russian astrophysicist who

studies this area. Here is his reply when Sakib relayed my information to him: "yes, this object is unknown as possible dwarf galaxy, only known as SDSS source. It is also not detected as HI-source in the ALFALFA HI survey in Arecibo. Due to its texture, it may be a peripheric dIrr member of the Virgo cluster." Later he wrote: "sure, it is a real irregular dwarf galaxy of bluish color and low surface brightness, however, unseen in GALEX. Such kind objects may be gas-rich, as well as gas-poor." I should mention not being seeing by ALFALFA HI means it is radio



quiet, somewhat rare for a dwarf galaxy.

Until it is studied we won't know much more than this. I do measure its size as about 10,000 light-years if a member of the Virgo Cluster at about 60 million light-years.

The previously unknown galaxy is circled in dark green in the annotated image, to the upper right of HCG 59. I've stretched the heck out of this one to bring out the probably dwarf. That makes for some nasty stuff around bright stars that under a normal stretch wouldn't be seen.

As you can imagine things have been rather hectic here the last couple days with a zillion emails flying about. The above pretty much boils things down to what is pretty much agreed with. Still lots of speculation on why GALEX and other survey's missed it. Apparently Sloan missed it due to the stars or star groups it is resolving being too far apart for the system to see it as an entity rather than just individual small sources. My timing on this was bad with the AAS going on at the same time. Now LIGO has announced a second discovery of black holes merging today at the conference. A new galaxy in a nearby cluster is small potatoes but exciting for me just the same. I never expected when I built the observatory that it could achieve such a feat. Today's digital technology has changed things drastically from my film days.

Here are additional emails from Russia:

"Well, I shall try to do images of this galaxy with the 6-m telescope in the next spring. But the most important case would be to measure its radial velocity. To get its optical spectra is a very difficult task. I may ask somebody from Arecibo team to search for HI-signal from your object, of course, if you agree."

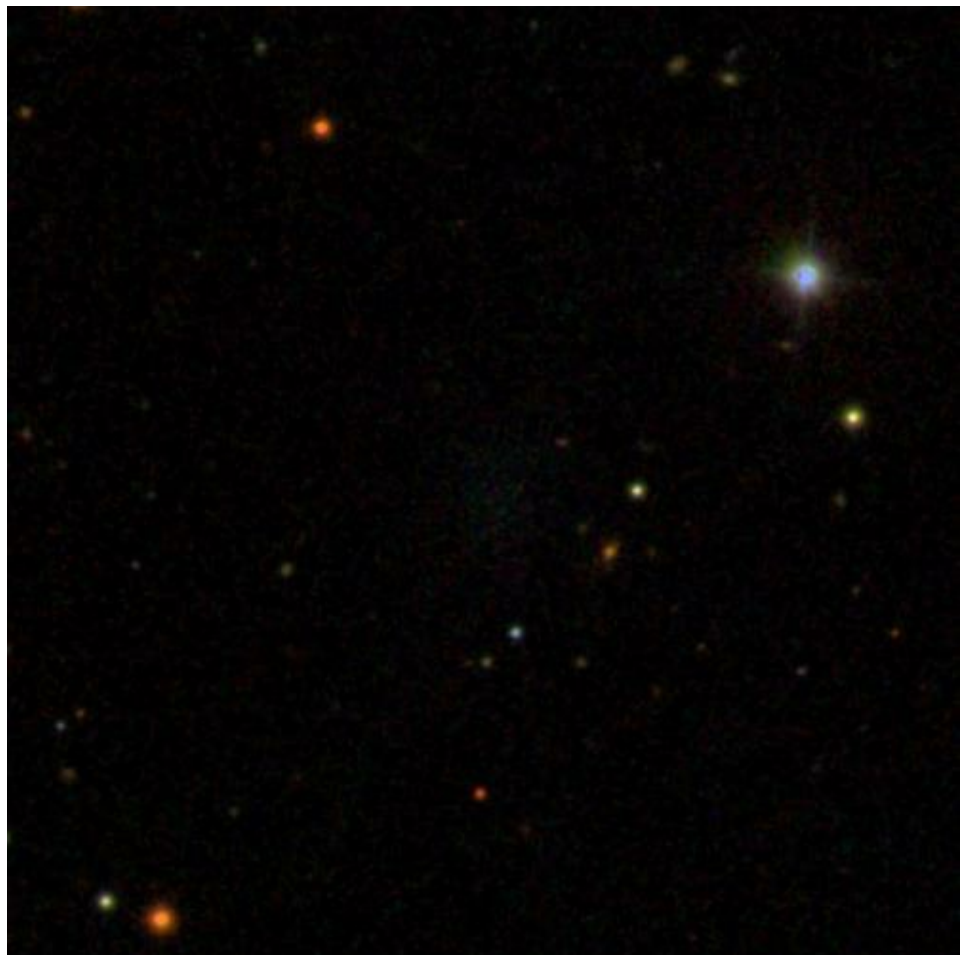
"I just asked Martha Haynes, one of the authors of the Arecibo HI-survey, to look at a possible HI-signal from "Johnson 1". If been successful, it may give us its radial velocity and kinematic distance. I am waiting for Martha's reply at the beginning of next week. Congratulations with the finding so dim dwarf galaxy.

Best wishes,  
Igor Karachentsev"

For those who can still catch it where it gets dark earlier than well after midnight that it is here now the coordinates are 11h 48m 09.1s +12d 48' 49". I'm out of luck until next year.

Now for the regular part of the post about what I thought I was doing when I found the unknown galaxy.

HCG 59 is a group of 5 galaxies in about 2 degrees south of Denebola in Leo. 4 of the galaxies are about 200 million light-years distant but one is a bit over a billion light-years distant so obviously not a true



*Sloan image of the newly discovered galaxy*

member. Quite a few other galaxies are in the field that are at the 200 million light-year distance indicating the group is far larger than the sub group that is HCG 59. Hickson groups have a very specific definition that is meant to rule out galaxy clusters. But ignores if they are actually related. Thus this group includes one that obviously isn't and excludes one that seems to be worthy of including that is the right distance but is too low of surface brightness to qualify. For more on the specifics see Hickson's paper at: <http://articles.adsabs.harvard.edu/full/1982ApJ...255..382H/0000382.000.html>

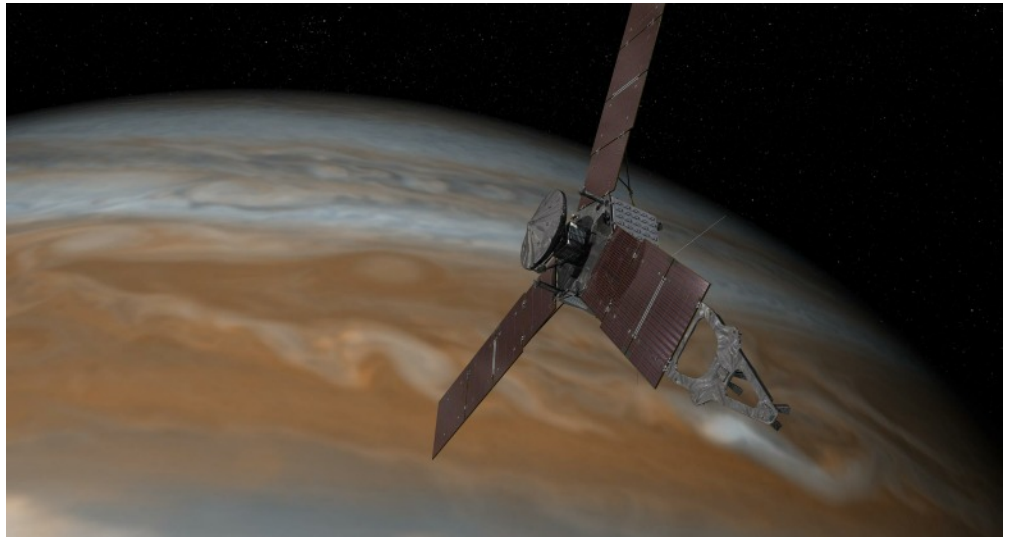
HCG 59C is the largest of the 4 truly related galaxies though being somewhat edge on appears smaller than 59A. It is

only a bit over 50,000 light-years across. Less than half the size of 59E thanks to the latter's much greater distance. 59A appears to be a rather red and dead, or at least near dead spiral. By redshift the closest member of the group is 59D which is a really neat irregular galaxy full of star clouds. It's redshift puts it at 180 million light-years distant. Enough difference from 59C's 220 million light-year distance they may not be related at all, just a line of sight group. An HST image of this galaxy is at: [https://upload.wikimedia.org/wikipedia/commons/6/6b/Hickson\\_Compact\\_Group\\_59.jpg](https://upload.wikimedia.org/wikipedia/commons/6/6b/Hickson_Compact_Group_59.jpg)

Four asteroids are in the image. They are moving very slowly as they are at the point in their orbits where they are changing

from between retrograde and prograde motion. In fact two are prograde (p) and two are retrograde (r). I've caught asteroids near this point before but not with some on either side. Because they are moving so slowly all but one looks at first glance (maybe second as well) to be just a very distant, near starlike galaxy. To be sure I checked each against the Sloan images to verify nothing was there when Sloan took the field. Besides the positions matched those given by the Minor Planet Center's Minor Planet Checker. The night was poor (most are of late), I doubt I'd have picked these up if they were moving normal speed across the sky given the poor conditions.

## **NASA's Juno Spacecraft to Risk Jupiter's Fireworks for Science**



*On July 4, NASA will fly a solar-powered spacecraft the size of a basketball court within 2,900 miles (4,667 kilometers) of the cloud tops of our solar system's largest planet. Launched in 2011, the Juno spacecraft will study the giant planet from an elliptical, polar orbit. Juno will repeatedly dive between the planet and its intense belts of charged particle radiation, traveling from pole to pole in about an hour, and coming within 5,000 kilometers (about 3,000 miles) of the cloud tops at closest approach.*

*Juno's primary goal is to improve our understanding of Jupiter's formation and evolution. The spacecraft will spend a little over a year investigating the planet's origins, interior structure, deep atmosphere and magnetosphere. Juno's study of Jupiter will help us to understand the history of our own solar system and provide new insight into how planetary systems form and develop in our galaxy and beyond.*

# Curiosity Self-Portrait at 'Okoruso' Drill Hole

*This May 11, 2016, self-portrait of NASA's Curiosity Mars rover shows the vehicle at the "Okoruso" drilling site on lower Mount Sharp's "Naukluft Plateau." The scene is a mosaic of multiple images taken with the arm-mounted Mars Hand Lens Imager (MAHLI).*



# July Observing: What to View

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Jim Kvasnicka

This is a partial list of objects visible for the upcoming month.

## Planets

**Jupiter:** Shines at magnitude -1.9 with a disk 33" wide in the west.

**Venus:** Sets about a half hour after the Sun.

**Mercury:** Becomes visible around mid-month setting 45 minutes after the Sun.

**Mars:** Dims to magnitude -0.8 with a disk 13" wide.

**Saturn:** Dims to magnitude 0.3 in Ophiuchus with the rings open 26° from edge on.

**Uranus / Neptune:** In Pisces and Aquarius.

## Messier List

**M3:** Class VI globular cluster in Canes Venatici.

**M4:** Class IX globular cluster in Scorpius.

**M5:** Class V globular cluster in Serpens Caput.

**M53:** Class V globular cluster in Coma Berenices.

**M68:** Class X globular cluster in Hydra.

**M80:** Class II globular cluster in Scorpius.

**M83:** Galaxy in Hydra.

**Last Month:** M58, M59, M60, M84, M86, M87, M88, M89, M90, M91, M98, M99, M100

**Next Month:** M6, M7, M8, M9, M10, M12, M19, M20, M21, M23, M62, M107

## NGC and other Deep Sky Objects

**NGC 5907:** Thin elongated galaxy in Draco.

**NGC 6543:** Cat's Eye Nebula in Draco.

**NGC 6369:** Little Ghost Nebula in Ophiuchus.

**NGC 6633:** Large loose open cluster in Ophiuchus.

**NGC 6072:** Fairly bright planetary nebula in Scorpius.

**NGC 6302:** Bug Nebula in Scorpius.

**NGC 6337:** Pale blue planetary nebula in Scorpius.

**IC 4703:** Eagle Nebula in Serpens Cauda, M16 is the open cluster.

## Double Star Program List

**Nu Draconis:** Equal white pair.

**Psi Draconis:** Light yellow pair.

**40/41 Draconis:** Equal pair of pale yellow stars.

**Xi Scorpii:** Yellow primary with a pale blue secondary.

**Struve 1999:** Two yellow-orange stars.

**Beta Scorpii:** Blue-white primary with a pale blue secondary.

**Nu Scorpii:** Yellow and light blue stars.

**Delta Serpentis:** Light yellow pair.

**Theta Serpentis:** Blue-white stars.



## Challenge Object

**NGC 5595 and NGC 5597:** A faint pair of galaxies in Libra separated by 4'. NGC 5595 is slightly brighter.

# Focus on Constellations: Ophiuchus

Jim Kvasnicka

Ophiuchus, the Serpent Bearer, is a large constellation covering 948 square degrees making it the eleventh largest constellation. Most of it lies just NW of the southern part of the summer Milky Way. The SE wing of the constellation extends into the Milky Way almost to the direction toward the Galactic Center. Because most of our Galaxy's globular clusters are distributed around the direction toward the Galactic Center, Ophiuchus is rich in globular clusters, which make up most of its showpiece objects. The constellation Ophiuchus is best seen in July.

## Showpiece Objects

**Globular Clusters:** M9, M10, M12, M14, M19, M62, M107

**Planetary Nebulae:** NGC 6309, NGC 6369 (Little Ghost Nebula), NGC 6572

**Open Clusters:** NGC 6633

**Dark Nebulae:** B57, B60, B61, B62, B63, B64, B59/65-7/78 (Pipe Nebula), B72 (Snake Nebula)

**Multiple Stars:** Rho Ophiuchi, Lambda Ophiuchi, 24 Ophiuchi, 36 Ophiuchi, Omicron Ophiuchi

## Mythology

Ophiuchus represented the god of medicine Aesculapius, son of Apollo. Aesculapius/Ophiuchus was taught the art of healing by Chiron, the Centaur in the constellation Centaurus. According to one story, when Aesculapius once killed a snake another came along with a medicinal herb in its mouth that revived the first snake. Aesculapius took some of the herb and gained the power to restore life. Hence the symbol of Aesculapius and

medicine in general, is the staff of two intertwined serpents. Aesculapius was so successful that the kingdom of Pluto, god of the Nether World, was threatened. Pluto appealed to Zeus, who killed Aesculapius with a thunderbolt. Apollo interceded on his dead son's behalf with Zeus, who relented and immortalized Aesculapius in the heavens as the constellation Ophiuchus.

## Number of Objects Magnitude 12.0 and Brighter

**Galaxies:** 1

**Globular Clusters:** 17

**Open Clusters:** 4

**Planetary Nebulae:** 8

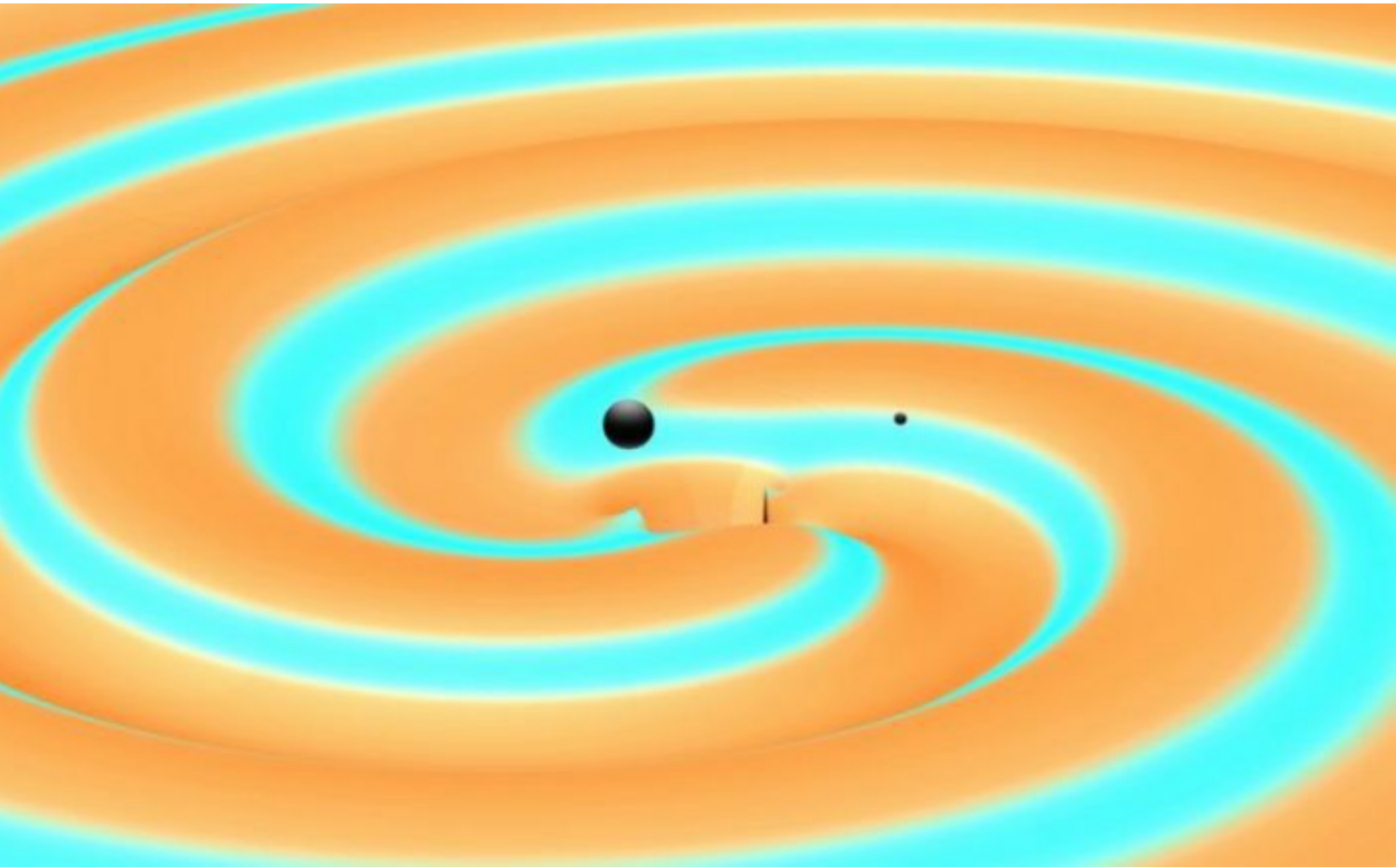
**Dark Nebulae:** 19



*Photo: Till Credner - Own work: AlltheSky.com*

# Second Gravitational Wave Source Found by LIGO

Nancy Atkinson, *Universe Today*



*This image depicts two black holes just moments before they collided and merged with each other, releasing energy in the form of gravitational waves. Image credit: Numerical Simulations: S. Ossokine and A. Buonanno, Max Planck Institute for Gravitational Physics, and the Simulating eXtreme Spacetime (SXS) project. Scientific Visualization: T. Dietrich and R. Haas, Max Planck Institute for Gravitational Physics.*

Lightning has struck twice – maybe three times – and scientists from the Laser Interferometer Gravitational-wave Observatory, or LIGO, hope this is just the beginning of a new era of understanding our Universe. This “lightning” came in the form of the elusive, hard-to-detect gravitational waves, produced by gigantic events, such as a pair of black holes colliding. The energy released

from such an event disturbs the very fabric of space and time, much like ripples in a pond. Today’s announcement is the second set of gravitational wave ripples detected by LIGO, following the historic first detection announced in February of this year.

“This collision happened 1.5 billion years ago,” said Gabriela Gonzalez of Louisiana State University at a press conference

to announce the new detection, “and with this we can tell you the era of gravitational wave astronomy has begun.”

LIGO’s first detection of gravitational waves from merging black holes occurred Sept. 14, 2015 and it confirmed a major prediction of Albert Einstein’s 1915 general theory of relativity. The second detection



occurred on Dec. 25, 2015, and was recorded by both of the twin LIGO detectors.

While the first detection of the gravitational waves released by the violent black hole merger was just a little “chirp” that lasted only one-fifth of a second, this second detection was more of a “whoop” that was visible for an entire second in the data. Listen in this [video](#).

“This is what we call gravity’s music,” said González as she played the video at today’s press conference.

While gravitational waves are not sound waves, the researchers converted the gravitational wave’s oscillation and frequency to a sound wave with the same frequency. Why were the two events so different?

From the data, the researchers concluded the second set of gravitational waves were produced during the final moments of the merger of two black holes that were 14 and 8 times the mass of the Sun, and the collision produced a single, more massive spinning black hole 21 times the mass of the Sun. In comparison, the black holes detected in September 2015 were 36 and 29 times the Sun’s mass, merging into a black hole of 62 solar masses.

The scientists said the higher-frequency gravitational waves from the lower-mass black holes hit the LIGO detectors’ “sweet spot” of sensitivity.

“It is very significant that these black holes were much less massive than those observed in

the first detection,” said Gonzalez. “Because of their lighter masses compared to the first detection, they spent more time—about one second—in the sensitive band of the detectors. It is a promising start to mapping the populations of black holes in our universe.”

LIGO allows scientists to study the Universe in a new way, using gravity instead of light. LIGO uses lasers to precisely measure the position of mirrors separated from each other by 4 kilometers, about 2.5 miles, at two locations that are over 3,000 km apart, in Livingston, Louisiana, and Hanford, Washington. So, LIGO doesn’t detect the black hole collision event directly, it detects the stretching and compressing of space itself. The detections so

billion billion. The signal from the latest event, named GW151226, was produced by matter being converted into energy, which literally shook spacetime like Jello.

LIGO team member Fulvio Ricci, a physicist at the University of Rome La Sapienza said there was a third “candidate” detection of an event in October, which Ricci said he prefers to call a “trigger,” but it was much less significant and the signal to noise not large enough to officially count as a detection.

But still, the team said, the two confirmed detections point to black holes being much more common in the Universe than previously believed, and they might



*An aerial view of LIGO Hanford. (Credit: Gary White/Mark Coles/California Institute of Technology/LIGO/NSF).*

far are the result of LIGO’s ability to measure the perturbation of space with an accuracy of 1 part in a thousand

frequently come in pairs.

“The second discovery “has truly put the ‘O’ for Observatory in LIGO,” said

Albert Lazzarini, deputy director of the LIGO Laboratory at Caltech. "With detections of two strong events in the four months of our first observing run, we can begin to make predictions about how often we might be hearing gravitational waves in the future. LIGO is bringing us a new way to observe some of the darkest yet most energetic events in our universe."

LIGO is now offline for improvements. Its next data-taking run will begin this fall and the improvements in detector sensitivity could allow LIGO to reach as much as 1.5 to two times more of the volume of the universe compared with the first run. A third site, the Virgo detector located near Pisa, Italy, with a design similar to the twin LIGO detectors, is expected to come online during the latter half of LIGO's upcoming observation

run. Virgo will improve physicists' ability to locate the source of each new event, by comparing millisecond-scale differences in the arrival time of incoming gravitational wave signals.

In the meantime, you can help the LIGO team with the Gravity Spy citizen science project through Zooniverse.

## ***Hubble's Bubble Lights up the Interstellar Rubble***

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*This article is provided by NASA Space Place.*

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Ethan Siegel



When isolated stars like our Sun reach the end of their lives, they're expected to blow off their outer layers in a roughly spherical configuration: a planetary nebula. But the most spectacular bubbles don't come from gas-and-plasma getting expelled into otherwise empty space, but from young, hot stars whose radiation pushes against the gaseous nebulae in which they were born. While most of our Sun's energy is found in the visible part of the spectrum, more massive stars burn at hotter temperatures, producing more ionizing, ultraviolet light, and also at higher luminosities. A star some 40-45 times the mass of the Sun, for example, might emit energy at a rate hundreds of thousands of times as great as our own star.

The Bubble Nebula, discovered in 1787 by William Herschel, is

perhaps the classic example of this phenomenon. At a distance of 7,100 light years away in the constellation of Cassiopeia, a molecular gas cloud is actively forming stars, including the massive O-class star BD+60 2522, which itself is a magnitude +8.7 star despite its great distance and its presence in a dusty region of space. Shining with a temperature of 37,500 K and a luminosity nearly 400,000 times that of our Sun, it ionizes and evaporates off all the molecular material within a sphere 7 light years in diameter. The bubble structure itself, when viewed from a dark sky location, can be seen through an amateur telescope with an aperture as small as 8" (20 cm).

As viewed by Hubble, the thickness of the bubble wall is both apparent and spectacular. A star as massive as the one

creating this bubble emits stellar winds at approximately 1700 km/s, or 0.6% the speed of light. As those winds slam into the material in the interstellar medium, they push it outwards. The bubble itself appears off-center from the star due to the asymmetry of the surrounding interstellar medium with a greater density of cold gas on the "short" side than on the longer one. The blue color is due to the emission from partially ionized oxygen atoms, while the cooler yellow color highlights the dual presence of hydrogen (red) and nitrogen (green).

The star itself at the core of the nebula is currently fusing helium at its center. It is expected to live only another 10 million years or so before dying in a spectacular Type II supernova explosion.



*Image credit: NASA, ESA, and the Hubble Heritage Team (STScI/AURA), of the Bubble Nebula as imaged 229 years after its discovery by William Herschel.*

## ***Cassini Spots Disruption in Saturn's Narrow F Ring***

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A bright disruption in Saturn's narrow F ring suggests it may have been disturbed recently. This feature was mostly likely not caused by Pandora (50 miles or 81 kilometers across) which lurks nearby, at lower right. More likely, it was created by the interaction of a small object embedded in the ring itself and material in the core of the ring. Scientists sometimes refer to these features as "jets."

Because these bodies are small and embedded in the F ring itself, they are difficult to spot at the resolution available to NASA's Cassini spacecraft. Instead, their handiwork reveals their presence, and scientists use the Cassini spacecraft to

study these stealthy sculptors of the F ring.

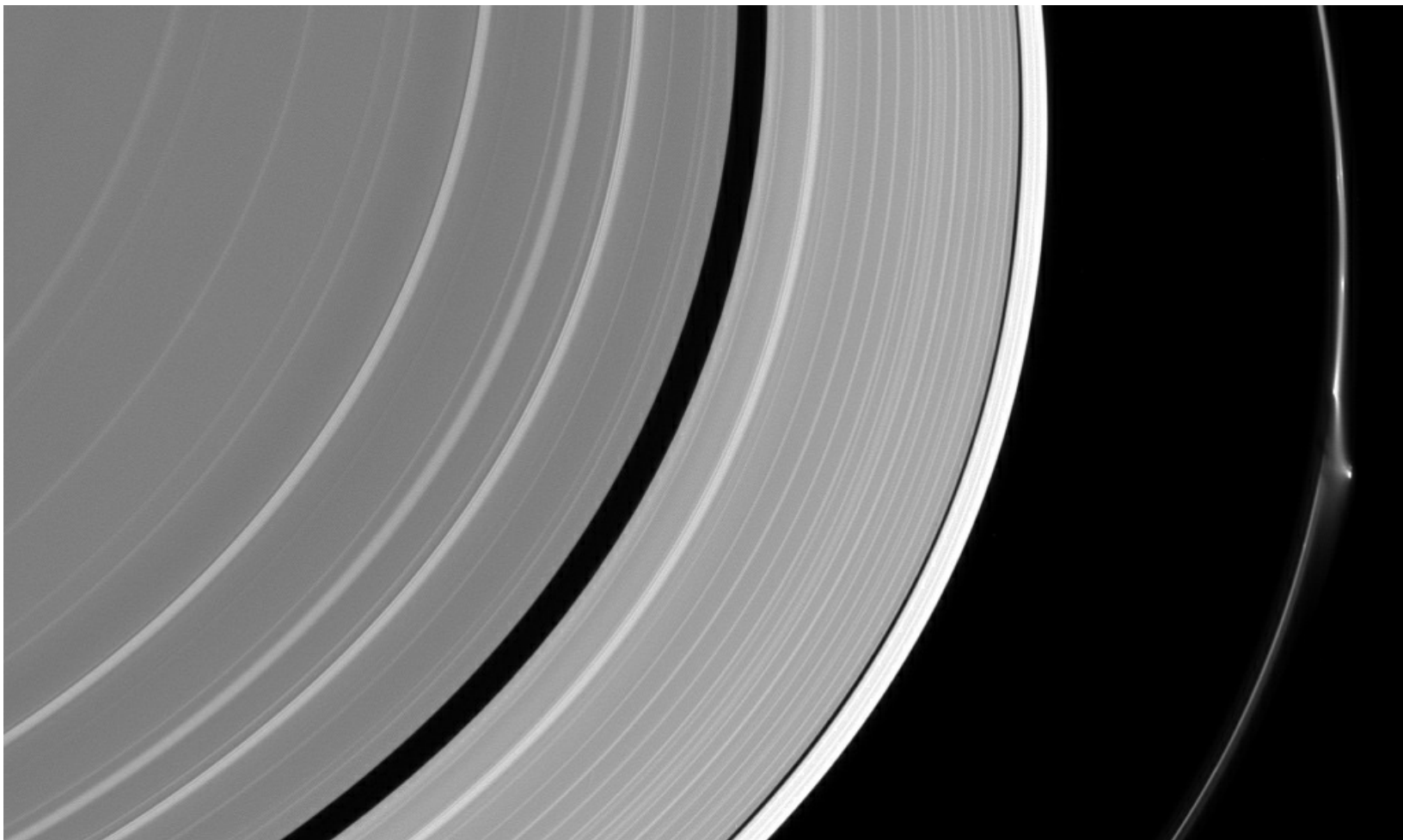
The image was taken in visible light with the Cassini spacecraft narrow-angle camera on April 8, 2016.

The view was acquired at a distance of approximately 1.4 million miles (2.2 million kilometers) from Saturn and at a Sun-Saturn-spacecraft, or phase, angle of 105 degrees. Image scale is 8 miles (13 kilometers) per pixel.

The Cassini mission is a cooperative project of NASA, ESA (the European Space Agency) and the Italian Space Agency. The Jet Propulsion Laboratory, a division of the

California Institute of Technology in Pasadena, manages the mission for NASA's Science Mission Directorate, Washington. The Cassini orbiter and its two onboard cameras were designed, developed and assembled at JPL. The imaging operations center is based at the Space Science Institute in Boulder, Colorado.

For more information about the Cassini-Huygens mission visit <http://saturn.jpl.nasa.gov> and <http://www.nasa.gov/cassini>. The Cassini imaging team homepage is at <http://ciclops.org>.



## President's Message:

This month's meeting will find you minus your President, as I will be in Wisconsin on business. What, you say? How can our meeting exist without our President? Well, how nice of you to say something like that. But don't worry, our Vice President, Ron Veys -- you do remember him, don't you? -- will take over for me.

We had a good viewing session at our last star party and Ron should cover that. We had a good turnout and one of our out-state members, Larry Stepp, drove all the way from Texas to be out there. Well, maybe he wasn't up just for our star party.

Also this next month brings with it a very good (dark) lunar eclipse, July 5-6. Although I won't be there for the meeting, I very much promote that we gather at Earl's that night and morning for one of our rare "full moon" star parties. From all accounts, this should be a spectacular eclipse. Consult your Sky & Tel for notes on viewing this.

The article also mentions that readers should make their own timings for the various contacts of the umbra's passage across the various craters. So, some of us might wish to do that. Remember, for you younger ones or other members who have no telescopes, or small ones, this is a good viewing session for lawn chairs, blankets, binoculars, or small telescopes. So, get plenty of sleep Sunday night and come on out.

Also, thanks to Lee Thomas, who is producing our taped messages for the phone answering service at the observatory. Needless to say, his first message for June which started out with "THIS IS A SOLAR FLARE ALERT--" caught my attention for the entire message. The next day I gave the observatory phone number to half a dozen of my office workers and told them to call it with no other explanation. They were up every night of the week after that looking for auroras!

-- RUSS GENZMER

THE PRAIRIE ASTRONOMER is published monthly by the Prairie Astronomy Club, and is free to all club members. Yearly subscription without club membership is \$6.00. Regular membership, \$16.00. Family membership is \$18.00. Memberships include 1-year subscription to SKY & TELESCOPE, the club newsletter, and 4 quarterly issues of THE REFLECTOR, Journal of the Astronomical League. Address correspondence and membership renewals to: PRAIRIE ASTRONOMY CLUB, INC., P.O. Box 80553, Lincoln, Nebraska 68501.

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REGULAR MEMBER - \$30.00 per year. Includes club newsletter, and 1 vote at club meetings, plus all other standard club privileges.

FAMILY MEMBER - \$35.00 per year. Same as regular member except gets 2 votes at club meetings.

STUDENT MEMBER - \$10.00 per year with volunteer requirement.

If you renew your membership prior to your annual renewal date, you will receive a 10% discount.

Club members are also eligible for special subscription discounts on Sky & Telescope Magazine.

## CLUB TELESCOPES

*To check out one of the club telescopes, please contact a club officer. Scopes can be checked out at a regular club meeting and kept for one month. Checkout can be extended for another month if there are no other requests for the telescope, but you must notify a club officer in advance.*

100mm Orion refractor: David Pennington  
10 inch Meade Dobsonian: Lee Taylor  
13 inch Truss Dobsonian: Available

## CLUB APPAREL



Order club apparel from [cafepress.com](http://cafepress.com):



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