

# ***The Prairie Astronomer***

September 2016 Volume 57, Issue #9

## ***September Program:***

***Rick Johnson's Astrophotography***

**Cover: NGC 5759  
A Pair of Interacting Galaxies  
by Rick Johnson**



***Night Sky Network***



The Newsletter of the Prairie Astronomy Club

# ***The Prairie Astronomer***

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**NEXT PAC MEETING: September 27, 7:30pm**  
**At Hyde Observatory**

## **PROGRAM**

September: Rick Johnson's Astrophotography

A showcase of the best of Rick Johnson's astrophotography from the past few years with a comparison with other amateur and professional photos.

## **FUTURE PROGRAMS**

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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**Buy the book! The Prairie Astronomy Club: Fifty Years of Amateur Astronomy.**  
Order online from [Amazon](#) or [lulu.com](#).

# EVENTS



PAC Meeting  
 Tuesday September 27th, 2016, 7:30pm  
 Hyde Observatory

PAC Meeting  
 Tuesday October 25th, 2016, 7:30pm  
 Hyde Observatory

Howling Homestead, October 29

PAC Meeting  
 Tuesday November 29, 2016, 7:30pm  
 Hyde Observatory

PAC Meeting  
 Tuesday December 27, 2016, 7:30pm  
 Hyde Observatory

## 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 August 30, 2016

President Jim Kvasnicka called the meeting to order. No visitors.

Upcoming Events:

Hyde is open every Saturday night.

The next club star party is Friday, September 2 at the farm.

Branched Oak observatory will also be hosting a star party on Sept. 2nd.

Jim will host a lunar party on Friday September 9th at his home.

There are several events on Sat. Sept. 10. Including:

A Girl Scout event.

The Wildwood Star Party.

Homestead has a Boy Scout event that same night.

Jim reviewed those volunteering at each and notified Homestead we may not have anyone available.

Beth asked about the requirements for the scouting astronomy badge. Bob Kacvinski and Jim discussed this.

Branched Oak is having an event on October first, and is asking for volunteers to provide about 4 'scopes.

Homestead National Monument is having its annual Howling Homestead event on Saturday, Oct. 29.

Jim reviewed the membership benefits and dues for the club.

Jim provided his monthly observing report, featuring the constellation Cygnus.

Club Business

Nominations will be taken for next year's officers will begin at

the September meeting, and remain open until elections the following month.

Lee Thomas presented the Hyde Volunteer of the Year Award to Leonard Mertz. Congratulations!

Lee also made a request for volunteers for Hyde.

Jim also presented Brett Boller with the transit of Mercury award from the AL.

Brian Sivill presented a slide show of the progress of construction on the Boller-Sivill observatory at Branched Oak.

Adjourn to our programs, NSP review and Mark Dahmke's adventures in astrophotography.

Respectfully submitted by  
Lee Taylor



*Lee Thomas presented Leonard Mertz his Hyde Volunteer of the Year award at the August PAC meeting. Congratulations Leonard!*



*Brett Boller received the Astronomical League Planetary Transit Special Award for his observations of the May 9 Mercury Transit. Congratulations Brett!*



# Boller-Sivill Observatory - Construction Update

Brian Sivill and Brett Boller

Extensive progress has been made at the Boller-Sivill Observatory in the past 30 days. We have been onsite every single weekend since the last newsletter, leading to considerable forward progress.

One sunny weekend Brett and I (and a few volunteers) managed to build the entire roof assembly, wheels and all. We got some great help from John Willman, Lee Taylor and John Reinert. The bare skeleton of the rolling roof assembly was truly a thing of beauty as we admired our work.

Soon after, Brett, Bill Boller and I put the fancy red sheet tin on the new structure's roof, and boy does it look great! The sheet tin adds an amazing amount of rigidity to the framework, the roof is very solid and stable.

Over one rainy weekend I managed to get a few LED lights put up inside, anticipating the structure to be enclosed (and dark) very soon. We will fully LED light the observatory in both white and red.

During one of Brett and Bill's weekday visits to the site, they

put up brand new white sheet tin on the West side. As of this writing, the entire structure is now sided. Most of our siding was purchased by Bill and Brett at a local auction for a very good price. We did have a few slight color mismatches but we worked with it pretty well. I helped sheet tin over a two day weekend, working in the hot sun. But the bulk of the siding efforts were accomplished by Brett and his Dad, Bill. The structure looks simply fabulous.

The last two weekends, Brett and I have been working on the



steel structure where the roof will reside when rolled away for observing/photographing. There will be a steel beam bridging to the structure, and then extensions on the far end to allow the roof to fully move off of the building.

This last weekend Doug Burhman loaned us his welder al-

lowing my nephew, Jaymes Sivill to do some test welding. The welds looked good, but Jaymes determined that our 120v welder powered from a borrowed generator just didn't have the juice to do the job. So we will be renting a portable welder to complete the structure welding very soon.

We're hoping to get the roof rolling in time for Branched Oak Observatory's Star Party and fundraiser on Saturday, October 1st. We encourage all PAC members, friends and family to attend. We will be giving tours of the new facility!

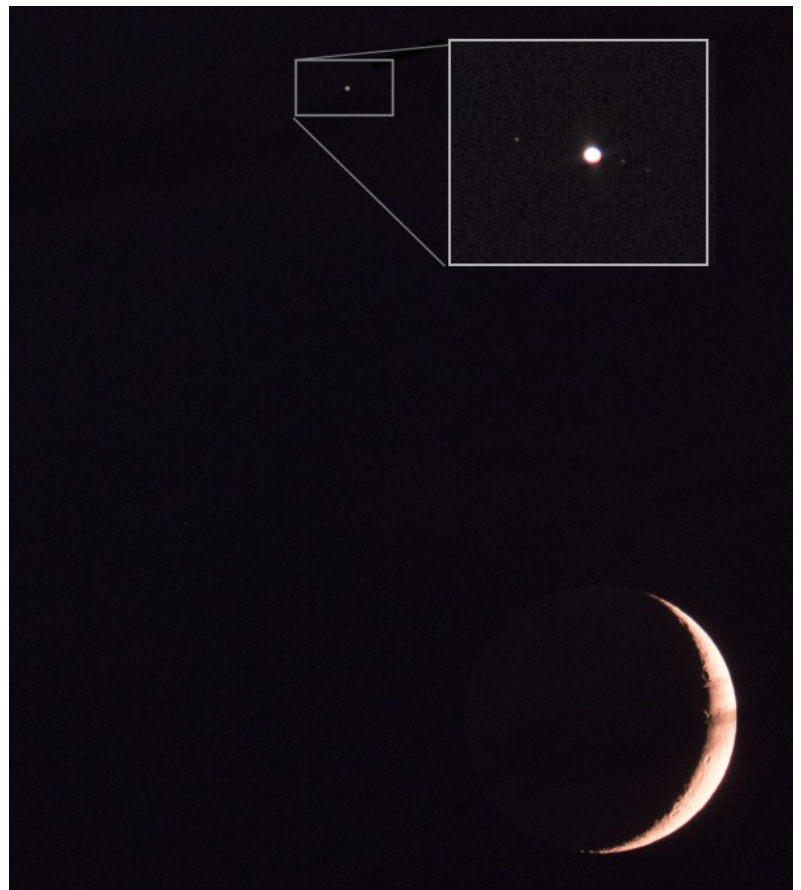


## Astrophotography

Moon and Jupiter,

August 5, Mark Dahmke.

$\frac{1}{4}$  second, ISO 800, Celestron Onyx (500mm).



## Cassini Begins Epic Final Year at Saturn

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After more than 12 years studying Saturn, its rings and moons, NASA's Cassini spacecraft has entered the final year of its epic voyage. The conclusion of the historic scientific odyssey is planned for September 2017, but not before the spacecraft completes a daring two-part endgame.

Beginning on November 30, Cassini's orbit will send the spacecraft just past the outer edge of the main rings. These orbits, a series of 20, are called the F-ring orbits. During these weekly orbits, Cassini will approach to within 4,850 miles

(7,800 kilometers) of the center of the narrow F ring, with its peculiar kinked and braided structure.

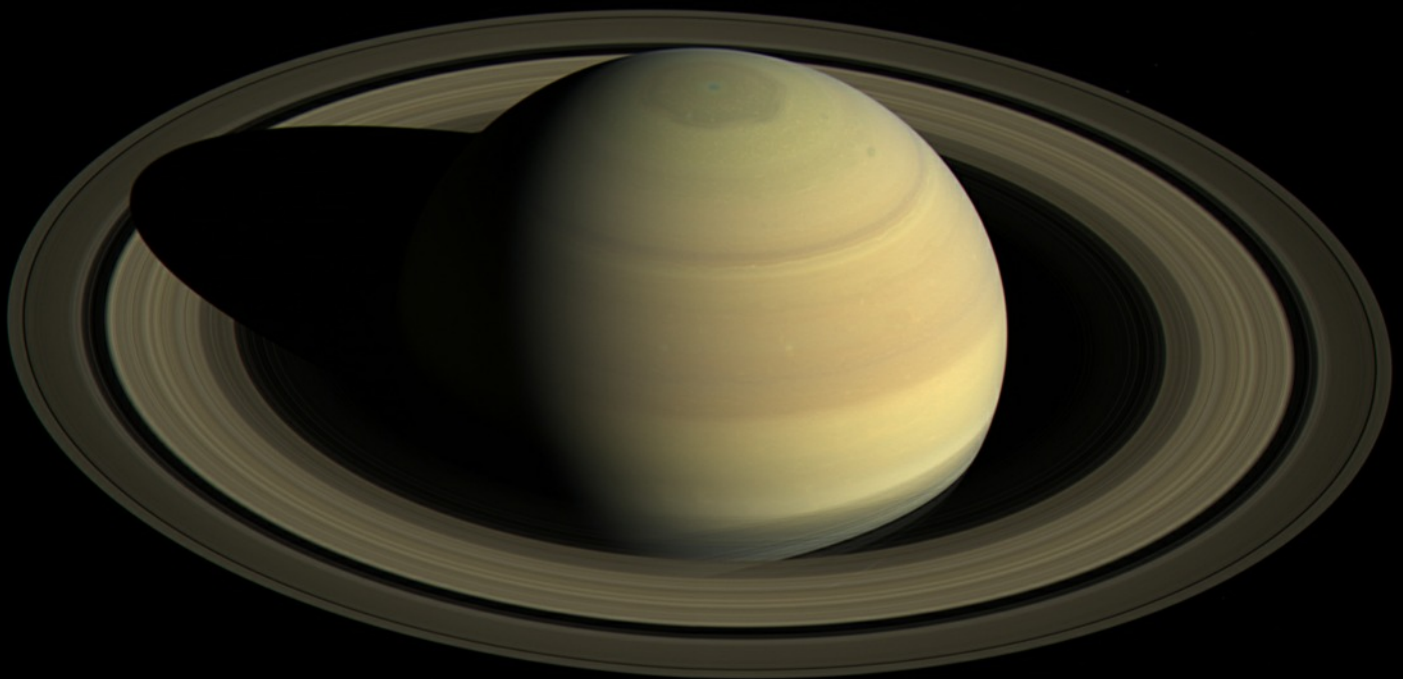
[DOWNLOAD VIDEO Four Days at Saturn](#)

"During the F-ring orbits we expect to see the rings, along with the small moons and other structures embedded in them, as never before," said Linda Spilker, Cassini project scientist at NASA's Jet Propulsion Laboratory, Pasadena, California. "The last time we got this close to the rings was during arrival at Saturn in 2004, and we

saw only their backlit side. Now we have dozens of opportunities to examine their structure at extremely high resolution on both sides."

The Last Act: A Grand Finale

Cassini's final phase -- called the Grand Finale -- begins in earnest in April 2017. A close flyby of Saturn's giant moon Titan will reshape the spacecraft's orbit so that it passes through the gap between Saturn and the rings - an unexplored space only about 1,500 miles (2,400 kilometers) wide. The



*Since NASA's Cassini spacecraft arrived at Saturn, the planet's appearance has changed greatly. This view shows Saturn's northern hemisphere in 2016, as that part of the planet nears its northern hemisphere summer solstice in May 2017. Image credit: NASA/JPL-Caltech/Space Science Institute*



spacecraft is expected to make 22 plunges through this gap, beginning with its first dive on April 27.

During the Grand Finale, Cassini will make the closest-ever observations of Saturn, mapping the planet's magnetic and gravity fields with exquisite precision and returning ultra-close views of the atmosphere. Scientists also hope to gain new insights into Saturn's interior structure, the precise length of a Saturn day, and the total mass of the rings -- which may finally help settle the question of their age. The spacecraft will also directly analyze dust-sized particles in the main rings and sample the outer reaches of Saturn's atmosphere -- both first-time measurements for the mission.

"It's like getting a whole new mission," said Spilker. "The scientific value of the F ring and Grand Finale orbits is so compelling that you could imagine a whole mission to Saturn designed around what we're about to do."

#### Getting Into Saturn, Literally

Since the beginning of 2016, mission engineers have been tweaking Cassini's orbital path around Saturn to position the spacecraft for the mission's final phase. They have sent the spacecraft on a series of flybys past Titan that are progressively raising the tilt of Cassini's orbit with respect to Saturn's equator and rings. This particular orientation enables the spacecraft to leap over the rings with a single (and final) Titan

flyby in April, to begin the Grand Finale.

"We've used Titan's gravity throughout the mission to sling Cassini around the Saturn system," said Earl Maize, Cassini project manager at JPL. "Now Titan is coming through for us once again, providing a way for Cassini to get into these completely unexplored regions so close to the planet."

The Grand Finale will come to a dramatic end on Sept. 15, 2017, as Cassini dives into Saturn's atmosphere, returning data about the planet's chemical composition until its signal is lost. Friction with the atmosphere will cause the spacecraft to burn up like a meteor soon afterward.

To celebrate the beginning of the final year and the adventure ahead, the Cassini team is releasing a new movie of the rotating planet, along with a color mosaic, both taken from high above Saturn's northern hemisphere. The movie covers 44 hours, or just over four Saturn rotations.

#### 'A Truly Thrilling Ride'

"This is the sort of view Cassini will have as the spacecraft repeatedly climbs high above Saturn's northern latitudes before plunging past the outer -- and later the inner -- edges of the rings," said Spilker.

And so, although the mission's end is approaching -- with a "Cassini Final Plunge" clock already counting down in JPL mission control -- an extremely

important phase of the mission is still to come.

"We may be counting down, but no one should count Cassini out yet," said Curt Niebur, Cassini program scientist at NASA Headquarters in Washington. "The journey ahead is going to be a truly thrilling ride."

The Cassini-Huygens mission is a cooperative project of NASA, ESA (European Space Agency) and the Italian Space Agency. NASA's Jet Propulsion Laboratory, a division of Caltech in Pasadena, manages the mission for NASA's Science Mission Directorate, Washington. JPL designed, developed and assembled the Cassini orbiter.



## Observatory Update: **NGC 4666**

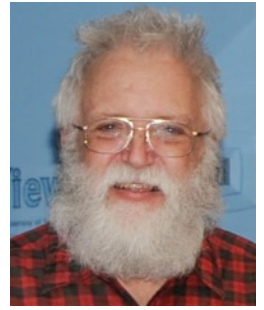
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*Rick Johnson*

NGC 4666 is a very active galaxy though doesn't look it in ordinary light. Seen in X-rays however it is a different story. While not listed at NED as a starburst galaxy it is one. This has resulted in a "super wind" of very hot gasses coming from the core of the galaxy and blowing away from it at high speed. There's a lot on this on the web. One article is here: <https://www.eso.org/public/usa/news/eso1036/> It refers to the galaxy cluster in my annotated image toward the bottom of my image.

What attracted me to it was it was in the 2MFGC as a flat galaxy. It's somewhat unusual for a starburst galaxy to not have much of a central bulge. So I was surprised to find that it was such an active starburst galaxy. While NED classifies it as SABc; I see no bar. Neither does the NGC Project that says it is Sc but Seligman says SBc? again with a bar. Seen rather edge on it is hard to tell who is right. The galaxy was discovered by William Herschel on February 22, 1784. It is in

the original Herschel 400 observing program. Another reason it was on my to-do list. My notes from April 23, 1985 under poor conditions with ground fog using my 10" f/5 says simply: "Highly elongated galaxy, otherwise little noted. Hint of two other galaxies in the field but they are very difficult to see through the fog." I assume those were the other two NGC



galaxies in my image. I was using only 50x due to the conditions. I find distance estimates in published papers running from 60 to 80 million light-years. The latest say 80 so using that I get a size of a bit over 115,000 light-years so a rather large spiral. It is located in Virgo a bit northeast (1.3 degrees) of Porrima (Gamma).

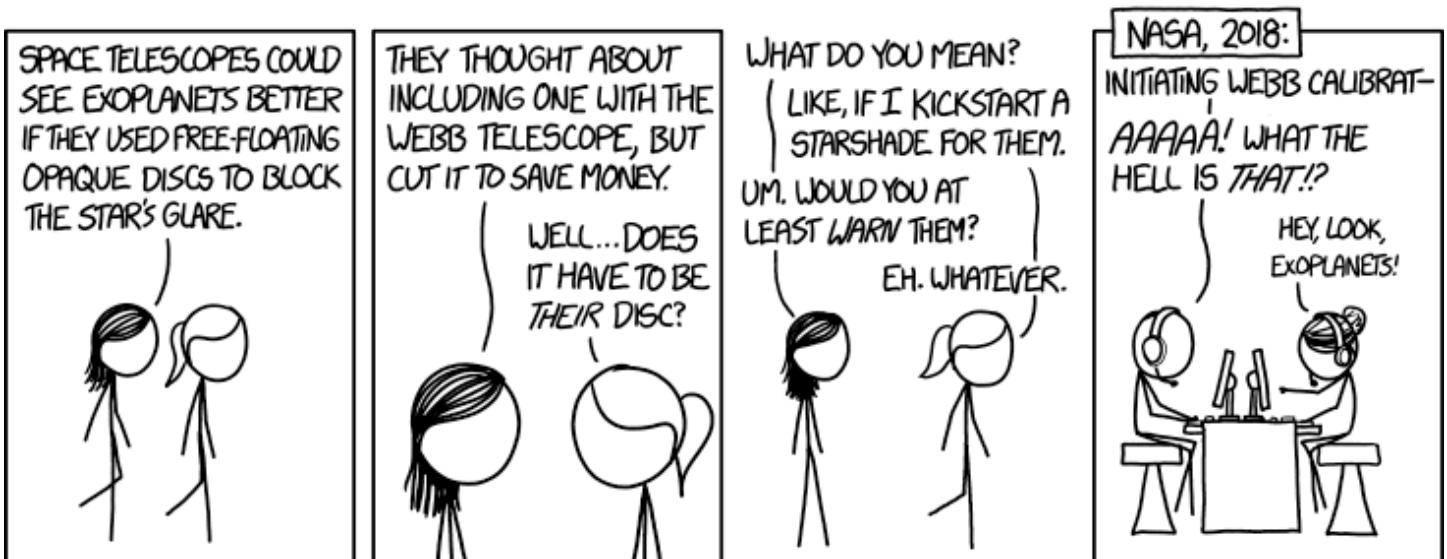
To its southeast is NGC 4668. It is listed as Sb(s)d: by NED though it looks rather disorganized to me. Seligman says SBcd? while the NGC project says SBcd Irr. I can agree to the Irr part. NED shows a star cloud in it as a separate galaxy. I've noted it on the annotated image but am quite sure it is just a star cloud in the galaxy. It was discovered on April 11, 1787 by William Herschel. Apparently he didn't see it when he recorded NGC 4666. It's not in either of the Herschel 400 observing programs. Assuming a 90 million light-year distance it is about 40,000 light-years across, rather typical for this type of galaxy.

The other NGC galaxy in the image is NGC 4653. It too is a William Herschel discovery. He found it on April 11, 1787 the same night as NGC 4668. He scanned by declination letting the earth's rotation bring objects into view. NGC 4653 and 4668 may be just far enough south of 4666 that these weren't in the scan that picked it up. NGC 4653 isn't in either Herschel 400 program. NED classifies it as SAB(rs)cd. The NGC project says simply Sc while Seligman says SBc?. So again there's a disagreement over the galaxy having a bar. This galaxy has a lot of detail but the night I took this image was so poor much of it is lost. Assuming its distance is 140 million light-years I get a size of 113,000 light-years thanks to its faint outer structures.

One distant galaxy to the west of NGC 4666 is ASK 001562.0. At 2.76 billion light-years I can't see much detail. It is listed as being an XBONG galaxy. That is an X-ray Bright Optically Normal Galaxy. Odd but that seems to describe NGC 4666 as well.

Another rather unusual label is found east of NGC 4666, RQQ AGN which stands for a Radio Quiet Quasar. The AGN label is found on most quasars as they are the ultimate active nucleus but since NED included it I did too. Quasar is a short way of saying quasi stellar radio source so a radio quiet one is unusual.

There were quite a few asteroids in the image that I'd normally show but this was taken under very poor transparency, only one showed up enough to point out. That only barely. But most of this spring has had poor transparency so to get anything at all I had to endure it unfortunately. Didn't help that seeing wasn't very good either. Stars are wonky as it was drizzling shortly before this was taken. After it quit due to the short nights of May I didn't wait for the scope to equalize (takes about 30 minutes which I don't have this time of the year being so far north). Tube currents then play havoc with star shapes.



xkcd.com

# Club Offices and Duties

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*Nominations for next year's officers will begin at the September meeting, and remain open until election at the October meeting.*

Club officer nominations are made in September and elections are held in October. The following is a list of responsibilities of each of the officers and what is required to maintain a functioning club.

As stated in the bylaws, the club has five officers: President, Vice President, Secretary, Treasurer and Second Vice President. The business of the club is managed by a Board of Directors. The Board consists of the five elected officers. Each decision of the Board requires an affirmative vote by at least three Board members. The Board can also create additional non-elected offices as required and can initiate impeachment proceedings against officers who have been negligent in performing their duties.

The Prairie Astronomy Club has a fifty year history of service to club members and the community. Potential club officers should have a good understanding of the history of the club, its formation and mission, its relationship with Hyde Observatory and the types of events, activities and outreach that is part of the tradition of the club. The most complete resource is the book *The Prairie Astronomy Club: Fifty Years of Amateur Astronomy*, which is in the club library or available as a PDF document.

## **President**

The President organizes and directs the regular monthly meetings and all other club activities. The President also prepares the meeting agenda and PowerPoint for the meeting.

The President also officially represents the club at meetings at the regional and national level where he/she is in attendance or delegates this authority. The President has the authority to call meetings of the Board and to appoint non-elected officers.

The President should have good communication skills and be comfortable interacting with the media and public, be a good public speaker, be available to do radio and TV interviews and to deliver prepared introductions and remarks at club-sponsored events.

Another duty of the President is the annual club audit. Within 10 days of assuming office, the President must appoint a committee of three club members to perform the audit. The audit must be completed within 45 days of the close of the fiscal year which is October 31.

When assuming office, the President should hold a meeting of the Board to present his/her direction and ideas for the club for the coming year, and appoint any unfilled non-elected positions.

## **Vice President**

The Vice President is responsible for running club meetings and other events in the absence of the President. The VP is also to be the mediator in cases of procedural dispute and must be available to assume the duties of any officer at the direction of the President. The VP also maintains control of the current inventory of all club property.

## **Secretary**

The Secretary handles all Club correspondence, is responsible for the distribution of information received through official club correspondence and is in charge of Club publicity (often the job of Publicity or Outreach Coordinator is delegated to a non-elected member). The Secretary also sends out membership renewal notices and delivers meeting minutes to the newsletter editor. The Secretary is responsible for maintaining an accurate club membership roster. The master copy of the roster is currently maintained on the Night Sky Network website. The bylaws also require publication of the complete roster in the newsletter on an annual basis.

## **Treasurer**

The Treasurer is responsible for all Club funds and for keeping accurate records of all monetary transactions. The Treasurer



must submit a written report of the club's monetary status at the request of the President or give a verbal report at the request of any member during regular meetings. He/she also prepares an annual financial report in November for publication in the newsletter and presentation at the November meeting. The Treasurer is also responsible for all tax filings and reporting requirements, to maintain the club's 501c3 status.

### **Second Vice President (and Program Chair)**

The Second Vice President is responsible for the formation and presentation of the monthly club programs. Ideally the 2nd VP should try to plan ahead six months to one year to build a list of potential presenters or programs. The 2nd VP also sends out email announcements of upcoming programs to the membership, and sends a program description to the newsletter/website editors.

The club usually has several non-elected officers:

The **Publications Chairperson** (or Newsletter Editor) is responsible for editing and publishing the Prairie Astronomer. The newsletter editor may also be the website manager/editor. The newsletter editor should have a good working knowledge of desktop publishing software (and

computers in general), graphics, photo editing, some design and layout experience and some experience with social networking and Internet marketing. The Website editor needs to be familiar with WordPress (or similar CMS software) and HTML, graphics and word processing applications. Ideally the newsletter and website editor(s) should have prior experience with the publication of a newsletter or website, or demonstrated skills. The publications chairperson is also responsible for social networking for the club - posting Facebook and Twitter announcements for club meetings and events.

If the club has an appointed **Outreach Coordinator**, the coordinator takes on some of the roles performed by other officers – organizes outreach events, shares in media communications tasks, puts together flyers, etc.

The **Club Librarian** (often the Vice President) manages the club library. He/she keeps a current bibliographic listing of all Club library material including the archive of all back issues of The Prairie Astronomer. The Club Librarian and Secretary work together to maintain a record of club activities and regularly update the official club history.

The **Observing Chairman** presents a monthly report at Club meetings and/or in the Prairie Astronomer. He/she keeps members informed of upcoming celestial events, sky objects of special interest and star parties.

The **Recording Secretary** (often the Club's elected Secretary) is responsible for keeping the minutes of the club meetings and filing a copy with the Club Secretary. Minutes need to be kept in a systematic fashion as they record the history and life of the club and need to be published in the Prairie Astronomer on a monthly basis.

The **Site Chairperson** (if one is appointed) is responsible for establishing a site committee to oversee the maintenance and security of the club observing site.

While not a requirement of the bylaws, all club officers and appointees should have good computer and social media skills, should be accessible and responsive via email and phone.

# October Observing: What to View

Jim Kvasnicka

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

## Planets

**Venus:** Low in the southwest after sunset at magnitude -4.0.

**Saturn:** At magnitude 0.5 NNE of Antares.

**Mars:** Starts October at magnitude 0.4 in Sagittarius just below M8, the Lagoon Nebula.

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

**Mercury / Jupiter:** Only Mercury is visible in the dawn sky to start the month with Jupiter becoming visible around October 8<sup>th</sup>.

## Messier List

**M11:** The Wild Duck Cluster in Scutum.

**M16:** Open Cluster (Eagle Nebula) in Serpens.

**M17:** Omega or Swan Nebula in Sagittarius.

**M18:** Open cluster in Sagittarius.

**M24:** The Small Sagittarius Star Cloud.

**M25:** Open Cluster in Sagittarius.

**M26:** Open cluster in Scutum.

**M55:** Class XI globular cluster in Sagittarius.

**M75:** Class I globular cluster in Sagittarius.

**Last Month:** M13, M14, M22, M28, M54, M69, M70, M92

**Next Month:** M27, M30, M56, M57, M71, M72, M73

## NGC and other Deep Sky Objects

**NGC 7009:** Saturn Nebula in Aquarius.

**NGC 7293:** Helix Nebula in Aquarius (use an OIII filter).

**NGC 7331:** Galaxy in Pegasus, brightest member of the Deer Lick Group.

**NGC 7332/7339:** Pair of edge on galaxies in Pegasus.

**NGC 7479:** Galaxy in Pegasus.

**NGC 7814:** Galaxy in Pegasus.

**NGC 40:** Bow-Tie Nebula in Cepheus.

## Double Star Program List

**8 Lacerta:** Four white stars.

**Beta Cephei:** White primary with a blue secondary.

**Struve 2816:** White primary with two blue stars in Cepheus.

**Xi Cephei:** Yellow pair.

**Delta Cephei:** Yellow and pale blue stars.

**Eta Persei:** Bright yellow and light blue stars.

**Struve 331:** White primary with a blue-white secondary.

**Epsilon Pegasi:** Yellow and white pair.

## Challenge Object

**NGC 7769/7770/7771:** NGC 7769 is the brightest member of a trio of galaxies in Pegasus.



# Focus on Constellations: Pegasus

Jim Kvasnicka

Pegasus the Winged Horse is upside down with only the front half of the horse appearing in the sky. The body of Pegasus is marked by the four stars of the Great Square of Pegasus making the constellation easy to find. The NE star of the Great Square, Alpheratz, is shared by Andromeda. Pegasus contains 1,121 square degrees making it the seventh largest constellation. Even though it is big it is rather poor in objects because it is off the Milky Way. Pegasus contains one Messier object in M15, a bright globular cluster. Like most off the Milky way constellations Pegasus has quite a few galaxies. Most of the galaxies are small and faint; requiring dark skies and moderate aperture to see. The constellation Pegasus is best seen in October.

## Showpiece Objects

**Globular Clusters:** M15

**Galaxies:** NGC 7331, NGC 7332, NGC 7479, NGC 7814

## Mythology

Pegasus was the winged horse of Greek Mythology. When Perseus cut the head off of the Medusa some of the blood fell into the sea and mixed with the sea foam. From this mixture sprang Pegasus the Winged Horse. Because sea foam is always white Pegasus is always shown as being white. Perseus mounted the mighty Pegasus and was riding the winged horse when he rescued the princess Andromeda from the Sea Monster Cetus.

## Number of Objects Magnitude 12.0 and Brighter

**Galaxies:** 18

**Globular Clusters:** 1

**Open Clusters:** 3

**Planetary Nebulae:** 2

**Dark Nebulae:** 0

**Bright Nebulae:** 0

**SNREM:** 0





# September Outreach

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Jim Kvasnicka

September was a busy outreach month for PAC with request to help at three different outreach events. Having three outreach events in one month is somewhat unusual, but what made this even more unusual is that all three events were on the same night! I didn't know if we could cover three events on the same night. I discussed the three events at the August PAC meeting when we reviewed upcoming events. I asked for PAC members to step up and help and I'm proud to say that PAC was able to cover these three outreach events all on the

same night. This says a lot about our members and their willingness to help and share with the public their love of astronomy.

I would like to give a big thank you to all the club members who volunteered to help on September 10<sup>th</sup> at these three events.

## Wild Wood Star Party – Nebraska City

Dan Delzell, Bob Kacvinsky, and Mike Kearns

## Boy Scout Event – Homestead National Monument, Beatrice

Rick Brown, Beth Jenckes, Scott Bohaty, Dave Knisely, and John Lammers

## Girl Scout Event – Lincoln

Dave Churilla and Jim Kvasnicka

Our next scheduled outreach event is the Howling Homestead on October 29<sup>th</sup> at the Homestead National Monument near Beatrice.

**The Great American Total Eclipse  
August 21, 2017**



Planning your eclipse trip? Take a look at Fred Espenak's presentation on YouTube:

<https://www.youtube.com/watch?v=K4KnxE6yAul>

# One Incredible Galaxy Cluster Yields Two Types of Gravitational Lenses

This article is provided by NASA Space Place.

With articles, activities, crafts, games, and lesson plans, NASA Space Place encourages everyone to get excited about science and technology. Visit [spaceplace.nasa.gov](http://spaceplace.nasa.gov) to explore space and Earth science!

Ethan Siegel



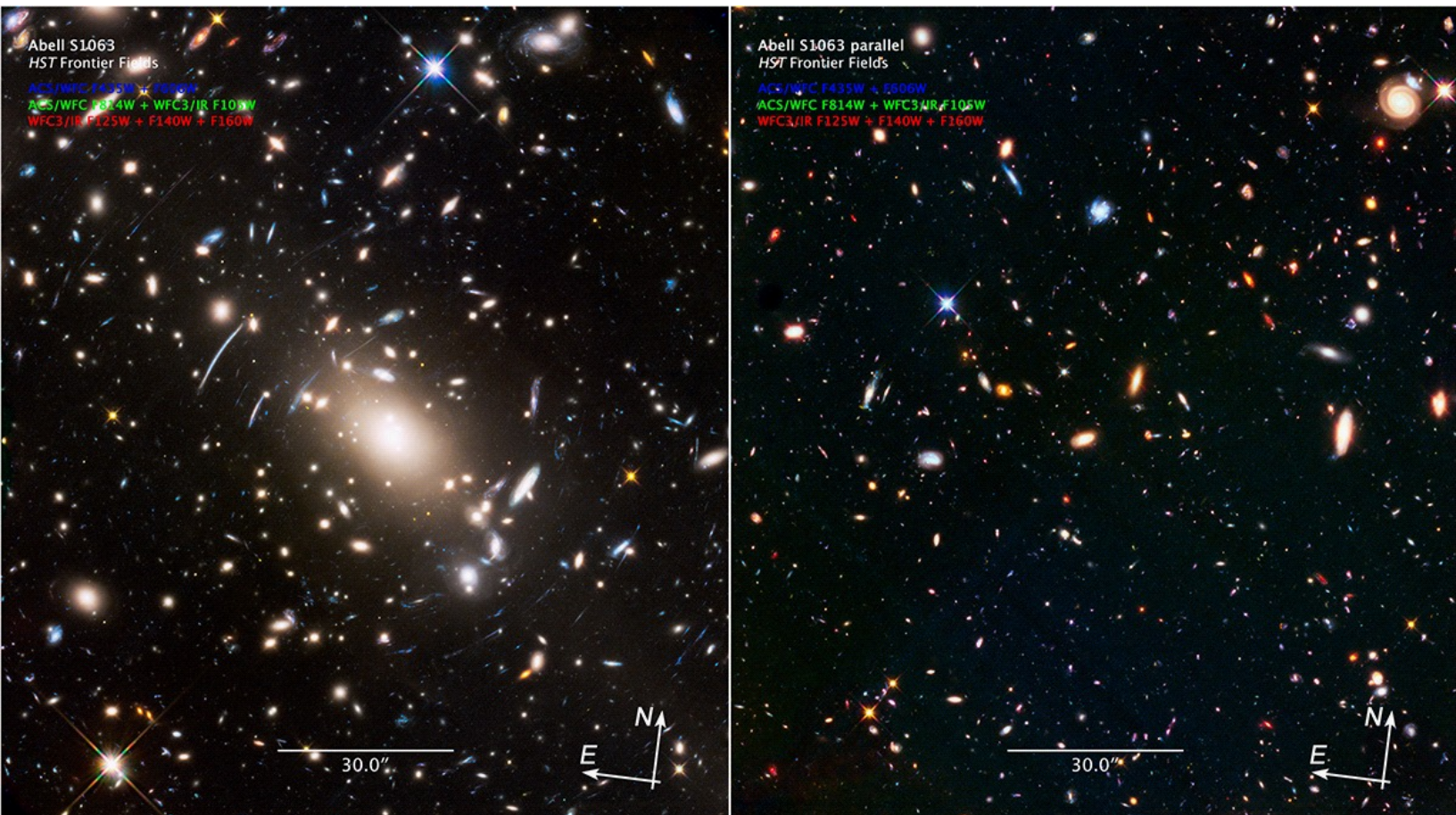
There is this great idea that if you look hard enough and long enough at any region of space, your line of sight will eventually run into a luminous object: a star, a galaxy or a cluster of galaxies. In reality, the universe is finite in age, so this isn't quite the case. There are objects that emit light from the past 13.7 billion years—99 percent of the age of the universe—but none before that. Even in theory, there are no stars or galaxies to

see beyond that time, as light is limited by the amount of time it has to travel.

But with the advent of large, powerful space telescopes that can collect data for the equivalent of millions of seconds of observing time, in both visible light and infrared wavelengths, we can see nearly to the edge of all that's accessible to us.

The most massive compact,

bound structures in the universe are galaxy clusters that are hundreds or even thousands of times the mass of the Milky Way. One of them, Abell S1063, was the target of a recent set of Hubble Space Telescope observations as part of the Frontier Fields program. While the Advanced Camera for Surveys instrument imaged the cluster, another instrument, the Wide Field Camera 3, used an optical trick to image a



Galaxy cluster Abell S1063 (left) as imaged with the Hubble Space Telescope as part of the Frontier Fields program. The distorted images of the background galaxies are a consequence of the warped space dues to Einstein's general relativity; the parallel field (right) shows no such effects. Image credit: NASA, ESA and Jennifer Lotz (STScI)



parallel field, offset by just a few arc minutes. Then the technique was reversed, giving us an unprecedentedly deep view of two closely aligned fields simultaneously, with wavelengths ranging from 435 to 1600 nanometers.

With a huge, towering galaxy cluster in one field and no comparably massive objects in the other, the effects of both weak and strong gravitational lensing are readily apparent. The galaxy cluster—over 100 trillion times the mass of our sun—warps the fabric of space. This causes background light to bend around it, converging on our eyes another four billion

light years away. From behind the cluster, the light from distant galaxies is stretched, magnified, distorted, and bent into arcs and multiple images: a classic example of strong gravitational lensing. But in a subtler fashion, the less optimally aligned galaxies are distorted as well; they are stretched into elliptical shapes along concentric circles surrounding the cluster.

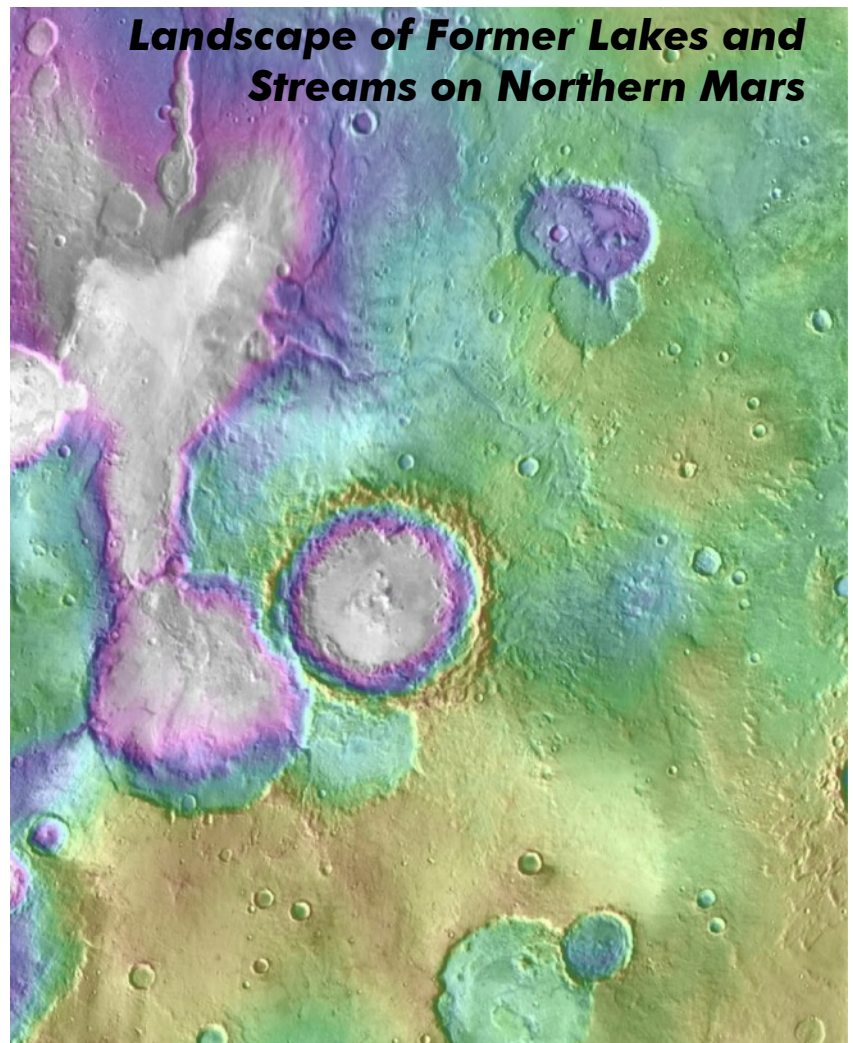
A visual inspection yields more of these tangential alignments than radial ones in the cluster field, while the parallel field exhibits no such shape distortion. This effect, known as weak gravitational lensing, is a

very powerful technique for obtaining galaxy cluster masses independent of any other conditions. In this serendipitous image, both types of lensing can be discerned by the naked eye. When the James Webb Space Telescope launches in 2018, gravitational lensing may well empower us to see all the way back to the very first stars and galaxies.

If you're interested in teaching kids about how these large telescopes "see," be sure to see our article on this topic at the NASA Space Place: <http://spaceplace.nasa.gov/telescope-mirrors/en/>

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*Valleys younger than better-known ancient valley networks on Mars are evident on the landscape in the northern Arabia Terra region of Mars, particularly in the area mapped here with color-coded topographical information overlaid onto a photo mosaic. The area includes a basin informally named "Heart Lake" at upper left (northwest). Data from the Mars Orbiter Laser Altimeter (MOLA) on NASA's Mars Global Surveyor orbiter are coded here as white and purple for lower elevations, yellow for higher elevation. The elevation information is combined with a mosaic of images from the Thermal Emission Imaging System (THEMIS) camera on NASA's Mars Odyssey orbiter, covering an area about 120 miles (about 190 kilometers) wide. The mapped area is centered near 35.91 degrees north latitude, 1 degree east longitude on Mars. These lakes and streams -- also shown on a hydrologic modeling map at PIA20839 -- held water several hundred million years after better-known ancient lake environments on Mars, according to 2016 findings.*





## Mars Rover Views Spectacular Layered Rock Formations

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The layered geologic past of Mars is revealed in stunning detail in new color images returned by NASA's Curiosity Mars rover, which is currently exploring the "Murray Buttes" region of lower Mount Sharp.

The new images arguably rival photos taken in U.S. National Parks.

Curiosity took the images with its Mast Camera (Mastcam) on Sept. 8. The rover team plans to assemble several large, color

mosaics from the multitude of images taken at this location in the near future.

"Curiosity's science team has been just thrilled to go on this road trip through a bit of the American desert Southwest on



Mars," said Curiosity Project Scientist Ashwin Vasavada, of NASA's Jet Propulsion Laboratory, Pasadena, California.

The Martian buttes and mesas rising above the surface are eroded remnants of ancient sandstone that originated when winds deposited sand after lower Mount Sharp had formed.

"Studying these buttes up close has given us a better understanding of ancient sand dunes that formed and were buried, chemically changed by groundwater, exhumed and eroded to form the landscape that we see today," Vasavada said.

The new images represent Curiosity's last stop in the Murray Buttes, where the rover has been driving for just over one month. As of this week, Curiosity has exited these buttes toward the south, driving up to the base of the final butte on its way out. In this location, the rover began its latest drilling campaign (on Sept. 9). After this drilling is completed, Curiosity will continue farther south and higher up Mount Sharp, leaving behind these spectacular formations.

Curiosity landed near Mount Sharp in 2012. It reached the base of the mountain in 2014 after successfully finding evidence on the surrounding

plains that ancient Martian lakes offered conditions that would have been favorable for microbes if Mars has ever hosted life. Rock layers forming the base of Mount Sharp accumulated as sediment within ancient lakes billions of years ago.

On Mount Sharp, Curiosity is investigating how and when the habitable ancient conditions known from the mission's earlier findings evolved into conditions drier and less favorable for life.

For more information about Curiosity, visit:

<http://mars.jpl.nasa.gov/msl>



*This view from the Mast Camera (Mastcam) in NASA's Curiosity Mars rover shows an outcrop with finely layered rocks within the "Murray Buttes" region on lower Mount Sharp.*

*The buttes and mesas rising above the surface in this area are eroded remnants of ancient sandstone that originated when winds deposited sand after lower Mount Sharp had formed. Curiosity closely examined that layer -- called the "Stimson formation" -- during the first half of 2016, while crossing a feature called "Naukluft Plateau" between two exposures of the Murray formation. The layering within the sandstone is called "cross-bedding" and indicates that the sandstone was deposited by wind as migrating sand dunes.*

*The image was taken on Sept. 8, 2016, during the 1454th Martian day, or sol, of Curiosity's work on Mars.*



# From the Archives: September, 1971

- - THE PRAIRIE ASTRONOMER - -

The meeting this month will be held in Olin Science Hall at Nebraska Wesleyan University at 7:30 p.m. Two important items on the agenda this time are club elections, and Prof. Moore's first lecture in his adult series on the motions of the planets. Don't miss this meeting; it'll be one of our best.

\* \* \* \* \*

## --The President's Report--

The summer milky way is especially brilliant on these crisp and clear September evenings. It also is well located as it stretches from Perseus in the northeast through Cygnus directly overhead, and on beyond Sagittarius in the southwest.

Many an evening, after looking at some of the choice deep sky objects in my telescope, I just lie back on the lawn and gaze at the majestic expanse above me. At times I look at the summer triangle of Vega, Deneb, and Altair and try to imagine some depth of vision of those three stars and the milky way beyond them. If one really wanted a 3-D view of this scene, he would have to have a separation of at least 100 astronomical units between his eyes. Since this is impossible, I just try to think of Altair as being 16 light years away, Vega at 26 LY, and Deneb at 1000-1500 LY with the milky way reaching to some 50,000 LY or so in the distant background.

Even with all these facts and figures in mind, the stars in the sky all seem to be the same distance away, as if they all were fastened to the surface of some kind of transparent sphere and the milky way at a considerable distance beyond.

I have now considered an experiment, although untried, which would bring this whole thing down to a more realistic scale. Just let one foot represent a light year. Then take some tiny flashlights and drive out to a choice location a few miles north of Lincoln where most of the city lights can be seen from a hilltop. The city lights stretching from southeast to southwest would be the milky way at some 2 - 10 miles, or 10,000 to 50,000 feet distance. There should be no trouble finding one of those 1000 watt farmyard lights. Go about  $\frac{1}{4}$  mile north of it (1300 feet) and there you have Deneb. Now place a 4-cell flashlight 26 feet away from you and a pen light 16 feet away and these would represent Vega and Altair respectively. With the two flashlights in the proper positions and the farmyard light and the city lights in the background, you should get some idea of the depth of field of the summer triangle and the milky way. Of course, don't expect to see anything like what's really in the sky, but it should give a little better 3-D effect.

I don't expect everyone to rush out on some hilltop overlooking Lincoln scattering flashlights around in a farm field and then standing there watching it all. In fact, if you actually do decide to try this, perhaps discretion might be in order. If someone witnessed this kind of activity, it might take an awfully lot of explanation to the authorities as to why you shouldn't be locked up.

However, just to visualize an experiment like this should help one get a better perspective of the depth of field of the summer triangle and the milky way. The real thing still wins the cigar in any contest though, I think we'll all agree.

---Earl Moser



## CLUB MEMBERSHIP INFO

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):



Shop through Amazon Smile to automatically donate to PAC:



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