The Prairie Astronomer

February 2017 Volume 58, Issue #2

February Program: Illuminating Our Neighborhoods

SH2-188 by Rick Johnson

Night Sky Network

The Newsletter of the Prairie Astronomy Club

The Prairie Astronomer

NEXT PAC MEETING: February 28, 7:30pm

At Hyde Observatory

PROGRAM

"Illuminating Our Neighborhoods".
With an assist from the International Dark-Sky Association our February program will reacquaint us with the issues municipalities face when planning outdoor illumination schemes. By replacing the familiar mercury and high pressure sodium lamps with energy efficient light emitting diodes (LEDs) new neighborhoods can benefit from what is perceived to be an upgrade. However, there are trade offs and the impact to astonomical observing near such light sources can be significant. Join us and you too will be in the know.

FUTURE PROGRAMS

Tentative:

March: Eclipse planning
April: How to Photograph an Eclipse
May: Club Dinner
June: Solar Star Party - and eclipse prep for public
July: NSP - no club meeting
August: NSP & Eclipse review
October: Club viewing night at Hyde
November: How to Buy a Telescope

Buy the book! The Prairie Astronomy Club: Fifty Years of Amateur Astronomy.
Order online from Amazon or lulu.com.

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EVENTS

PAC Meeting
Tuesday February 28, 2017, 7:30pm
Hyde Observatory

Newsletter submission deadline March 18

PAC Meeting
Tuesday March 28, 2017, 7:30pm
Hyde Observatory

PAC Meeting
Tuesday April 25, 2017, 7:30pm
Hyde Observatory

2017 STAR PARTY DATES

Photo by Brian Sivill

	Star Party Date	Star Party Date	Lunar Party Date
January	Jan 20th	**Jan 27th**	
February	Jan 17th	**Feb 24th**	
March	Mar 17th	**Mar 24th**	
April	Apr 21st	**Apr 28th**	
May	May 19th	**May 26th**	May 5th
June	Jun 16th	**Jun 23rd**	Jun 30th
July	Jul 14th	**Jul 21st**	
NSP	**July 23rd - July 28th**		
August	**Aug 18th**	Aug 25th	
September	Sep 15th	**Sep 22nd**	Sep 1st
October	Oct 13th	**Oct 20th**	
November	Nov 10th	**Nov 17th**	
December	Dec 15th	**Dec 22nd**	

Dates in **BOLD** are closest to the New Moon.

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Boller-Sivill Observatory - Construction Update

Brian Sivill and Brett Boller

Last month at the Branched Oak Observatory and the Boller-Sivill Observatory we completed considerable work on our solar-powered electrical system. Until recently, our solar charging and power distribution had been largely temporary in nature. We now have two complete power delivery systems installed: a 12v DC system, and a 120v AC system. The newly-installed 120v circuit breaker panel is supplied by by a 1000 watt inverter which powers all of BSO's computer and network hardware. Eventually, we'll need a second (or larger) inverter, but this will cover our 120v needs for some time. A 12v circuit breaker panel was installed powering all of our LED lighting and supplies the telescopes. Both systems are powered by a new battery array comprised mostly of 6v golf cart batteries donated by Brett's friend, Stan Houlden. And of course, the battery array is recharged by 100% clean sunshine from our solar panel array. New solar panels will soon be ordered to replace these older generation types we're using. The new panels will increase our charging power five-fold

A few weeks ago a volunteer crew pre-assembled Branched Oak Observatory's 15 foot dome in Doug Buhrman's shop. This was a test run to see what will be needed for final assembly on site. The dome looks great assembled and appears to have all of the pieces and parts needed. Soon, B.O.O. will have a shiny, beautiful astronomy dome!

The big news from this last weekend: We installed Michael Sibbernsen's 7 inch Maksutov-Cassegrain telescope on one of the remaining concrete piers. So we now have three operational telescopes in the Boller-Sivill roll-off. Two are mounted on piers while one SCT still resides on a tripod. We've had a number of exciting star parties at BOO/BSO recently, and we're all looking forward to milder weather and more astronomy.

Astrophotography

Moon completely enters Earth's Penumbra. 6:44PM Feb. 10 2017. Michael Sibbernsen. Nikon D7000. Sigma 500 APO Lens. f6.3 1/40sec. Taken from Papillion, Nebraska through a thin layer of clouds.

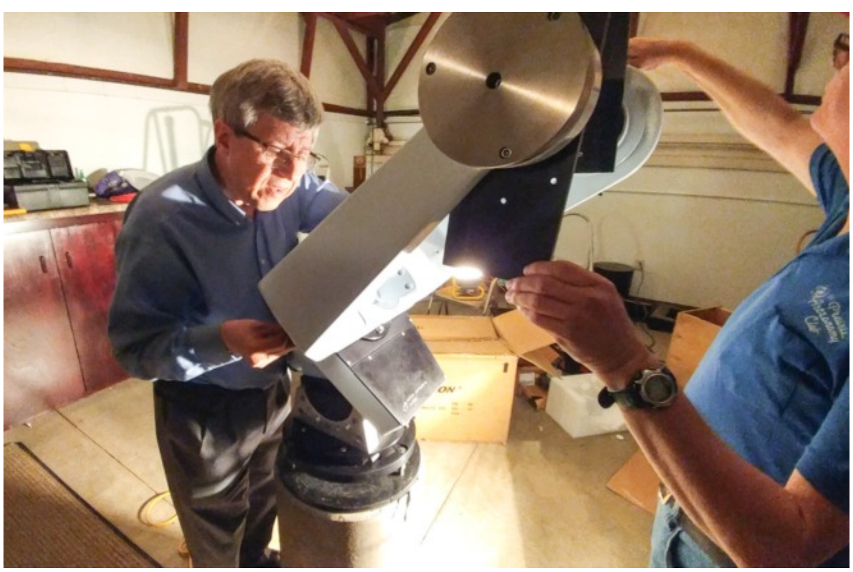
The Moon and Venus, January 30, 2017.

Nikon D600, 50mm f/1.8 Nikkor lens, ISO 100 0.4 seconds at f/3.5

Mark Dahmke

Hyde Observatory's New Telescope

Dave Knisely, Ron Veys and Mark Dahmke started assembly of the Mathis Instruments fork mount on Wednesday, February 15th.



Cover Photo

Rick Johnson

The planetary SH2-188 looks much like the Medusa Nebula though you'll see no blue in it. But the real clue that something different is going on here is that the "white" dwarf is not in the center of the arc as it is in the Medusa Nebula. The arc is very close to the star. It is the faint blue star near the rather obvious orange star well down and left of center. Near the center there is a bright blue star but that is not related to the nebula. So how did the central star get so far off of center? The best idea to date is that this is a runaway star. At one time it was a member of a binary star system. That star, long long ago, blew itself up nearly completely. It didn't leave a neutron star or black hole. The companion star was then flung into space by its orbital velocity much as letting David's sling release its stone. Now this rather normal star was hurtling through space. It couldn't make a nice hole in the interstellar medium as it was plowing through it at high speed. When this star eventually turned into a white dwarf and lets its outer shell puff off the shell immediately ran into the interstellar gases. While both are less dense than the best vacuum we can create in our labs there was almost immediately a collision but a very lopsided one as the gasses from the opposite side of the shell were running away from the interstellar gasses so no collision could occur to any extent. The bubble was free to expand unbothered by the dust and gas between stars to the upper right but toward the lower left, the direction the star was moving at high speed, the collision immediately slowed down the shell given off by the central star preventing it from getting very far away from its source. This very violent collision makes the red arcs you see. Notice the brightest parts of the nebula are at the point of collision. The central star in this nebula is just too weak to cause the gases to glow blue so none is seen. Note the odd stuff in the lower left corner are due to bright blue and yellow stars just off the edge of the CCD and aren't real objects, just ghosts created when a bright star hits the very edge of the glass protecting the CCD. Some are available without the glass and don't have this problem but mine isn't available without a cover so this happens every now and then. If you want some deep reading on the nature of this object and how it was formed go to: https://arxiv.org/pd...h/0512028v1.pdf

Dr. Kate Russo - Eclipse Chaser

Jack Dunn

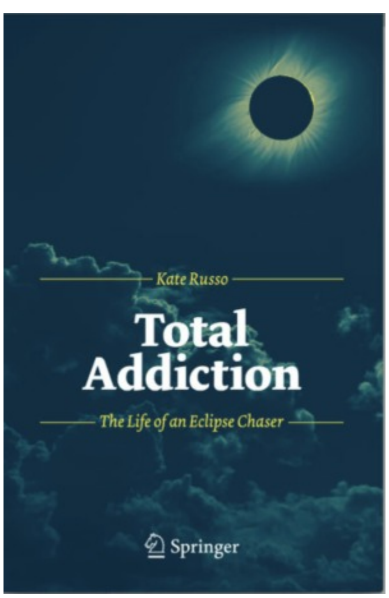
Dr. Kate Russo is an internationally recognized author and eclipse chaser. She is also a Ph.D. psychologist whose specialty is studying the human reactions and reflections regarding the eclipse experience of totality. Dr. Russo grew up in Australia and now resides in Belfast, Northern Ireland. She has several books on eclipse chasing, most notably: "Total Addiction" which is available from Amazon. Dr. Russo will be crossing the US following the path of the August total solar eclipse giving presentations and workshops. The trip will begin around the end of May or beginning of June in South Carolina and proceed all along the path.

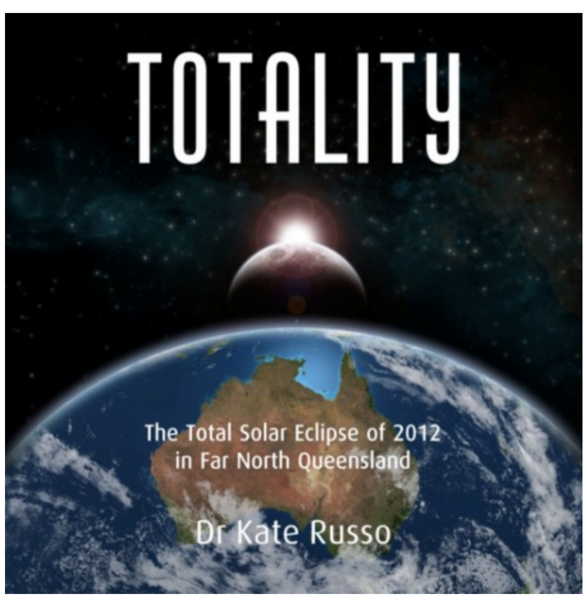
Arrangements are being made to hopefully bring Dr. Russo to Lincoln to give a presentation on the eclipse as part of the recognition of Hyde Observatory's 40th anniversary year. Once her trip along the path is finished, she will be settling into a local community to study that community and its citizens as they experience totality and also the reactions of people to being the center of interest before the event and the repercussions afterwards. This work will be part of another book she has already started. Here is a passage from Dr. Russo's book which I particularly like because often people outside of astronomy will ask: "so what's the big deal about seeing a total eclipse of the Sun?"

"Most people are familiar with the image of the Sun in total eclipse - the black disc with the delicate blue-white of the corona streaming out from behind. However, pictures do not, and cannot convey the beauty , the eeriness and the feel of totality. Nothing you read, see or hear can prepare you for the spine-tingling , goosebump-inducing, experience of the two most familiar heavenly bodies

dramatically crossing paths, turning day momentarily into night. The eerie twilight that confuses birds and other animals and, at times, humans is like no other experience you have ever had. It is impossible to be a passive observer. You do not simply see a total eclipse. You experience it. You are immersed in it. You are completely overwhelmed by it." - Dr. Kate Russo from "Total Addiction."

Dr. Russo's website is www.beingintheshadow.com



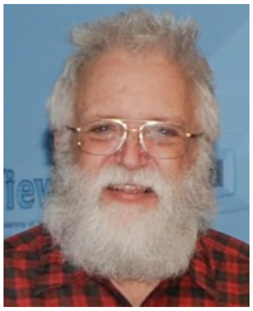


Observatory Update: NGC 7437

Rick Johnson

NGC 7437 is a face on, low surface brightness ring galaxy. Or is it a ring galaxy? Though the ring is not obvious visually it meets the requirements some say. It is classified as SAB(rs)d by NED and SAB(rs)c: by a paper detailing such ring galaxies. While the paper is rather deep reading and 160 pages long it does have a diagram detailing the ring structure on Page 141. http://www.aanda.org/articles/aa/pdf/2014/02/aa21633-13.pdf Not all sites even recognize the bar let alone the ring with the NGC project saying it is Sc and Seligman saying Scd?

Other than this paper I found little on this rather faint galaxy. It was discovered by Lewis Swift on October 31, 1885 and is located in Pegasus just southwest (1.8 degrees) of Markab that marks the southwest corner of the great square and start of the horse's neck. Visually it is quite faint in a 17" scope so not an easy target. It was fainter than I expected needing at least three or four times the exposure time I gave it.



There are a lot of galaxies in my annotated image at about 1.2 billion light-years. While there are several galaxy clusters in my image, including one at about that distance it has no size while these galaxies at the 1.2 billion light-year distance are seen across my image it appears there are more at that

distance than the cluster can account for with a count of just 21 with much of the cluster obviously below my frame. A couple other clusters are at about 2 billion light-years but I found few individual galaxies at this distance that at about 1.2 billion light-years.

In the upper right quadrant is the spiral galaxy ASK 143213.0 at 2.05 billion light-years. It is so large I can resolve spiral arms in it at that distance. I measure its diameter at 196,000 light-years. That is one huge spiral.

Near the left edge and above center is a galaxy I've labeled as AGN at 3.89 billion light-years. NED actually lists it as a quasar but it is obviously elongated southeast to northwest and therefore not a point source as a quasar usually is.

This marks my move into December images. Though it wasn't my first December image attempt, the first night's data shows severe issues with clouds and possibly a failing camera making processing them nearly impossible. Even if I did I'd have such poor results I'd have to retake them next year anyway. So I doubt I'll try and process that first night's work.

Solar Eclipse Science: Testing General Relativity

Source: *NASA Website*

[Editor's note: if you've never seen a total eclipse before, don't try to do science, just watch it and enjoy!

This type of project is very difficult to do unless you have an expensive astrograph with minimal distortion. Also Rick Johnson said that it would be difficult to calculate the centroid of a star using only Photoshop. However the article was interesting and thought I'd include it in the newsletter.]

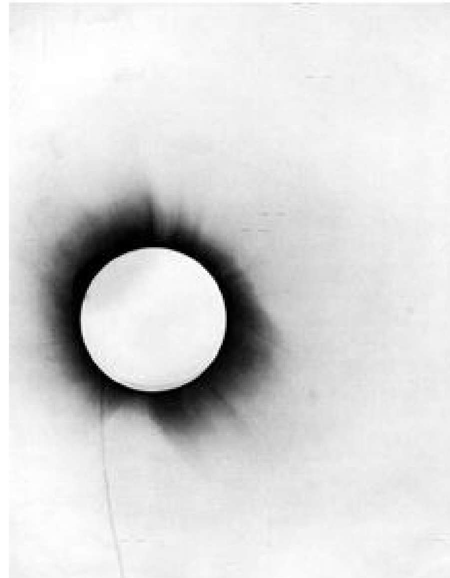
On May 29, 1919, Einstein's four-year-old Theory of General Relativity was put to its first test during a total solar eclipse. By measuring how the images of stars shift when the sun is close-by, and with a lot of care, you might be able to repeat this famous test from nearly 100 years ago.

For the 1919 eclipse, only a few stars (identified by the marks in the photo shown here) were visible on the photograph through the glare of the bright solar corona. The photo was large enough to cover both the eclipsed solar disk and the surrounding stars within 1.5 degrees of the sun. Even so, the measurement was at the very limit of what could be done given atmospheric distortion, star twinkling, and the unfavorable scale of the image for making such a precise measurement.

What is General Relativity?

Einstein's theory proposes that gravity is not an actual force, but is instead a geometric distortion of spacetime not predicted by ordinary Newtonian physics. The more mass you have to produce the gravity in a body, the more distortion you get. This distortion changes the trajectories of objects moving through space, and even the paths of light rays, as they passes close-by the massive body. Even so, this effect is very feeble for an object as massive as our own sun, so it takes enormous care to even detect that it is occurring!

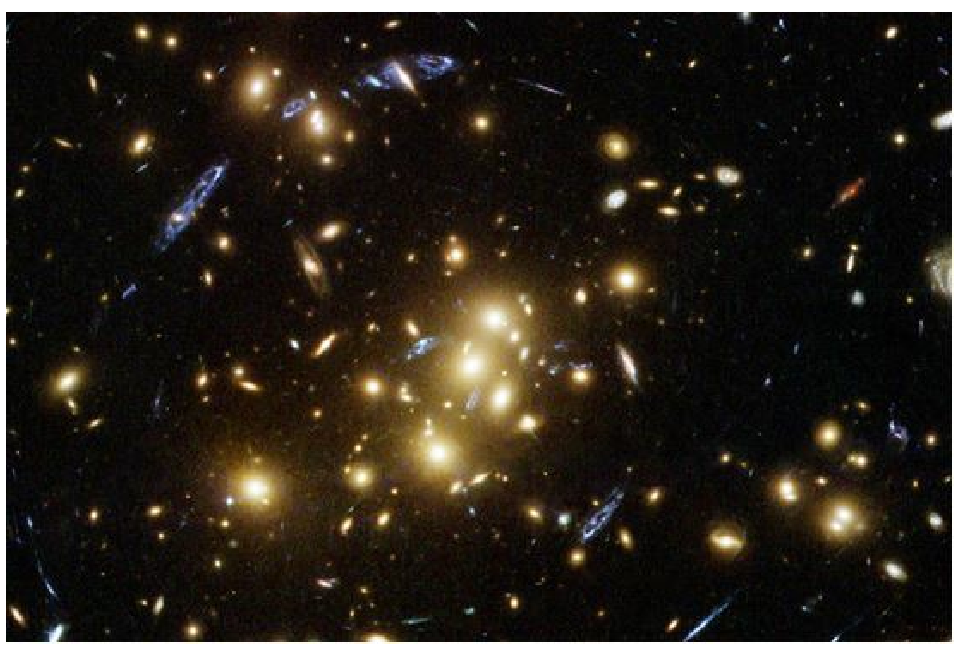
General Relativity predicts how much of this bending of light you should see given the mass of the object. Called 'gravitational lensing' it has been detected on the cosmological scale as entire clusters of galaxies distort the light from more distant galaxies behind them as this image from the Hubble Space Telescope shows.



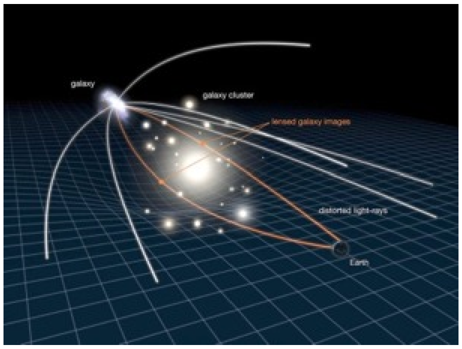
Eddington photo of 1919 eclipse for testing general relativity

Credit: Philosophical Transactions of the Royal Society of London. (1920)

The blue objects are the image of a single, more distant, spiral galaxy that has been lensed by the multiple gravitational fields in the foreground cluster of



galaxies. The cluster, called CL0024 1654, is located 4 billion light years away towards the constellation Pisces.



Gravity distorts space near a massive object

Credit: NASA/ESA

Einstein published his theory and predictions in 1915, and in 1919 the British physicist Sir Arthur Eddington took advantage of a total solar eclipse to attempt to detect the shifting images of stars near the limb of the sun. The problem was that during totality the sky does not get perfectly dark, and only a handful of stars were visible near the sun from which to make the measurement.

The basic idea is that you have to compare the positions of the stars before the sun arrives at its sky position at totality, and during the eclipse when the sun is present. The star images should appear to shift outwards from their normal sky position, but the amount is very slight and hard to measure. It amounts to only about an astronomical 'second of angular arc' or 1/3600 of a degree. The entire diameter of the sun is about 1800 arcseconds to give you a sense of scale. Also, stars twinkle and this smears out the image of a star over a scale of about an arcsecond as well.

So, how do we do it?

The precise formula for the starlight deflection is given by

$$\text{Theta} = \frac{4\ G\ M}{c^2\ R} \quad \text{radians}$$

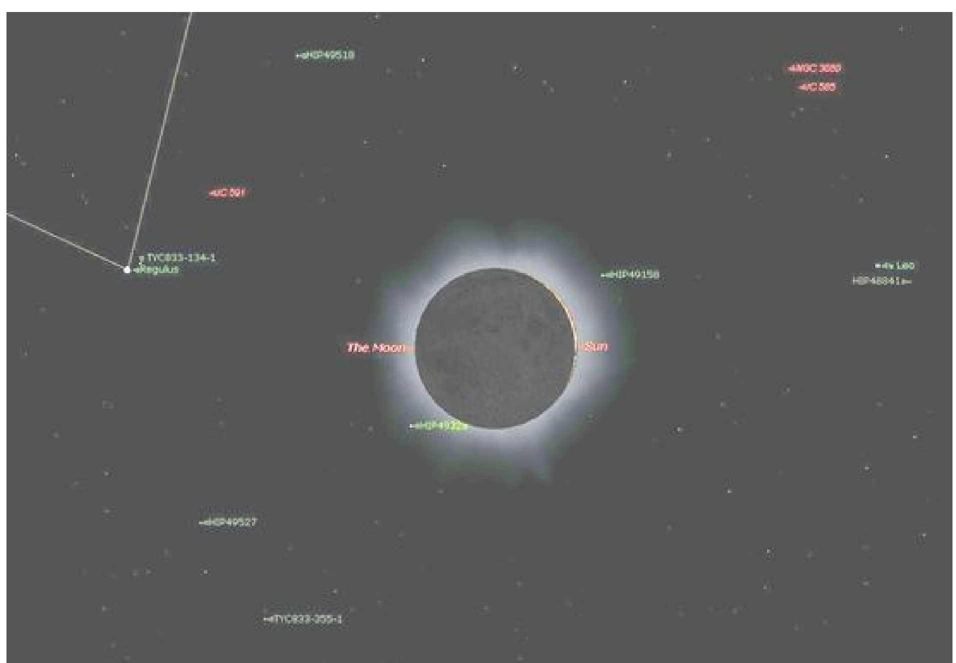
where for the sun we have M = 2×10^{30} kg, G is the constant of gravity of 6.67×10^{-11}, c is the speed of light 3×10^{8} meters/sec, and R is the distance between the light ray and the center of the sun in meters. If we plug-in the numbers and use the fact that 1 radian = 206265 arcseconds, we get for a radius of the sun of R = 6.9×10^{8} meters,

Theta = 206265 (4)(6.67×10^{-11})(2×10^{30})/(3×10^{8})2 (6.9×10^{8}) = 1.75 arcseconds.

In fact, as viewed from Earth, if we use the observed radius of the sun as a unit of measure, as we double the distance of the star from the center of the sun, the deflection decreases by ½. At three times the sun's radius, the deflection is 1/3 as large or 0.6 arcseconds. What helps with the observation is that the deflection only occurs along the line connecting the star with the center of the sun. There is no 'sideways' component to the effect for a point-source like a star.

So to measure the deflection of the star's images due to relativity, we just need to compare the positions of stars far from the disk of the sun at totality, with the positions of the target stars closest to the sun at the time of totality. The farther-away stars should not change their positions by very much compared to the close-in target stars. These more-distant stars will then will serve as a frame of reference for the undisturbed geometry of space near the sun.

What will the sky surrounding the eclipse look like at the time of totality? Will there be many



stars close to the sun that you can measure? This will determine whether you have enough star deflection measurements from which to detect the shift! Here is what the sky will look like near the sun at totality, for the sun located at Right Ascension 10hours 03minutes and Declination +11degrees 56minutes in the constellation Leo. The viewing location for the simulated sky scene image is near Carbondale, IL. (Credit: TheSky software).

The eclipse will take place not far from the bright star Regulus in the constellation Leo. As you can see from this figure, there are quite a few stars near the limb of the sun, but these stars are between magnitudes of +7 and +10. This means they are between 3 and 40 times fainter than the faintest naked-eye stars you can easily see at night from a clear location. Only Regulus will be easily seen during totality without a telescope, but at its distance from the sun, which amounts to a projected distance of 5.3 solar radii, its image will only shift by about 1.75/5.3 = 1/3 arcseconds. The many fainter stars such as HIP49158 will show a much larger deflection of over 1 arcsecond, but the challenge is that these faint stars may be completely lost in the glare of the solar corona!

The Setup.

This experiment will require a telescopic photograph to detect and measure enough stars. Only with a telescope will you be able to detect the faint stars, and have a large enough magnification across the image so that you can make measurements near the required limit of 1 arcsecond.

Taking photographs through a telescope is a significant level of difficulty and makes this a very hard project for the amateur astronomer who is not skilled with these techniques. The easiest method is to take a digital photograph of the star field near the sun so that the photograph captures stars as close to the solar limb as possible, but also captures images of stars at least three or four times farther from the center of the sun compared to the solar radius. These distant stars like Regulus will be so far from the sun's limb that their positions will not change by very much (0.5 arcseconds or less) compared to the stars closer to the limb (shifts of 1 arcsecond or more). We can then make a 'differential' measurement of the gravitational deflection.

How to detect the shift.

To do this, you will need to take the photo through a telescope. Taking an ordinary camera photo with a regular camera telephoto lens will not work because the size of the solar disk is so small in a typical 'beauty' shot that it will not have the resolution required to detect enough stars and see the shift.

Make sure you take at least a few images of the eclipsed sun while you are photographing the star field. Ideally, the width of the star field you photograph should span about 3 to 5 times the solar radius. You will have to select a telescope and eyepiece combination that allows for this level of field coverage and magnification.

You will need to test-out your method long in advance of the eclipse, preferably by photographing the star field near Regulus during the weeks before the eclipse. For your telescope-camera combination, find a magnification that lets you capture a digital image about three degrees across. During the eclipse, you will have to make many short-exposure images, but not so long that the corona burns out the entire image field. Experiment with your exposures until you can just capture enough of the fainter stars near 8th magnitude to make at least three or four measurements. Because the sky brightness resembles the twilight sky just after sunset, you might want to try photographing faint stars in the twilight sky to see what kinds of exposure times you need. You might also experiment using filters that reduce skyglow. The eclipse only lasts 2.6 minutes so you can use this time to make 5 or more exposures of 30 seconds or longer so long as the corona light is not a problem. Ideally, you would like ten images that you can measure to improve your estimate of the average positions of the reference and target stars.

For best results, you need the photograph to have a resolution of about 1 arcsecond per pixel because the effect you are trying to measure is not much more than this under ideal conditions. That means the sun will appear to have a diameter of 1800 pixels in the image. That also means that for most megapixel-format cameras, you may not be able to capture images of distant reference stars if they are more than a few solar radii from the center of the sun and keep the image scale high enough to detect this deflection for the inner-most stars. Also, the solar corona will be bright enough that most faint stars will not be visible through the diffuse coronal light nearest the solar limb so you will have to use only bright stars, which are generally fewer in number.

Here is a close-up of the field near the eclipse that you will see through your telescope adjusted so that the scale of the image allows you to measure the arcsecond-sized shift in the star images. The two brightest stars in the field are HIP-49158 (+7.8) and HIP-49328 (+7.1) which are seventh-magnitude stars. The rest are unusable faint stars that have magnitudes between +10 and +11 that will most certainly be lost in the glare of the corona.

If this image were taken with a megapixel camera like a Nikon D3000, it would have an image format of 3800x2600 pixels, so at this scale the resolution would be 4900 arcseconds/3800 pixels = 1.3 arcseconds/pixel. Since near the sun's limb the shift will be about 1.75 arcseconds, the star image will appear to shift away from the sun by just one pixel!

One way to confirm Einstein's prediction without any calculations is to superimpose the image of the starfield with NO sun, on top of the starfield image taken during the eclipse. Line up the reference stars so that their images overlap, and look at the stars nearest the sun. Those close-in stars may show some slight position changes away from the sun's center, which is the effect you are looking for. To actually measure how much shift occurred compared to Einstein's prediction will take much more careful work!

At least in principal, once you have the photograph, you need to measure the positions of the available stars in terms of their pixel locations. Usually you can import images into programs such as Photoshop, use the cursor to center on a star image and read-out its x and y location. Because the amount of the deflection depends only on the radial distance from the center of the sun, you need to keep track of how far the target star was from the center of the sun at its closest point. That means it will be convenient to line up the short edge of the image you take with the solar limb so you can use this edge as a distance reference point when you measure the deflections.

For each target star closest to the solar limb, measure its XY pixel location. Then determine its distance from as many other distant stars in the image as you can to form a grid work of

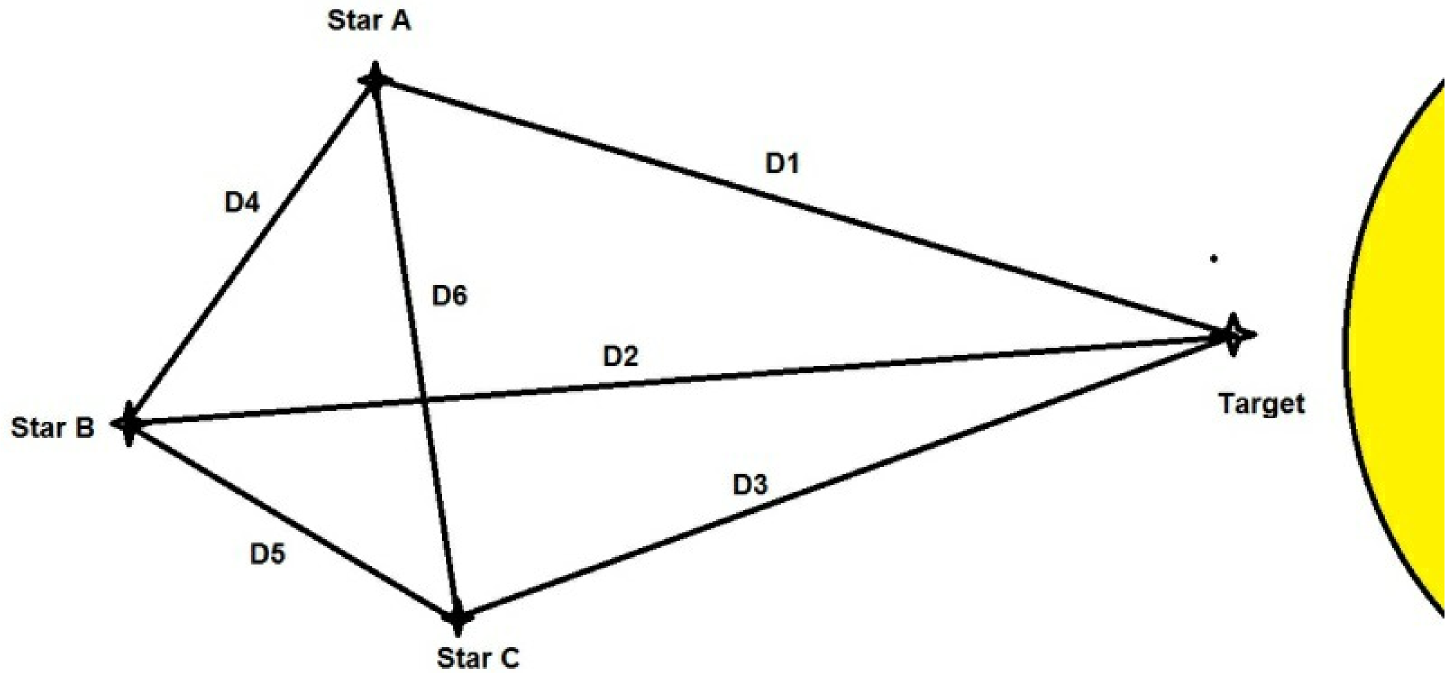
$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

relative measurements between the distant, fixed reference stars and the one in which you hope to detect a deflection. The more of these distant reference stars you have, the more precisely you can establish the relative position of the target star near the solar limb. The distance between two pixels is given by the Pythagorean formula.

where x1 and y1 is the x and y pixel address for Star 1 and x2 and y2 are the x and y pixel address for Star 2. First measure the distance of the star from your reference edge where the sun's limb would be, then determine as many distances between your target star position and the distant reference star positions.

Here's an example of what this measuring framework would look like (see diagram on next page). The distances D1, D2 and D3 establish how far the Target star is from these reference stars, and D4, D5 and D6 establish how much the reference stars move before and after the eclipse. Hopefully, the stars A, B and C are far enough away from the Target star that there is little distortion (change in their relative distances). The farther the target star is from the center of the sun, the less deflection you will be able to see.

Once you have made these measurements on as many limb stars as you can detect, you now need to make a measurement of where these target stars are when the sun is not there. To do this, photograph the same star field



at night and repeat the relative measurements again to get the position of your target stars when the sun is not there.

For each distance measurement, subtract the corresponding eclipse and non-eclipse measurements you made to determine differences between the distorted and undistorted views. Average these reference star numbers together for each target star to get the average difference for that target star. Also calculate the root-mean-square or 'rms' of the average distances for each Target star so keep track of how large the random error limit is. Your goal is to get this below one arcsecond so that you can detect the deflection with statistical confidence.

With any luck, you should be able to detect how the reference star distances to the target stars have changed slightly. The 'rms' number (related to the standard deviation of the sample measurements) you calculated will tell you whether you succeeded or not. If the average deflection you measured was 2 to 3 times the calculated rms of the data, you have probably seen evidence for the gravitational deflection of starlight! But don't be discouraged if the answer you get is zero. This is a very hard measurement to make, and the effort is worth more than the final answer! In fact, all you may be able to determine is that there was some slight difference in the star positions and not be able to actually measure how much it was in arcseconds. For it to be a true gravitational displacement, the shift you detect can only occur along the line between each star and the center of the sun. Any shifts you see that are not along this 'radial' line have nothing to do with the distortion of space but are a measure of how the images of the star shifts as it 'twinkles'. You can minimize this effect by taking several images in rapid succession and determining their average positions.

Amateur astronomers are, in fact, gearing up to make this very difficult, but not impossible, gravitational deflection observation. Here is an article in Sky and Telescope magazine by Donald Burns that describes his preparations for making this measurement.

http://www.skyandtelescope.com/sky-and-telescope-magazine/beyond-the-pri...

March Observing: What to View

Jim Kvasnicka

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

Planets

Venus: Reaches inferior conjunction on March 25th. In a telescope it is a thin crescent. Starting March 15th look for Venus both in the evening and in the morning before sunrise.
Mercury: Becomes visible on the western horizon on March 15th.
Uranus: On March 25th Uranus is 2.2° left of Mercury.
Mars: To the upper left of Venus and Mercury in the west.
Jupiter: Brightens to a -2.5 magnitude with a disk 44" wide.
Saturn: Rises well after midnight in western Sagittarius.
Neptune: Not visible in March.

Messier List

M41: Open cluster in Canis Major.
M44: The Beehive Cluster in Cancer.
M46/M47: Open clusters in Puppis.
M48: Open cluster in Hydra.
M50: Open cluster in Monoceros.
M67: Open cluster in Cancer.
M81/M82: Galaxy pair in Ursa Major.
M93: Open cluster in Puppis.

Last Month: M1, M35, M36, M37, M38, M42, M43, M45, M78, M79
Next Month: M40, M65, M66, M95, M96, M105, M106, M108, M109

NGC and other Deep Sky Objects

NGC 2438: PN in Puppis, a foreground object in M46.
NGC 2470: Galaxy in Canis Minor.
NGC 2683: Galaxy in Lynx.
NGC 2775: Galaxy in Cancer.

Double Star Program List

Epsilon Canis Majoris: Bright white and blue-shite pair.

Delta Geminorum: Wasat, yellow and rose colored stars.
Alpha Geminorum: Castor, White primary with a yellow secondary.
12 Lyncis: Close pair of yellow-white stars.
19 Lyncis: White pair.
38 Lyncis: White primary with a yellow secondary.
Zeta Cancri: Yellow and light yellow pair.
Iota Cancri: Yellow and pale blue stars.

Challenge Object

NGC 2749 Group: NGC 2749 is the brightest member of four galaxies in Cancer. Other members include NGC 2744, NGC 2751 and NGC 2752. Large aperture is required.

The Great American Total Eclipse
August 21, 2017

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

https://www.youtube.com/watch?v=K4KnxE6yAuI

Focus on Constellations: Cancer

Jim Kvasnicka

Cancer, the Crab, is the faintest of the twelve Zodiacal constellations. A dark moonless night is needed to see its dim stars between Leo and Gemini. Cancer contains two Messier objects, both are open clusters. M44 the Beehive Cluster is more visible than the star patterns in the constellation. The other open cluster is M67. Cancer covers 506 square degrees in the sky. Besides the two Messier open clusters Cancer contains many worthwhile double and multiple stars, and because it is located away from the Milky Way numerous galaxies. Cancer is best seen in the month of March.

Showpiece Objects

Open Clusters: M44 Beehive Cluster, M67
Multiple Stars: Zeta Cancri, Iota 1 Cancri

Mythology

The goddess Juno, who hated Hercules, sent Cancer the Crab to pinch and distract him as he fought with Hydra. However, Hercules simply crushed Cancer with his foot. Juno then elevated the Crab to the heavens as a reward.

Photo: Till Credner - Own work: AlltheSky.com

Number of Objects Magnitude 12.0 and Brighter

Galaxies: 7
Globular Clusters: 0
Open Clusters: 2
Planetary Nebulae: 0
Dark Nebulae: 0
Bright Nebulae: 0
SNREM: 0

Solar Eclipse Provides Coronal Glimpse

Marcus Woo

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On August 21, 2017, North Americans will enjoy a rare treat: The first total solar eclipse visible from the continent since 1979. The sky will darken and the temperature will drop, in one of the most dramatic cosmic events on Earth. It could be a once-in-a-lifetime show indeed. But it will also be an opportunity to do some science.

Only during an eclipse, when the moon blocks the light from the sun's surface, does the sun's corona fully reveal itself. The corona is the hot and wispy atmosphere of the sun, extending far beyond the solar disk. But it's relatively dim, merely as bright as the full moon at night. The glaring sun, about a million times brighter, renders the corona invisible.

"The beauty of eclipse observations is that they are, at present, the only opportunity where one can observe the corona [in visible light] starting from the solar surface out to several solar radii," says Shadia Habbal, an astronomer at the University of Hawaii. To study the corona, she's traveled the world having experienced 14 total eclipses (she missed only five due to weather). This summer, she and her team will set up identical imaging systems and spectrometers at five locations along the path of totality, collecting data that's normally impossible to get.

Ground-based coronagraphs, instruments designed to study the corona by blocking the sun, can't view the full extent of the corona. Solar space-based

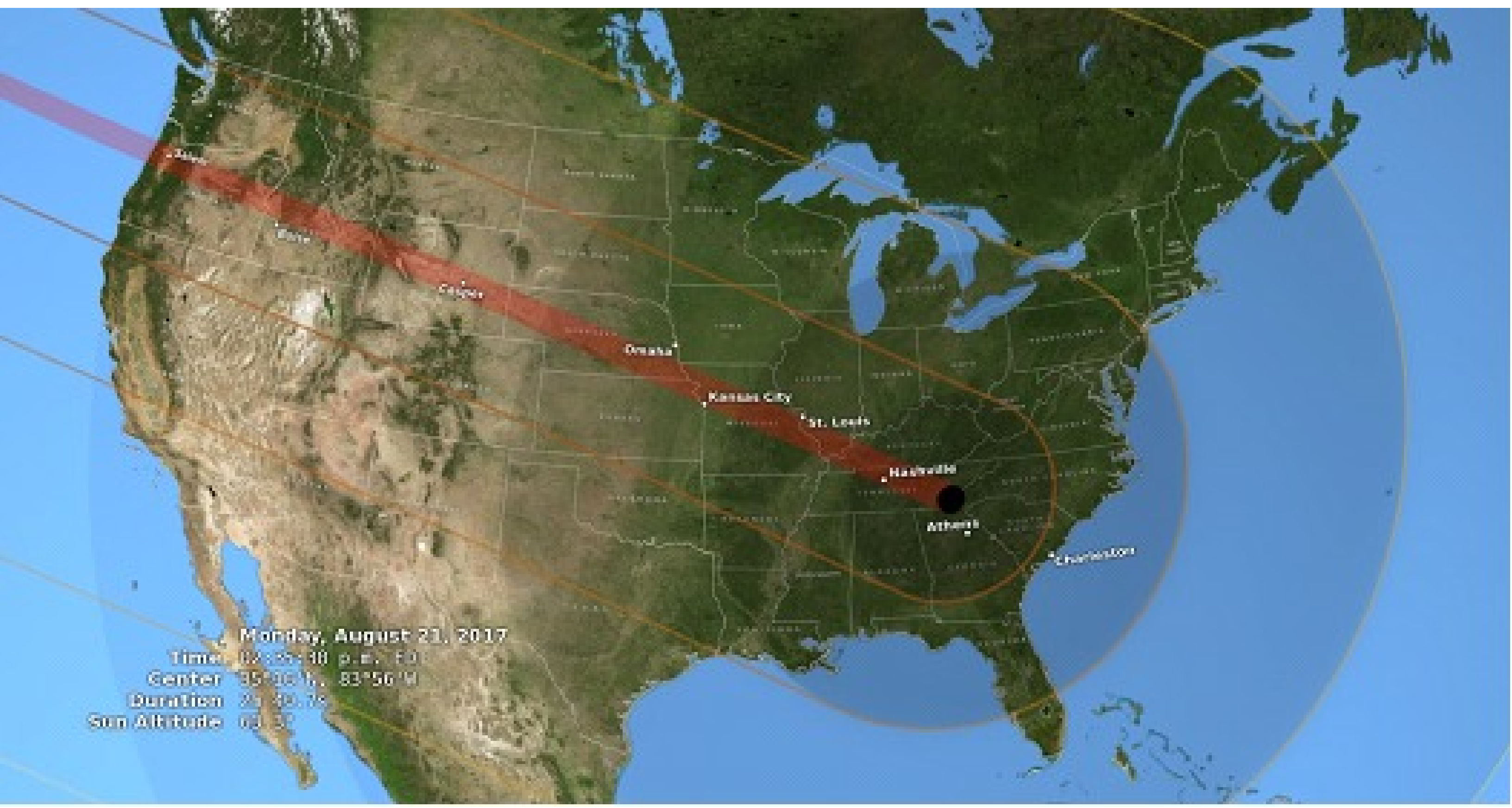


Illustration showing the United States during the total solar eclipse of August 21, 2017, with the umbra (black oval), penumbra (concentric shaded ovals), and path of totality (red) through or very near several major cities. Credit: Goddard Science Visualization Studio, NASA telescopes don't have the spectrographs needed to measure how the temperatures vary throughout the corona. These temperature variations show how the sun's chemical composition is distributed—crucial information for solving one of long-standing mysteries about the corona: how it gets so hot.

While the sun's surface is ~9980 Farenheit (~5800 Kelvin), the corona can reach several millions of degrees Farenheit. Researchers have proposed many explanations involving magneto-acoustic waves and the dissipation of magnetic fields, but none can account for the wide-ranging temperature distribution in the corona, Habbal says.

You too can contribute to science through one of several citizen science projects. For example, you can also help study the corona through the Citizen CATE experiment; help produce a high definition, time-expanded video of the eclipse; use your ham radio to probe how an eclipse affects the propagation of radio waves in the ionosphere; or even observe how wildlife responds to such a unique event.

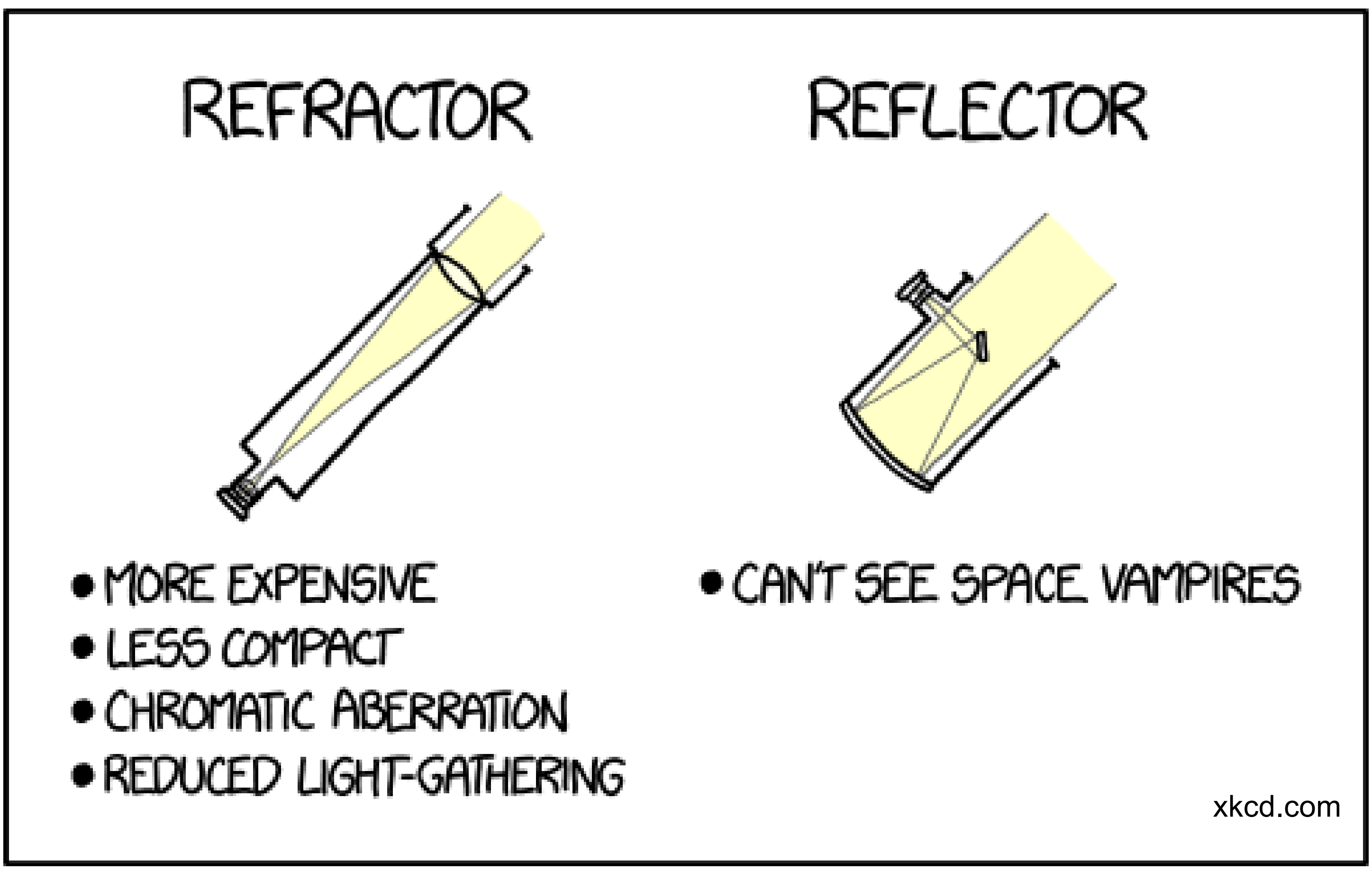
Otherwise, Habbal still encourages everyone to experience the eclipse. Never look directly at the sun, of course (find more safety guidelines here: https://eclipse2017.nasa.gov/safety). But during the approximately 2.5 minutes of totality, you may remove your safety glasses and watch the eclipse directly—only then can you see the glorious corona. So enjoy the show. The next one visible from North America won't be until 2024.

For more information about the upcoming eclipse, please see:

NASA Eclipse citizen science page
https://eclipse2017.nasa.gov/citizen-science

NASA Eclipse safety guidelines
https://eclipse2017.nasa.gov/safety

Want to teach kids about eclipses? Go to the NASA Space Place and see our article on solar and lunar eclipses!
http://spaceplace.nasa.gov/eclipses/



From the Archives: February, 1980

THE PRAIRIE ASTRONOMER -Page 2- February 26, 1980

THE PRESIDENT'S REPORT:

I've been staying awake plenty of nights lately, but, unfortunately, Astronomy was not the reason. That's right, Baby Veys has finally arrived. Little Melissa Louise put in her appearance at 6:48 p.m. on Friday, February 8. Since we had arrived at the hospital at 6:00 a.m. that morning, it was a long hard day. But I decided it was all worth it when the nurse handed me this little baby and I carried her around the delivery room just three minutes after she was born. (An experience almost as exciting as your first view of the Orion Nebula through a large telescope on a dark, clear night.) Of course, she's beautiful and, of course, I'm prejudiced. Thanks to all of you for your good wishes. You're all invited to come over and meet Melissa anytime.

As you all probably know already, Steve and Holly Myatt are also expecting--their first 12½-inch telescope, that is. Steve claims it will arrive any day now and has big plans for it. However, since these big plans call for the investment of large amounts of cash, and, since this aforementioned cash is the joint possession of both Mr. and Mrs. Myatt, Holly may have other plans. I'm not taking sides, I just can't wait to see this awesome instrument that is capable of probing the universe...and destroying a happy home.

Our club's secretary, Budd Duvall, has assembled a very interesting condensed version of our club's 13-year history. If space permits, we'll print this history in a future newsletter. Budd has also taken to recording the minutes of our club meetings and keeping them on file--a useful practice that had been neglected in recent years. Thanks for all your hard work, Budd.

See you all at the meeting.

-- RON VEYS

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:

Shop through Amazon Smile to automatically donate to PAC:

CLUB OFFICERS

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The Prairie Astronomer is published monthly by the Prairie Astronomy Club, Inc. Membership expiration date is listed on the mailing label. Membership dues are: **Regular $30/yr, Family $35/yr**. Address all new memberships and renewals to: **The Prairie Astronomy Club, Inc., PO Box 5585, Lincoln, NE 68505-0585**. For other club information, please contact one of the club officers listed to the right. Newsletter comments and articles should be submitted to: **Mark Dahmke, P. O. Box 5585, Lincoln, NE 68505 or** mark@dahmke.com**,** no less than ten days prior to the club meeting. The Prairie Astronomy Club meets the last Tuesday of each month at Hyde Memorial Observatory in Lincoln, NE.