Northern Lights

North-Central Region of the Astronomical League

Spring 2017 - Series II , Volume 1, No. 4

NCRAL 2017 - Rochester Astronomical Society

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Register NOW for NCRAL 2017

If you are planning to attend NCRAL 2017, you will want to register immediately if you have not already done so. As noted in the winter 2017 ***Northern Lights*** newsletter, the event will be held from April 21-23, 2017, on the campus of the Eagle Bluff Environmental Learning Center located on the crest of the rolling hills north of Lanesboro, Minnesota (about 40 miles southeast of Rochester). Our hosts will be the Rochester Astronomy Club. A detailed description was sent to NCRAL club ALCors, presidents, and newsletter editors back on January 31st noting that registration had opened. While you are no longer able to register for onsite accommodations (the deadline for onsite accommodations was February 23rd; however, you can choose to share accommodations with others in your club), you may still register online to attend the event by going to http://ncral2017.rochesterskies.org/.

This year's theme is "astronomical observing." Our hosts will be presenting a full line-up of lectures, panel discussions, demonstrations, and vendor exhibits during the conference. The speaker roster includes both amateur astronomers and scientists. Speakers come from such diverse locations as the University of Iowa, Iowa State University, NCRAL, the Minnesota Astronomical Society, University of Minnesota, Mayo Clinic, and Winona State University. Their expertise ranges from astronomical observing to aerospace medicine.

Here is a general schedule of main activities. Below the schedule are the names of speakers and their presentation abstracts.

Friday, April 21

Afternoon	Planetarium tour
Early evening	Vendor exhibits and roundtable discussions
Late evening	Dark sky observing

Saturday, April 22

Morning + Afternoon	Speaker presentations (see abstracts below)
Early evening	Banquet
Late evening	Dark sky observing

Sunday, April 23

Morning	Checkout

Dr. Carl J. Wenning of the (Bloomington/Normal) Twin City Amateur Astronomers – Carl is a well-known Central Illinois astronomy educator. He was the planetarium director at Illinois State University from 1978 to 2000 and director of the University's physics teacher education program from 1994-2008. He has also been a member of the Twin City Amateur Astronomers (TCAA) of Bloomington-Normal, Illinois, since 1978. He is currently NCRAL representative on the Astronomical League's national council, and editor-in-chief of NCRAL's ***Northern Lights*** newsletter. Carl has been recognized by the Astronomical League as a Master Observer, and received the 2007 NCRAL Region Award in recognition of his service to amateur astronomy. Carl will be speaking about his Astronomical Bucket List. What a full bucket that must be!

Dr. Jennifer L Anderson of Winona State University – Jennifer is doing research on impact cratering and has just received a major grant from the National Science Foundation to continue that research. She plans to talk about this fascinating subject at our conference.

Dr. Armando Manduca of the Mayo Clinic – Armando has a Ph.D. degree in astronomy from the University of Maryland. He continued this work as a post-doctoral fellow for 2 years at Mt. Wilson. He then worked for several years in the aerospace industry, including coding and managing post-processing software for the Hubble Space Telescope. He is currently at the Mayo Clinic, where he is a Professor of Biomedical Engineering, Professor of Radiology, and Chair of the Division of Biomathematics. Armando's presentation is titled The Greatest Instrument Ever Made — The History and Discoveries of the Mt. Wilson Telescope.

Russ Durkee of the Shed of Science Observatory – Russ is a professional astronomer who works from his own private observatory located in Minneapolis, MN. Russ is a gifted observer, mathematician, and speaker. He will present his observations of near earth objects and discuss the incredible amount of information he can tease out of the light curves he collects from these space rocks.

Dave Falkner of the Minnesota Astronomical Society – Dave has been a life-long amateur astronomer. He has served two terms as the President of the MAS. Dave is actively involved in the operation of the MAS Eagle Lake Observatory near Norwood-Young America, MN, which hosts public outreach events throughout the year. He is a NASA/JPL Solar System Ambassador and has authored the book *The Mythology of the Night Sky — An Amateur Astronomer's Guide to the Ancient Greek and Roman Legends.* Dave will present a historical perspective on how our knowledge about the universe has evolved over the last 500 years because of the vision, dedication and genius of some of the greatest astronomers in history: Brahe, Copernicus, Kepler, Galileo, Herschel, Newton, Einstein and Hubble. This is a story of observational astronomy at its best. We also hope Dave has time to discuss the Sun, Earth, and Moon geometry of eclipses in general and the Great American Eclipse of 2017 in particular – where to go and how to observe it.

Dr. Steve Kawaler from Iowa State University – Steve has been closely involved with the Kepler, K2, and TESS missions. His work focuses on learning what we can about the host stars through their variability, and how that variation informs our view of the architecture of their planetary systems.

Dr. Robert Mutel from the University of Iowa – Robert is a Professor of Astronomy in the Department of Physics and Astronomy. He is going to talk about the Iowa Robotic Telescope. He is currently developing a spectroscopic capability for this system.

Karl Young is from the University of Minnesota, Twin Cities – Karl is an Outreach Assistant for MIfAa and also a graduate student in his 4th year. His research and talk will focus on balloon-borne instruments which measure the cosmic microwave background.

EDITOR/REGIONAL REP'S MESSAGE

This is issue No. 4 (Series II, Vol. 1) of NCRAL's ***NORTHERN LIGHTS*** newsletter. As you will see by reading this issue, the newsletter continues to grow in size as does our readership. This expansion has occurred thanks to the willingness of several amateur astronomers within NCRAL who are willing to contribute information suitable to our NCRAL readers.

This Spring 2017 issue of ***NORTHERN LIGHTS*** is filled with numerous articles. As editor-in-chief of this publication, I want to acknowledge the contributions of the following NCRAL members to this issue: Assistant Editor Jim Gibbs, Twin City Amateur Astronomers (IL); Joe Ulowetz, Skokie Valley Astronomers; Tim Stone, Twin City Amateur Astronomers (IL); John Heasley, NASA Solar System Ambassador; and Audrey Fischer, Chicago Astronomical Society.

As always, this newsletter contains important information and serves several purposes:

1. It serves as a benefit of membership to our NCRAL-affiliated clubs.
2. It helps get the word out about events nationally and in the North-Central Region of the Astronomical League.
3. It provides an avenue for members' contributions to be published for readers across the NCRAL region.
4. It serves as a connection with AL members-at-large in the region.
5. It provides a potential avenue to recruiting new clubs that are not currently NCRAL affiliated.

The editors hope that this newsletter makes its way to ALL members of AL-affiliated clubs in the North-Central Region. ***NORTHERN LIGHTS*** is disseminated through an email network of club ALCors, presidents, and newsletter editors. The newsletter is intended for all club members, not just these leaders. So, if you haven't received your copy through one of your club's leaders (but have found it by way the NCRAL website or the NCRAL Facebook page), you might want to contact your club's leadership. Perhaps I don't have your ALCor's, president's, and editor's email addresses in my database. If you think not, please send that information my way. If you are an AL member-at-large and want to receive Northern Lights, please contact me.

I want to note once again that as your Regional Representative to the AL Council, you should feel free to contact me with questions or concerns about the regional or national program. I'm now in regular contact with AL President John Jardine Goss and other national officers, as well as regional chairpersons and representatives.

We need to be thinking ahead to electing NCRAL officers at the next business meeting at NCRAL 2017. To the best of my understanding, the positions of Chairperson and Vice Chairperson will once again be open for two-year terms. I understand that our Secretary/Treasurer (Don Klemt) and Regional Rep. (your's truly) have terms that will expire in 2018 and 2019 respectively.

Lastly, we are seeking nominations for the NCRAL Region Award. This award honors members of the North Central Region who have distinguished themselves by their service in the field of amateur astronomy. Find below both a call for nominations and a Submission Form. The deadline has been revised and is fast approaching. So, be certain to read the letter from Vice Chair Charlotte DuPree that follows.

Carl Wenning, Editor/Regional Rep.

carlwenning@gmail.com

Regional Officer Contact Information

Chairperson: **Gerry Kocken**
gerryk@kockenwi.com
(Term expires spring 2017)

Vice Chairperson: **Charlotte DuPree**
grdupree@charter.net
(Term expires spring 2017)

Secretary/Treasurer: **Donald Klemt**
donklemt@ameritech.net
(Term expires spring 2018)

Regional Rep. to the AL council: **Carl Wenning**
carlwenning@gmail.com
(Term expires spring 2019)

Seeking Nominations for NCRAL Region Award

Charlotte M. DuPree, Vice Chair, NCRAL
6219 Jay St.
Trenton WI 53095-9578
(262)675-0941

February 13, 2017

NCRAL club members,

Do you know someone who has dedicated his or her time and energy to promoting astronomy? Wouldn't you like to let them know they are appreciated for their hard work? This is your chance! It's time to make nominations for the NCRAL's Regional Award. This award recognizes exceptional, individual effort, and meritorious service to amateur astronomy, through the member's local astronomy club, doing public outreach, or the NCRAL, or the Astronomical League.

Using the guidelines and submission forms attached, we have made it easier than ever to nominate someone you feel deserves this award. This award will be presented in a special ceremony concluding the dinner banquet, of the NCRAL convention, on Saturday, April 22, 2017, Rochester, MN.

The Rules for nomination are as follows:

- The individual must be a member in good standing, either through an A.L. member organization or as a current member-at-large in the North Central Region of the Astronomical League.
- The three current regional officers and the regional representative are NOT eligible for this award. Past winners are also ineligible for this award.
- The regional officers and the regional representative are the voters and will base their decision on the information provided. Each member votes independently and will use his/her best judgment. All decisions are final.
- The winner will not be revealed until the time of the presentation. Those not selected, will not be revealed.
- All non-winning nominations will be kept on file, for two years after submission. After such time, a new nomination will need to be competed.

There are many deserving candidates within our region. It is our hope to have a least one nomination from each society of the NCRAL. I look forward to receiving your nominations. If there are any questions, please contact me via phone, email, or mail at the above listings.

Sincerely,

Charlotte DuPree
Vice Chair, NCRAL

Submission Form for the NCRAL Region Award

Candidate's name (as it will appear on plaque) _____

Shipping Address _____

City _____State _____Zip_____

Club Affiliation _____

Nominator's name _____Club affiliation_____

Address_____

City _____State_____Zip_____

Phone_____ Email_____

Submission Guidelines:

Prepare a statement of the nominee's accomplishments, supporting amateur astronomy. This statement should not exceed 3 double-spaced pages (1,000 words). Length does not necessarily equal strength. The statement should include number of years in office, or committee membership, and dates of said membership, pertaining to NCRAL. The statement should also include length of time participating in public outreach education, number of presentations, etc.

Supporting data: Please include any relevant newspaper clippings, photos, and other articles that support the nomination. For service to groups such as schools, scouts, etc., it would help the committee if you could obtain a brief statement from the teacher, leader, chair etc. on the usefulness of the presentation.

NOMINATIONS MUST BE RECEIVED BY SATURDAY MARCH 18, 2017. Any nominations received after this date will be kept on file for 2018.

All nominations must be sent to:

Charlotte DuPree, Vice-Chair, NCRAL
6219 Jay St.
Trenton, WI 53095-9578
262-675-0941

Driftless Dark Skies: Creating Constellations

by John Heasley, NASA Solar System Ambassador

Years ago, I went with the Cub Scouts to visit the Franklin Institute in Philadelphia. I definitely enjoyed being a blood cell and circulating through the giant heart there, but what really wowed me was the Fels Planetarium. The lights went down, the stars came out, and I was hooked. I loved the way the presenter not only named the stars but connected them with lines and created people and animals and things and told the tales that went with them.

There is something very comforting about the constellations. As long as you don't travel too far north or south, you see the same constellations at night wherever you go. They follow a reassuring pattern with Orion and Taurus and Gemini in the winter, Leo and Corvus and Virgo in the spring, Scorpius and Hercules and Cygnus in the summer, and Pegasus and Andromeda and Perseus in the fall. They become familiar friends. We can trace out their shapes, give them names, and retell their stories. They take us back to an earlier time when we were protected by a two-dimensional sheltering sky.

In 1928, the International Astronomical Union divided up the sky into 88 official constellations. This made it easier for stargazers to talk with one another, but we also lost a lot of variety. Different cultures see different constellations. Not all of us see a hunter when we look at the stars of Orion. The Egyptians saw Osiris, the Ojibwe see a paddler (Biboonkeonini the Wintermaker), the Lakota see the hand of a chief, and the Mayan see the Turtle of Creation.

Those seven brightest stars that we call Orion are not as tightly grouped as they appear, but vary in distance from 240 to 1360 light years. We are not even seeing them at the same time because their starlight left years apart over the span of a millennium. What we like to think of as a dome is three-dimensional space with vast distances between stars.

Once we learn to "see" a constellation, it is challenging to "unsee" it. Our familiarity with constellations inhibits us from seeing the stars in other ways. But it's rewarding to try. Here's how. Go out on any clear night. Choose a dozen or so of the brighter stars. Connect the dots and make a pattern that is pleasing to you. It could be a person or animal or object. Give it a name, and it's yours. Spin a tale to go with your pattern, and you have created a constellation. It's not officially recognized, but it's no more or less real than those of the IAU. Best of all, you have seen the starry sky anew!

John Heasley is an astronomy educator and stargazer who enjoys connecting people with the cosmos. He volunteers with NASA/JPL as a Solar System Ambassador. For more information about stargazing in southwest WI, like Driftless Stargazing LLC on Facebook and find out whenever there's something awesome happening in the skies. Driftless Dark Skies appears monthly in the Voice of the River Valley.

Members of Iowa County Astronomers creating constellations at their January meeting. Constellations included Monarch Butterfly, Tardis, Pac-Man, Cube, and Dragonfly.

Herschel's Garnet Star and the Elephant Trunk

by Tim Stone, Twin City Amateur Astronomers

In these late winter skies, the kingly constellation Cepheus has slipped into the northwest, carrying with it the memories of its splendors displayed in warmer skies. Being circumpolar, we can see this constellation any time, at least hypothetically, and most of us recognize it by the irregular pentagon of second and third magnitude stars. Just south of the base of this pentagon, we can find Mu Cephei, also known as "Herschel's Garnet Star." Mu Cephei is variable, and hovers at the limit of visibility in our moderately light-polluted sky. At its brightest, it is magnitude 3.4; at its dimmest, 5.1.

While nondescript to the naked eye, it is a remarkable star, worthy of a look with even a modest telescope. In the eyepiece, it is quite yellow in color, so much so that no contrasting star is needed (as with Albireo) to note its inherent color. William Herschel observed this star and wrote that its color resembled that of a garnet. In fact, garnets occur in a variety of colors, yellow and red being the most common. The star reddens significantly as it dims to its minimum, so Herschel might have observed it at any point in its cycle and still have accurately described it as garnet-colored.

Mu Cephei is sometimes called "Erakis," a name with an ambiguous origin. One TCAA member notes the similarity of this name to that of a planet in Frank Herbert's "Dune" series of science fiction books, but this star is not capable of hosting any such planet. It is a red supergiant of class M2-Ia, one of the largest stars known. Estimates of its size vary; at least one estimate places the value at 1,300 solar radii. At that size, its surface would be somewhere between the orbit of Jupiter and Saturn. This makes it one of the largest stars known, bested only by VV Cephei A and VY Canis Majoris.

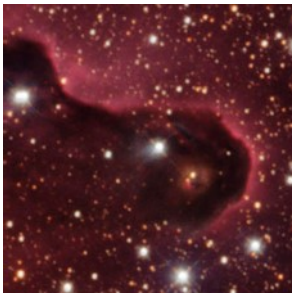
It's only a coincidence that two of the largest stars known are in the constellation Cepheus. Mu Cephei is a runaway star, with a high velocity of some 80 kilometers per second – 180,000 miles per hour. Astronomically speaking, it won't stay in Cepheus for long as it traverses our sky at its distance of approximately 6,000 light years.

The enormous surface area of this star glows at a mere 3,500°K – about 5,800°F. This is not quite three times as hot as the hottest lava as it erupts from volcanos here on Earth! Despite its relatively cool temperature, its enormous surface area radiates energy at an incredible rate. It may be as much as 100,000 times as bright as our sun. If so, it is certainly one of the brightest red supergiant stars in our galaxy.

As if these characteristics aren't enough, Mu Cephei seems to be ejecting mass from its outer atmosphere into its surroundings, a possible harbinger of the approaching end of this star's life. With a mass of some 19 times that of our sun, it is too large to fade into a white dwarf. It will undergo core collapse sometime in the future, resulting in a stupendous supernova which, from its relatively nearby distance, will be incredibly spectacular from here on Earth. It's highly likely the supernova will produce a stellar mass black hole. Between now and then, this star might evolve back to a blue supergiant, as the helium-carbon fusion cycle leads to much higher energy fusion reactions of heavier elements.

When Mu Cephei explodes, observers are very likely to see the resulting light burst and shock wave interact with the matter being now ejected from this star, much like we saw the matter around SN1987A in the Large Magellanic Cloud. While there's no indication that this star will go supernova any time soon in our timeframe, time is running out for it. Within a few hundred thousand years, it is likely to be no more.

Situated well in front of Herschel's Garnet Star, IC 1396 provides a beautiful photographic contrast to the garnet star. Composed almost entirely of hydrogen and dust, this very large nebula glows red with Hydrogen-alpha emission. Large clouds of obscuring dust stand out in silhouette against the glowing curtain, evidence of starbirth activity there. A brilliant blue multiple star system near the center of the nebula provides the ultraviolet radiation that is both powering and destroying this nebula.



The famous Elephant Trunk nebula is situated nearby. Its long pillar terminates in a peculiar torus that looks to some like the end of the trunk of an elephant. This torus, vdB 142, is a reflection nebula created by the young star at its center. The fledgling star has blown away enough of its cocoon of dust that it can be seen illuminating its surroundings as its nuclear fires ignite on its journey to bona fide starhood.

The stellar cycle of life is ongoing in this complex. The blue giant star responsible for this celestial display is also carving a cavity out of IC 1396. As it does so, the compressive forces cause other stars to coalesce from and ultimately carve out their own cavities, as vdB 142 has done. The large and the small, the young and the not-so-young, all interact in these clouds to create beauty we are only now learning to appreciate. Herschel's Garnet Star will watch for a few hundred thousand more years, and then it will add a new magnificence to this scene, a magnificence we can yet only imagine.

Working with the Chandra Space Telescope

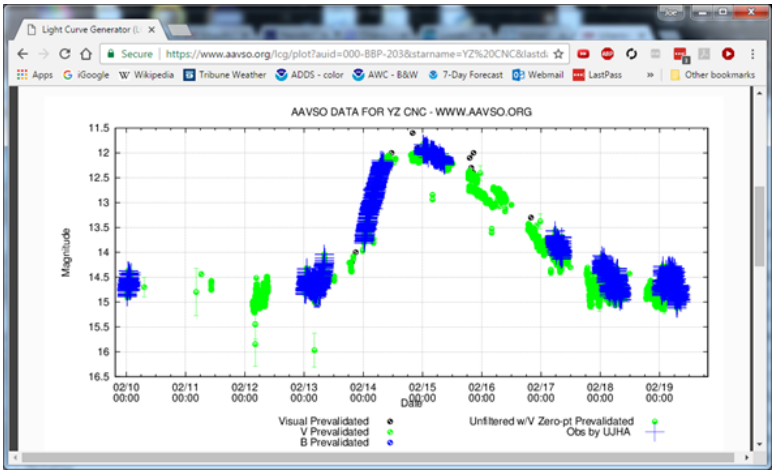
Joe Ulowetz, Skokie Valley Astronomers

I've been involved in astrophotography from the Chicago area for about 15 years, and lately I've been focusing my efforts helping a Pro-Am group called the "Center for Backyard Astrophysics." I, along with many other amateur astronomers, help study some rather interesting variable stars. We study cataclysmic variables involving a close pair of stars where one star is dumping material onto a companion "white dwarf" star. This causes sorts of mischief.

Our group, the Center for Backyard Astrophysics (CBA), sometimes gets asked to assist professional astronomers who study white dwarfs, and recently we were asked for help by a professor at the University of Southampton. He had permission to use the Chandra X-Ray Space Telescope to study one particular white dwarf, but only when it was having one of its roughly bi-weekly outbursts. He needed our help to watch the star and notify him the instant when the next outburst started.

Well, on the evening of February 13th the weather was clear in Chicago and I pointed my telescope at this star. I found that it had started its outburst. I was surprised no one else had noticed it first, but apparently Europe was cloudy that night and our East Coast was having a blizzard at the time. So, I was the first to report it.

Based on my notification, the Chandra X-Ray telescope was interrupted in what it was doing and was pointed at the star in time to study the outburst. I've never had the chance to re-target a space observatory before!



Star brightness time series plot with outburst, including my data in blue.

Here readers can find the message thread for triggering Chandra based on my data: http://cbastro.org/pipermail/cba-public/2017-February/001025.html. Additional information about this work can be found on the Center for Backyard Astrophysics web site: http://cbastro.org.

A Word About Hobbies

by Carl Wenning, Twin City Amateur Astronomers (IL)

Editor's note: The following article is abstracted from Guide #3 – Astronomy as a Hobby – published online by the Twin City Amateur Astronomers (Bloomington-Normal, IL). It was written by ***Northern Lights*** editor and is provided here as an enticement to get NCRAL members to read the entire 9-page document. The document was written as part of an effort to "understand" why amateur astronomy is graying, and what we can do about it. The document may be downloaded in its entirety from http://tcaa.us/TCAAGuides.aspx.

The Benefits of a Hobby – In days of old, hobbies were often handed down from parents to their children. Today, most of us do not know or seem to have forgotten what it means to have a hobby. We are so engaged in television, social media, gaming, web browsing, and email that hobbies, as we once knew them, have pretty much disappeared.

It's not at all uncommon today to see families gathered around a restaurant table with each person working away on a cell phone or tablet. This lack of face-to-face communication comes at a price. Youngsters become socially isolated. They do not learn to engender and develop meaningful relationships with others. Engagement in hobbies that involve others is one way to break down this all-too-common problem. Involvement with hobbies helps the young to learn interpersonal skills necessary to navigate the adult world. Kids who are engaged deeply in hobbies – especially those involving parents and other adults – learn the social skills necessary to ride out the storms of life. They somehow always seem to become productive and socially responsible adults.

A hobby is an activity done regularly in one's leisure time for pleasure. Hobbies, if they are truly hobbies and not merely passing interests, are time consuming and can often require considerable expenditures. Still, the benefits of having a hobby are numerous:

- **Hobbies provide a sense of leisure.** They give us a chance to take a break from our humdrum daily existence. They provide a break with a purpose. They provide fun and fulfillment and can help one live life with a purpose.
- **Hobbies provide a sense of passion**. Passion goes hand in hand with happiness and satisfaction. Without a passion, any happiness is only temporary because there's nothing to make it last.
- **Hobbies can be very motivational.** They provide a positive type of stress that makes one feel excited about what one is doing and about life. They provide a sense of excitement and joy.
- **Hobbies offer new challenges.** These challenges break up one's day-to-day routine and are quite positive in as much as they allow one to challenge him or herself to become a better person – all that one can hope to be. They offer us new ways of seeing and

experiencing the world.

- **Hobbies unite you with others.** Hobbies bring together those who have the same or at least similar interests. This helps to make life more fulfilling and keeps one's circle of friendships ever growing.

- **Hobbies are great stress reducers.** Adding things one doesn't want to do to a "to do" list is stressful. Adding things to such a list that one likes today can help alleviate day-to-day stressors by giving a break from them. When working on hobbies you have time to focus on things you like and this can be a great stress reducer.

- **Hobbies provide health benefits.** Engaging with hobbies is associated with better states of mind and help to lower levels of loneliness and depression. Experiencing enjoyable activities is associated with lower blood pressure and total cortisol. Hobbies are great for both mind and body.

- **Hobbies assist with character development.** When people interact with their peers, they learn social skills that tend to build one's character and sense of self-confidence. In addition, those with hobbies tend to have improved confidence and self-esteem.

The Benefits of Engaging Youth in a Hobby – What do parents who engage their children in hobbies know that others do not? It's that there are very substantial benefits of engaging youth in a hobby – not the least of which is growth in virtues. This oftentimes accounts for why certain children turn out to be successful adults whereas certain others are considerably less so. There are many cases in the history of the TCAA where engaged youth have gone on to lead highly successful lives thanks to the virtues they picked up by participating in this club.

William J. Bennett, in the preface to A Book of Virtues, notes, "Moral education – the training of the heart and mind toward good – involves many things. It involves rules and precepts – the dos and don'ts of life with others – as well as explicit instruction, exhortation, and training. Moral education must provide training in good habits. Aristotle wrote that good habits make all the difference…. Moral education must affirm the central importance of moral examples. It has been said that nothing is more important, more influential, more determining of a child's life than the moral power of quiet example. For children to take morality seriously, they must be in the presence of adults who take morality seriously, and with their own eyes they must see adults take that morality seriously…. This helps children to see what virtues look like in practice, how to recognize them, and how they work. The clear majority of Americans value honesty, compassion, courage, and perseverance. These are virtues, but because children are not born with the knowledge, they need to learn what virtues are."

As a former homeschooling parent with a dozen years of experience, I can tell you how very important it is for children to interact with and be influenced by adults. Great benefits arise from doing so. While our two daughters did spend less time with other kids than "normal", they did so because of spending more time with adults than "normal". Over the years many non-homeschooling parents chided my wife and me for the "lack of socialization" that they perceived resulted from homeschooling. My typical response was, "We're trying to raise adults here, not kids." Think about this statement for a moment.

Kids won't learn moral virtues from those who don't yet possess them. It's much like the blind leading the blind; they both fall into the ditch. It's only when kids spend time with virtuous adults that they learn these virtues in addition to knowledge and skills. Our club membership provides many virtuous examples of commitment, dedication, loyalty, seriousness of purpose, generosity, altruism, self-control...

Children who spend time with adults can avoid a lot of the frivolity and negativity that often comes from spending time with their peers such as emotional abuse, mistrust, feelings of guilt and inferiority, role confusion, isolation, discrimination, despair…

In addition to growing in virtue, children who spend time with adults tend to personally mature much more quickly. Interacting regularly with adults they learn to think like adults, speak like adults, and act like adults. They have no other choice. Lack of maturity is one of the main causes of children making poor decisions and getting into trouble with sometimes life-long consequences. The growth in personal maturity is one way to reduce if not altogether prevent such. Involvement with one or more parents in a hobby and an associated club are great ways to enhance the chances for success in life.

Now, I am not suggesting that youth should not socialize with other youth. There are many goods associated with doing so. For example, learning social and emotional coping skills, having the freedom to discover and explore personal interests, learning appropriate behavior by experiencing cause and effect in relationships, learning teamwork, having fun, and much more. Still, too much time with adults and too much time with children can be a bad thing. Remember Aristotle's famous dictum, "virtue lay in the middle way" – a midpoint between extremes.

Because this club's leadership sees the importance of involving youth in amateur astronomy, it hosts or participates in family-friendly events throughout the year such as our public observing sessions, Family Science Day, and the Universe Sampler course. Also, during the February Annual Meeting the club often confers the Eugene and Donna Miller Family Award in recognition of parents (or grandparents) who have worked diligently with one or more of their (grand)children. This is done to shine light on the importance of engaging youth with the hobby of amateur astronomy via participation in the TCAA.

Perhaps if parents were more interested in raising adults than children, more of them would spend time with their children training them in the virtues – both directly by discussion and indirectly through example. Two ways of doing so are by engaging kids in a hobby and joining a club. These provide both an "excuse" and resources for parents to spend quality time with their kids.

Do you know any parents with children who might benefit by pursuing the hobby of amateur astronomy and being affiliated with our club? Ask them to join us.

Foxwood Astronomy: SolarEclipseTimer

by Dr. Gordon Telepon

I am a plastic surgeon who practices in Decatur, Alabama. My hobby is astronomy and within that hobby I have a fascination with total solar eclipses; I have observed 3 of them overseas. I am really excited about the USA total solar eclipse. As part of my preparation for this eclipse, and to help the public get the most enjoyment out of it, I have released 3 mobile apps for the event. No one else in the country has this variety of eclipse-related mobile apps, and I know of no other mobile quiz game designed specifically to educate people about the 2017 solar eclipse. I ask you to PLEASE review this beneficial information and share it with as many people as possible. My main website with further information, YouTube instructional videos, and links to the apps can be found at www.solareclipsetimer.com

Solar Eclipse Timer: The Most User Friendly Eclipse Timing App Available. Get To The Path and It's 2 Tap Setup. Sophisticated enough for expert eclipse chasers. Auto geolocation; Auto Contact Time Calculation; Auto Duration Calculation; Max Eclipse Mark; Spoken Phenomena Reminders; Spoken Countdowns; Partial Phase Image Sequence Calculator: Built-in Totality Video.

Eclipse USA Quiz Game: The only mobile eclipse education game released for 2017. Two quizzes are free; Solar Fun Quiz 1 has 50 basic eclipse questions and Eclipse USA Quiz has 25 questions about the path across the USA. In-app upgrades include a more difficult eclipse quiz, Eclipse Pro Quiz 2 and also combination quizzes including separate quizzes dedicated to the 12 states in the path.

Totality Observer: For children and for fun, an arcade game to start their interest in eclipses. The theme; your child is an eclipse tour guide, he or she must move the clouds to get the guest's eyeballs to totality!

facebook

NCRAL Now on Facebook

Did you know that NCRAL now has a Facebook page for sharing information about your Region's AL-affiliated clubs? This feature was added following the NCRAL 2016 meeting when the number of "hits" on the meeting's Facebook site did not subside as would have been anticipated follow the end of the meeting. It was as through people were searching for NCRAL information and were not finding what they wanted. Hopefully users can now find what they are looking for, and others are free to post images and messages to this un-moderated group. You may now like us and follow NCRAL on Facebook at:

https://www.facebook.com/northcentralregionastronomicalleague/

North Central Region of the Astronomical League - NCRAL

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Stolen Soul Devoid of Starlight

by Audrey Fischer, Chicago Astronomical Society

Please take a look at these Light Pollution map simulations of Chicago and its neighbors by the world's expert Dr. Fabio Falchi of Italy, completed on December 2016. They show in an instant the difference that the amount of blue-rich light in the spectrum of streetlights makes… and the associated health and environmental risks.

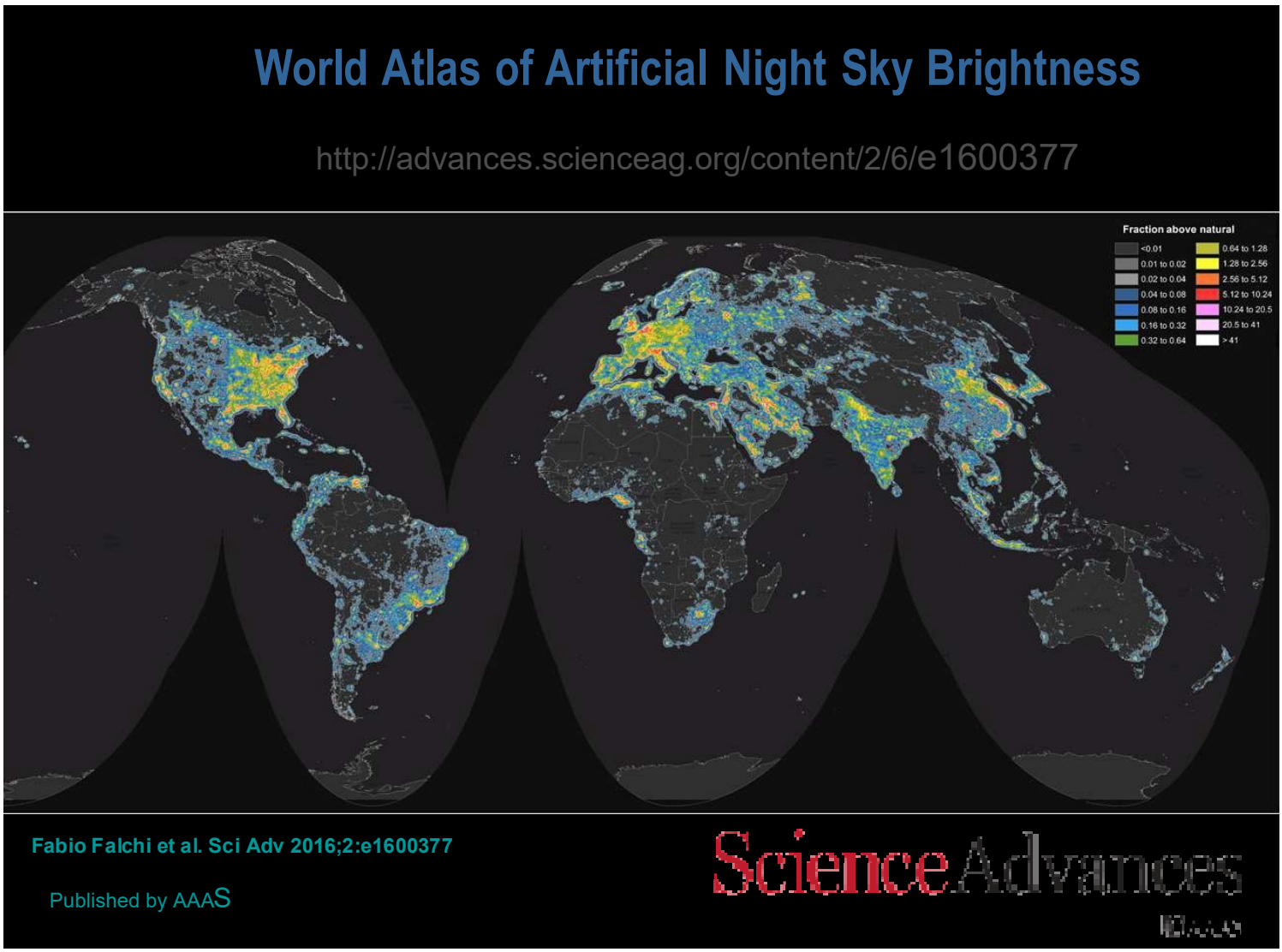
We are about to dramatically increase the blue light of our night skies… a known detriment -when we can make the choice to install no or minimal blue light. This affects not only citizens of Chicago and citizens of our neighbors -even 100 miles away in all directions, as well as ecosystems and migrating birds… but municipalities and small towns, too- worldwide.

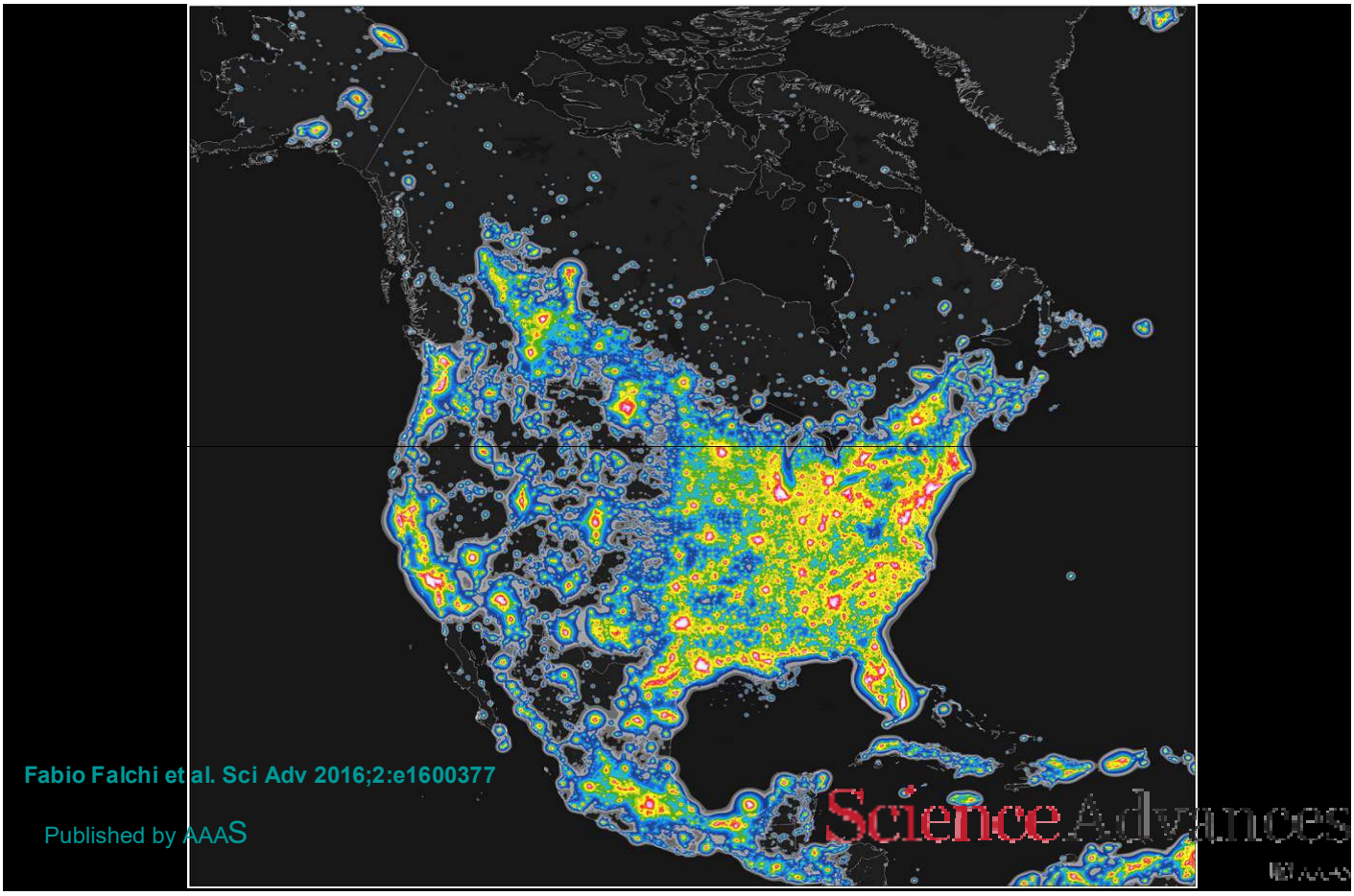
We need each and every one of you. With activism we can seize the opportunity to finally correct past lighting mistakes and make the right choice into an inspirational transformation of starlit cities and towns throughout the land.

Please make this commitment.

Recently, state-wide lighting initiatives are being activated in Illinois and other states. This can be good or disastrous, depending on which lighting spectrum and style fixture is chosen. Again, activism is essential.

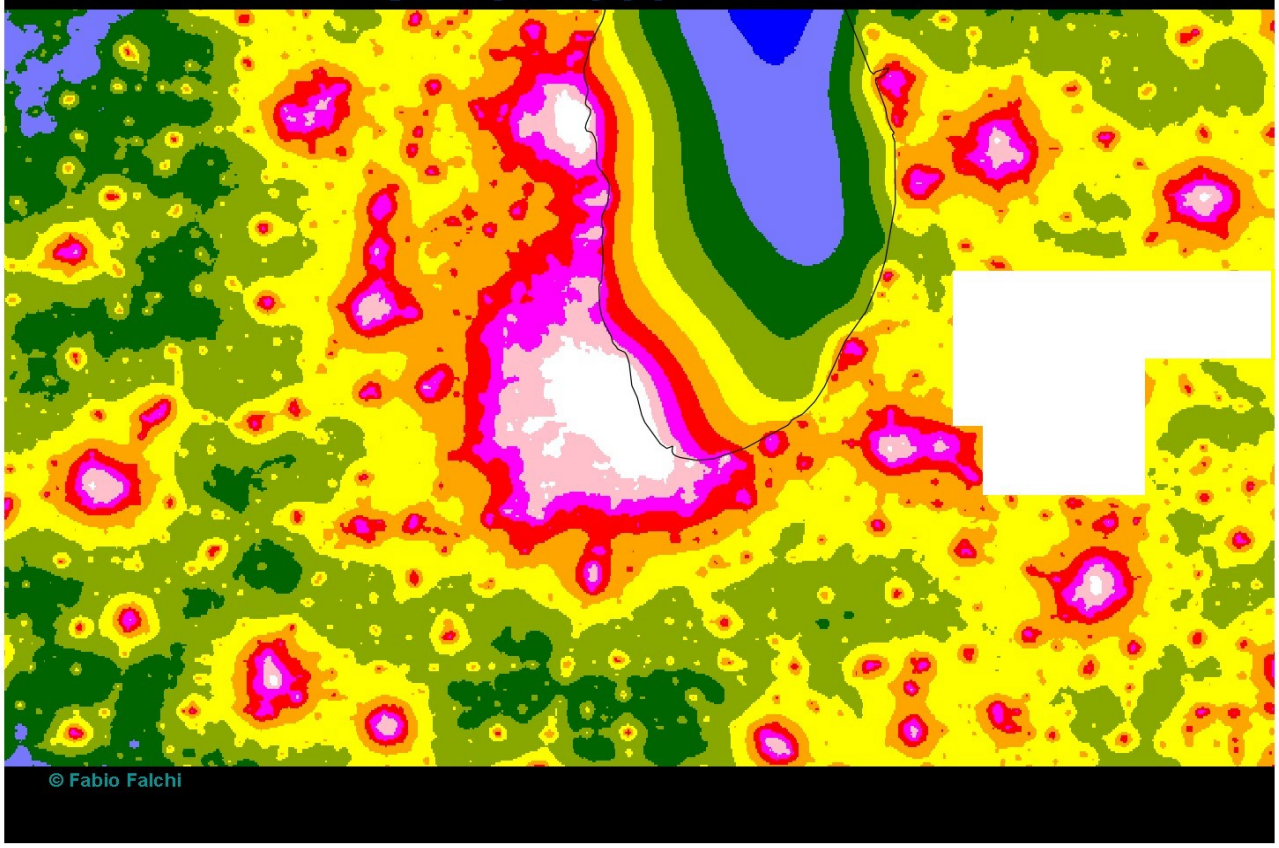
Please organize and recruit. Tap all your resources in not only the astronomy circles, but environmental, conservation, wildlife, educational groups and more. Write letters, talk to your representatives, attend BOD and other meetings the public is allowed, host meetings at libraries, get articles in the paper. Light pollution is a financial waste, but the largest crime is the stolen soul devoid of starlight.





- SLI= Star Light Index
- MSI= Melatonin Suppression Index
- Maps of the relative effects using the same light flux and changing the spectral distribution (each CCT is an average of several different LEDs of the same colour temperature)
- Each color step indicates a doubling of the pollution
- More details in: Martin Aubé, Johanne Roby, Miroslav Kocifaj, *Evaluating Potential Spectral Impacts of Various Artificial Lights on Melatonin Suppression, Photosynthesis, and Star Visibility, PlosOne, http://dx.doi.org/10.1371/journal.pone.0067798*

SLI of 4000 K LED



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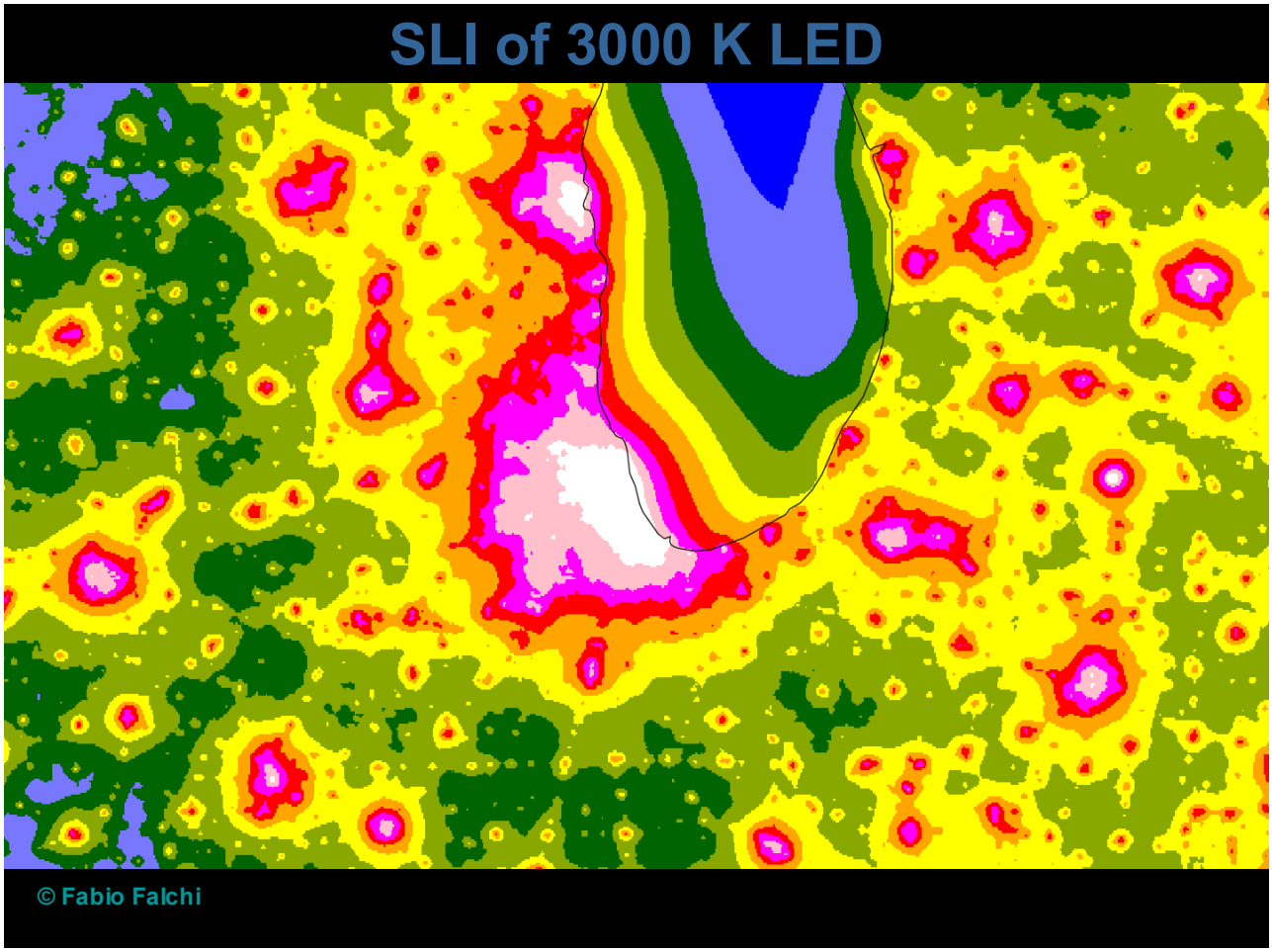
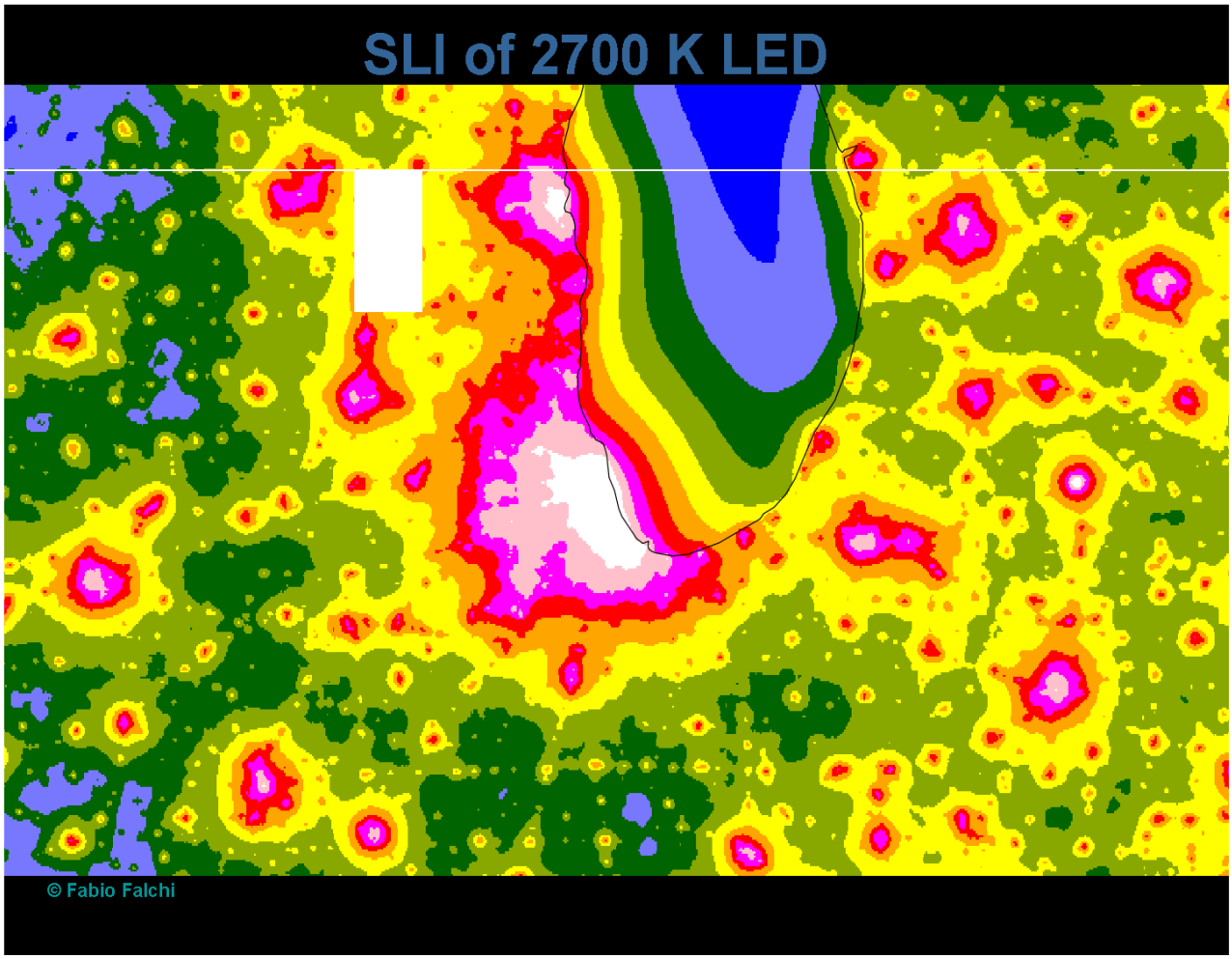
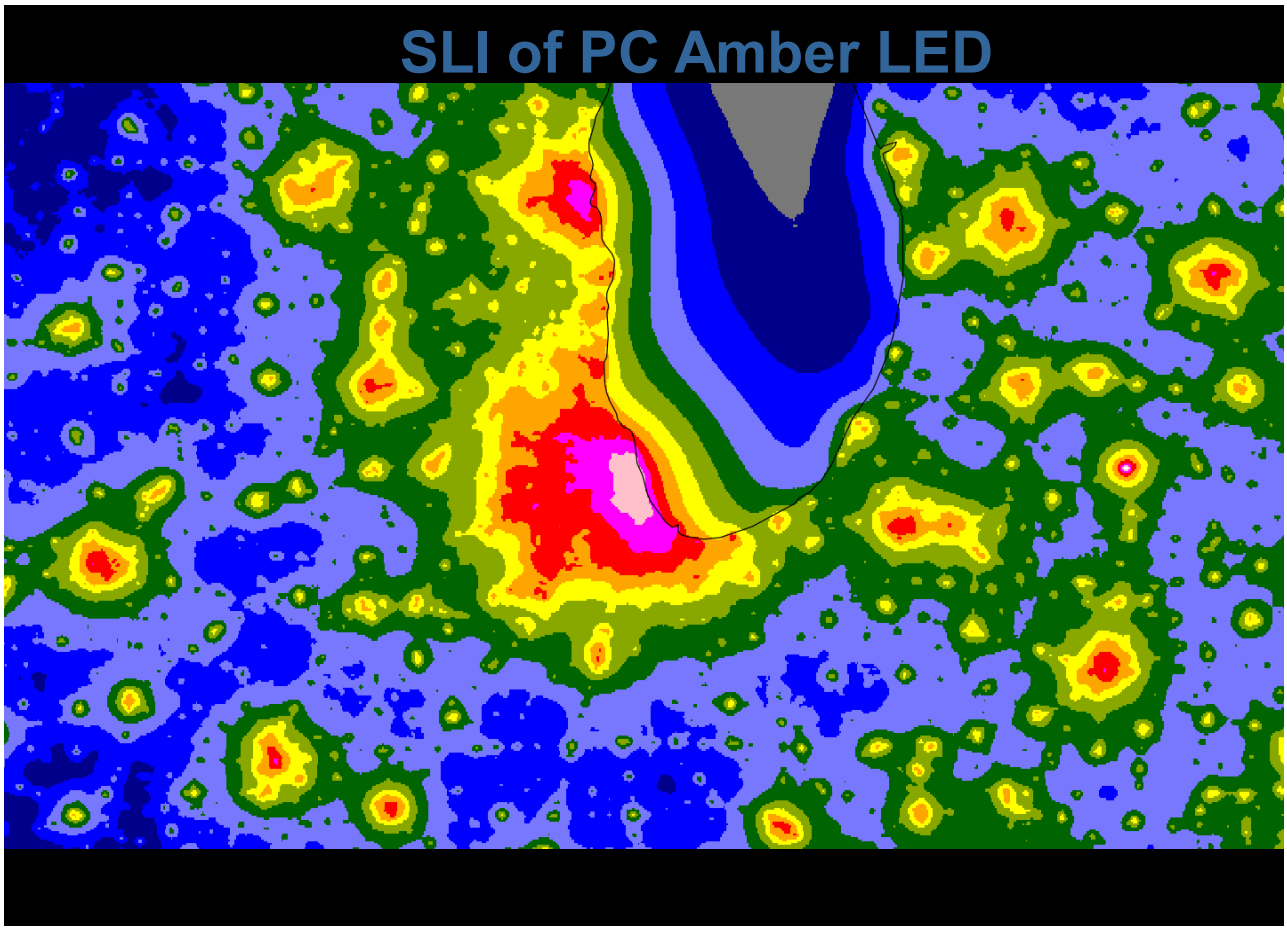
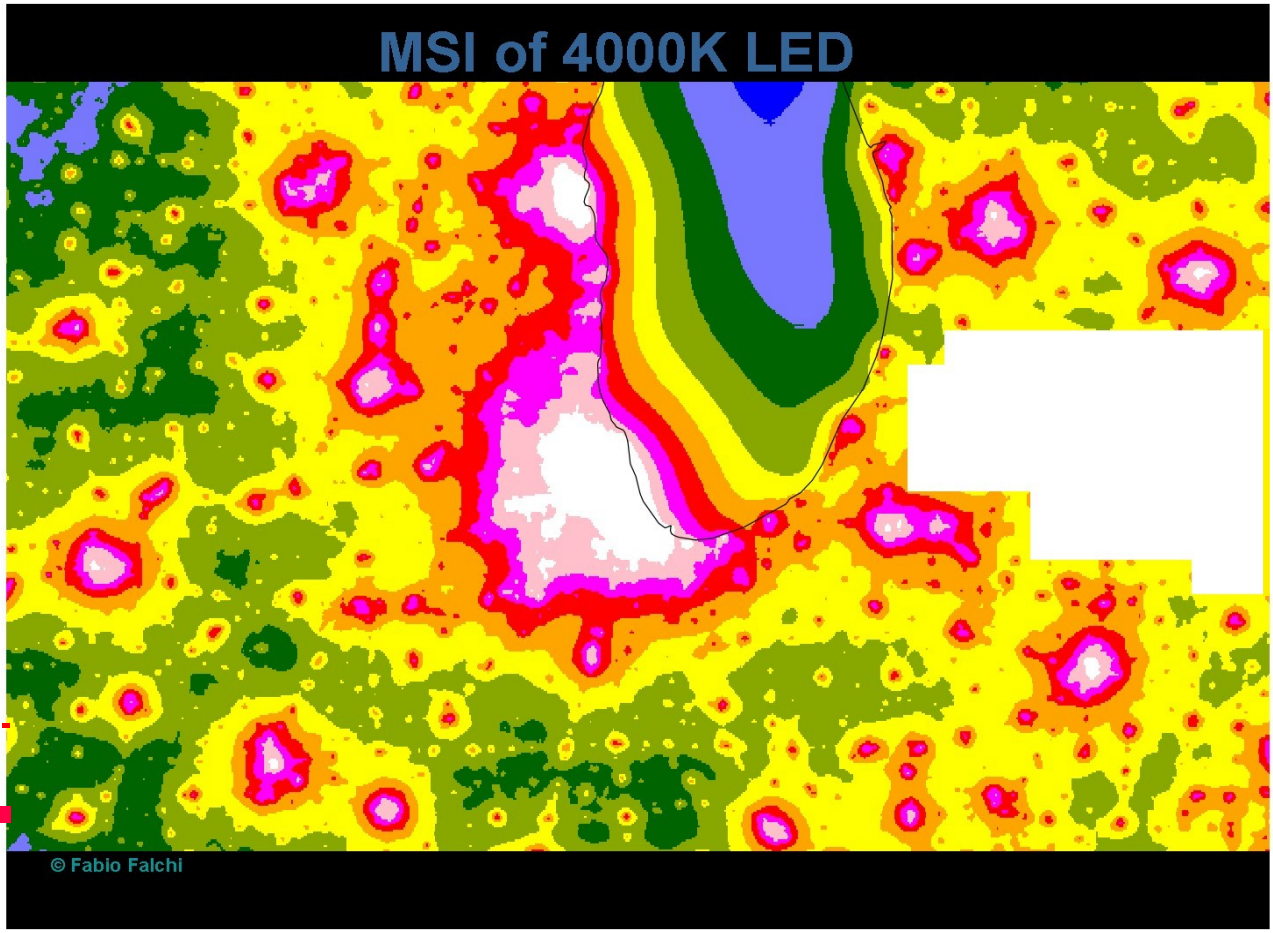
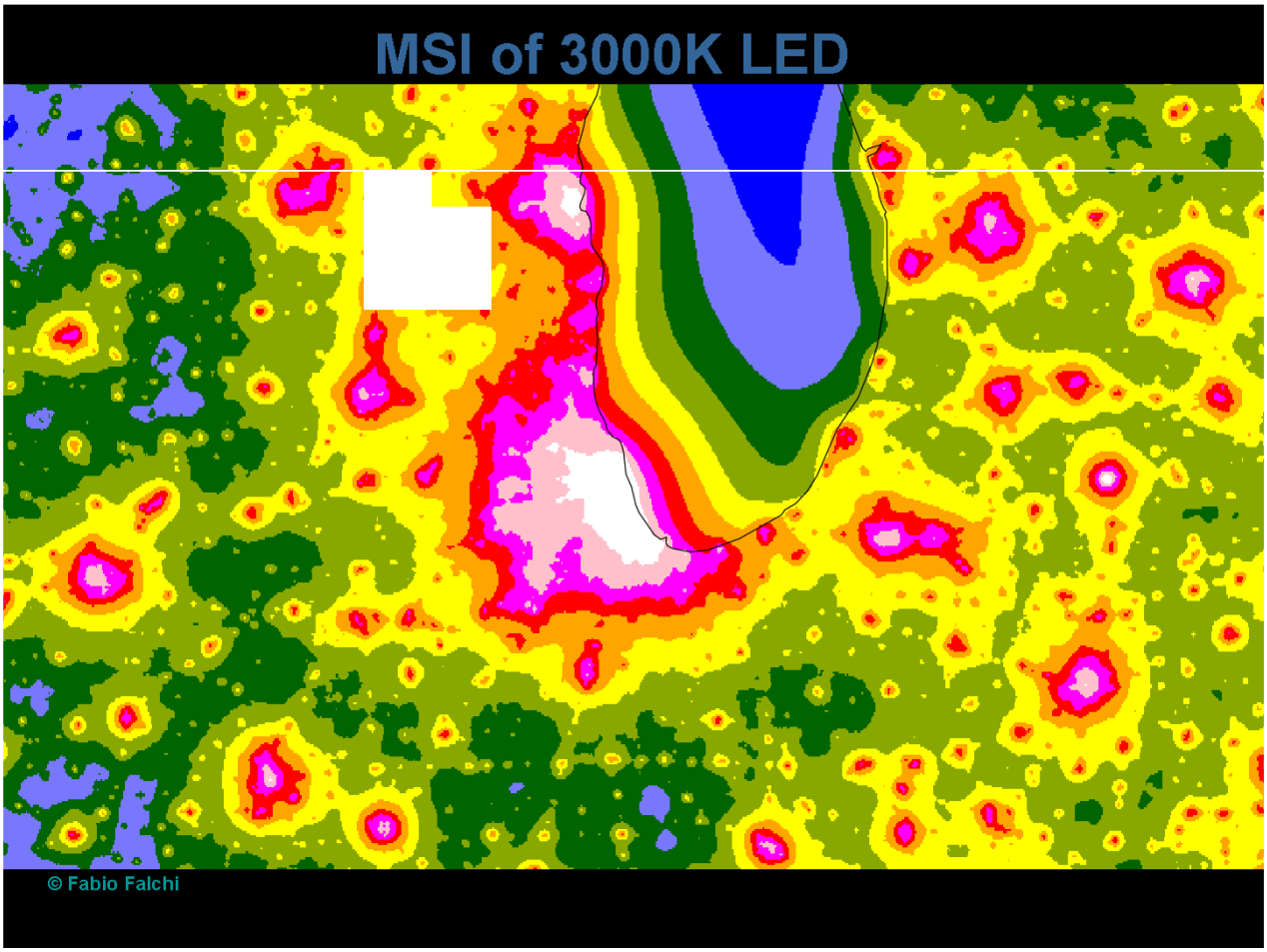


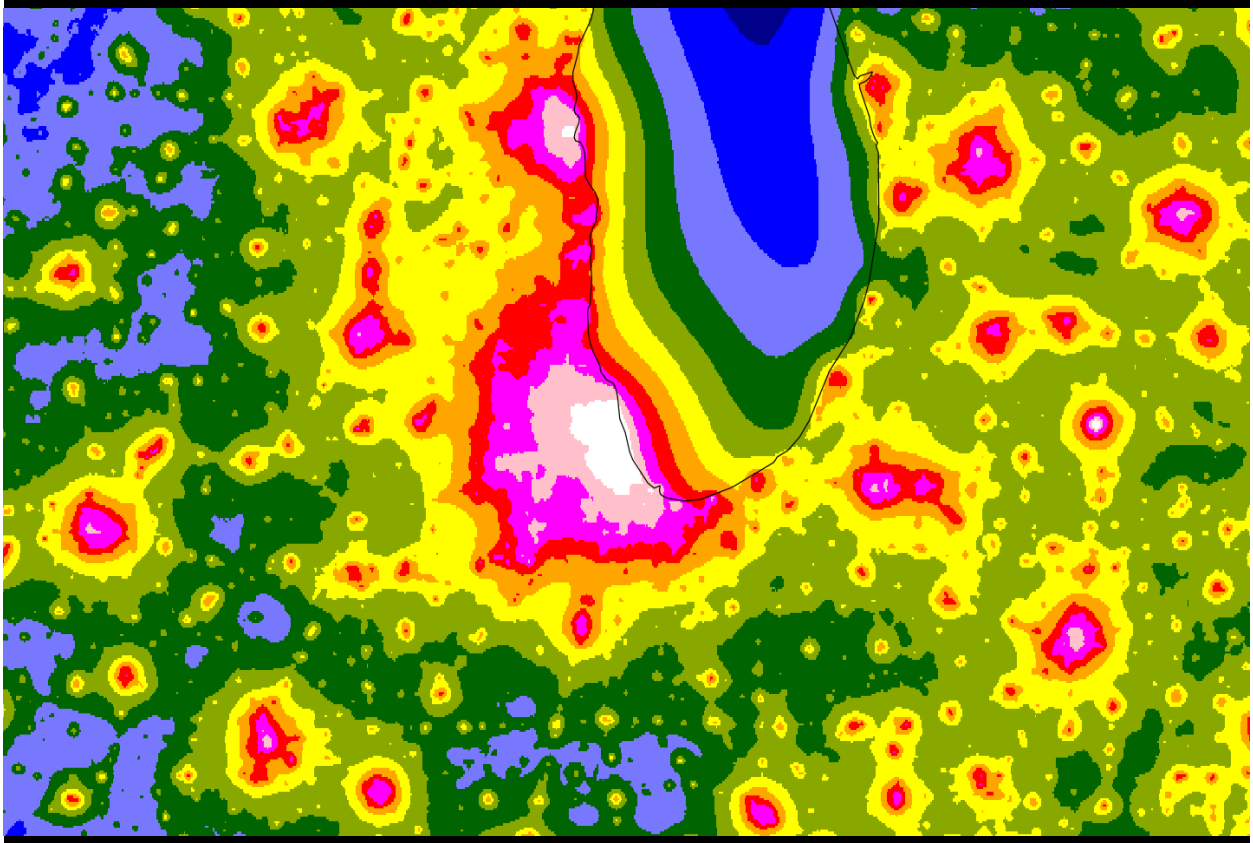




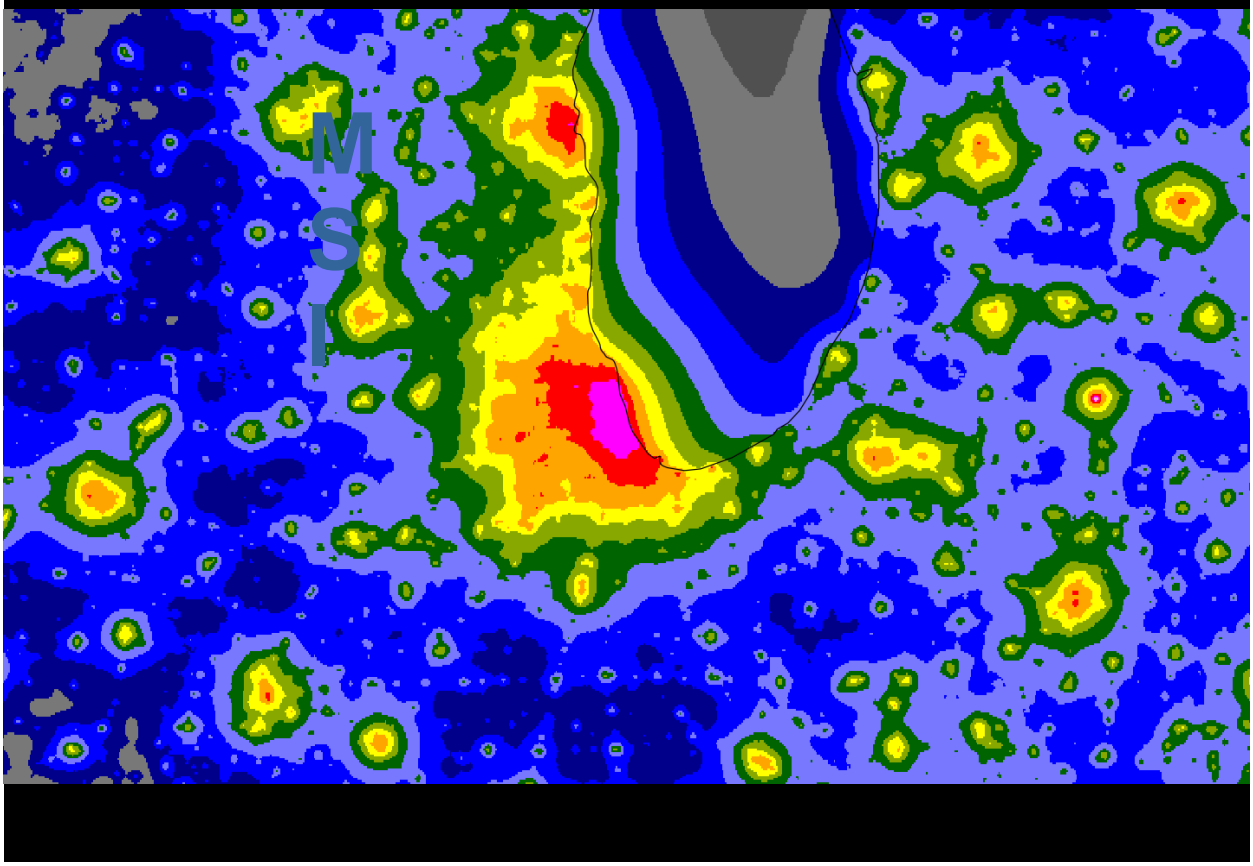




MSI of 2700K LED



MSI of PCI Amber LED



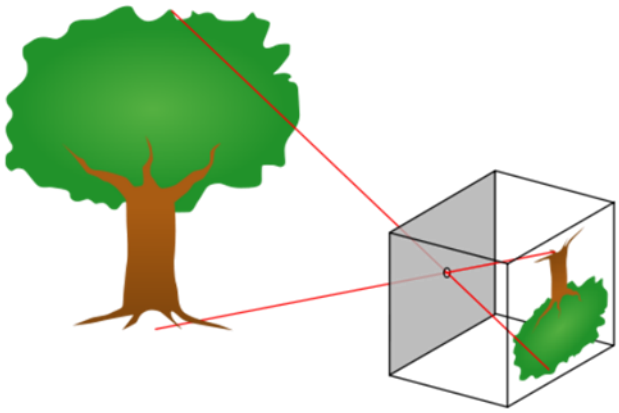
Getting Ready for the August Total Solar Eclipse: Indirect Viewing Methods

by Carl Wenning, Twin City Amateur Astronomers (IL)

The total solar eclipse of Monday, August 21st is fast approaching. That being the case, I want to focus member attention now on how to observe the sun during various phases of the eclipse with some simple equipment. While totality will last a maximum of about 2^m40^s this summer in southern Illinois, the partial phases of the eclipse will last hours, and these phases will be visible both from inside and outside of the path of totality. This will provide adequate time to experiment with viewing the sun using different methods.

Pinhole Projection and How It Works

Pinhole projection is the basis behind the well-known pinhole camera. Let's examine how such a camera works. Consider the tree and pinhole camera below. Light from the top of the tree passes through the pinhole and – because light travels in a straight line – it hits the bottom of the pinhole camera housing. Similarly, light from the base of the tree passes through the pinhole and hits the top of the box. Light from the left side of the tree reaches the right side of the box. Light from the right side of the tree reaches the left side of the box. Light from the center of the tree reaches the center of the box. The effect of this point-to-point mapping is the creation of an inverted projection of the tree within the pinhole camera. If film is placed on the back of the camera, a picture can be obtained. If one merely uses waxed paper, the tree's projection can be seen from the outside behind the box.



Achieving the Best Possible Pinhole Image

If you have ever experimented with pinhole projection, you know that two things influence the quality of the projected image: (1) pinhole diameter and (2) distance of the projected image from the pinhole. The smaller the pinhole, the sharper the projection; the longer the projection distance, the sharper the projection – at least to a point. Unfortunately, there is a tradeoff associated with projection brightness. Smaller pinholes and longer projection distances mean sharper but dimmer projections. Larger pinholes and shorter projection distances mean brighter but fuzzier projections. So, the goal is to optimize the distance of the projection for a given pinhole diameter.

Light, when it passes through any aperture, suffers from diffraction. The smaller the pinhole, the greater the diffraction. There is a diffraction limited projection quality that can be achieved using a pinhole and it is given by the following formula:

$$s = 730.5 * w^2$$

where s is the distance of projection (in mm) and w is the pinhole width or diameter (again in mm). You will note that the distance required for a diffraction-limited image goes up with the square of the diameter of the pinhole. This alone makes large pinholes impractical.

Now, let's say one has a 1mm pinhole diameter. How far must the projection be from the pinhole to achieve the best possible (diffraction limited) view? The answer, easily worked out in one's head using the above formula, is 730.5mm or about 0.73m.

For this size pinhole, increasing the projection distance beyond 0.73m will not improve the image quality. The only thing that will happen is that the brightness of the projection will further decrease. Light emanating from a pinhole is subject to the inverse-square law for the propagation of light. Double the distance and the image brightness becomes only one-fourth as much as before. The best and brightest projection will occur at 0.73m in this case. Less than 0.73m and you end up with a brighter but fuzzier image; more than 0.73m and you end up with a dimmer image – but not any sharper.

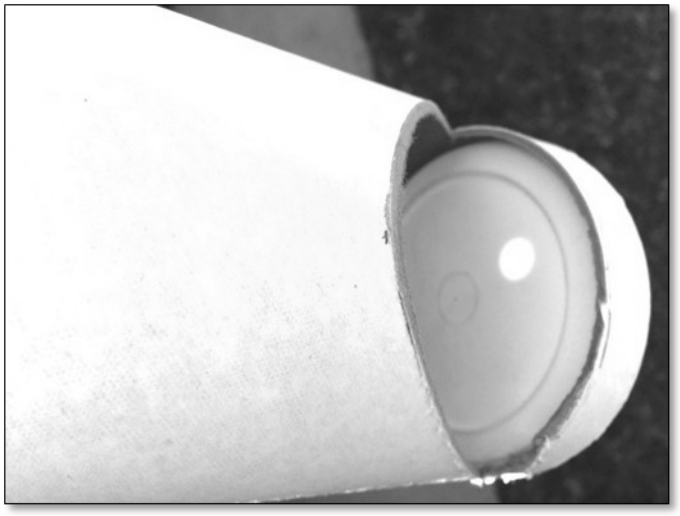
So, if the projection screen is set up 0.73m from the 1mm pinhole to produce the brightest and sharpest image of a 32'-diameter sun, just how big will the projection formed be? That can be worked out using the following formula:

$$D = 0.0093 * s$$

where D is the image diameter and s is the distance between the pinhole and viewing surface. Both are expressed in the same units, say mm. So, a 1mm pinhole produces a diffraction-limited projection of maximum brightness will have an image diameter of 0.0093 * 730.5mm = 6.79mm. That's tiny, but large enough to show considerable detail in the projection of the sun's image.

One practical means to produce an acceptable-size pinhole projections of the sun is with the use of a long mailing tube. Anything shorter – a tissue box, a shoe box, a small cardboard box – doesn't produce an adequate image size as the throw distance just isn't long enough

One can purchase a 37” long, 3”-diameter mailing tube from an office supply store for about $5. This tube is 900mm internally considering the indentation of the plastic endcaps. These can be used to produce pinhole images on the order of 81/3 mm in diameter. Notice in the previous image that I cut a wedge out of the bottom end to allow viewing of the projected image while providing a bit of dark space to provide sufficient contrast for viewing.



A 1.1mm diameter pinhole was produced at the opposite end with a drill bit, the diameter of which was chosen to optimize the brightness of the projection without degrading image quality. The width (diameter) of the pinhole was worked out from the initial formula presented in this article:

$$s = 730.5 * w^2$$

Solving for s and inserting the appropriate values, we get

$$w = \sqrt{\frac{s}{730.5}} = \sqrt{\frac{900}{730.5}} = 1.1mm$$

An observer can use a single pinhole, or even multiple pinhole system (a small sheet of pegboard, a kitchen strainer), to produce many small images of the sun that are surprisingly pleasing even if the projection distant isn’t large enough to secure diffraction-limited images. What one sees with shorter distances might be a bit fuzzy, but the projections are clear enough to make out the partial phases of the eclipsed sun nicely.

Natural Pinhole Projection

Eclipse watchers also can look in the areas around deciduous trees and bushes to take advantage of naturally-occurring pinholes. The crisscrossing of a myriad of leaves produces many pinholes that can serve to produce images of the sun as shown in the picture below. This next picture shows multiple projections of the nearly annularly eclipsed sun several years ago near the time of sunset.

Mirrored Projection

A nice variation on pinhole project is mirrored projection. Ideally this will be done using a front-surface mirror, but even cheap back-surface mirrors will work tolerably well. The other day, around noon, when the sun was shining brightly in the south, I used a flat Hello Kitty children’s makeup mirror to produce a projection of the sun on the east side of my house. The mirror is 60mm in diameter. Theoretically, the required diffraction-limited image would be formed some 2.6km away! Still, I found through experience that a practical distance is much less than this.

I stood on the sidewalk to the east of my house and reflected the sun’s light about 11m (11,000mm) producing a solar image of about 100mm in diameter on the siding. Moving into the partial shadow of nearby tree limbs (so the tree branches passed in front of the sun), I could clearly see the limbs in silhouette against the sun’s projection – even from 11m! If I were to mount the mirror on a tripod, I’d then be able to walk up to the image and inspect it more carefully.

As with the pinhole, there is a practical upper limit to the size of a reflecting mirror. Consider the question of how well a 6” (152.4mm) flat mirror would work to produce a diffraction-limited image. By the numbers, the required projection distance to obtain a diffraction-limit projection is over 10 miles (about 17km). With the inverse-square law, that projection would be far too dim to observe and atmospherics would play havoc with the image quality. Ergo, it is probably best to stick with small mirrors and accept the slightly degraded images that result from not achieving the projection distance required for diffraction-limited images.

Keep in mind that as Earth turns, any projection produced by a “fixed” mirror will quickly show the sun’s motion across the sky. A “fixed” mirror will need to be periodically adjusted to keep the sun’s projection in roughly the same place.

Want to keep a group of kids entertained using mirrored pinhole imaging of the sun during the August eclipse? Then go to a party store and pick up a party pack containing a dozen 30mm-diameter flat make-up mirrors for around $6 and let the kids have at it. They will get very acceptable projections of the sun with just several meters of projection distance.

Let the kids experiment with the mirrors by masking off parts of the mirror with their hands to form semicircles, rectangles, triangles and squares for instance. The tolerably well focused images of the sun formed at a great distance from the masked mirror will all still be circular, just somewhat dimmer than if the whole aperture of the mirror had been used. Many kids (as well as adults) will find this quite surprising.

Lensed Projection

If a mirror can be used to produce an image, then what about the use of a lens? As you might already know, pinholes and lenses work much the same; however, the advantage of the lens over the pinhole is that it will transmit more light thereby producing a brighter image. One of the drawbacks of a lens is that it has a fixed focal length.

(You might be curious about my use of the word image as opposed to projection here. With the use of pinholes, I spoke of projections; with the use of lenses, I speak of images. Is there a difference? Yes, projections can appear at any point behind a pinhole; images will occur only at particular distance behind a lens. If the object imaged is a very great distance away, then the image is produced at a distance roughly equal to the focal length of the lens.)

A lens will produce an image of the sun, but keep in mind that it will work only if it has a long enough focal length. A typical magnifying glass will not work. It will focus a whole lot of sunlight a very short distance from the lens producing a very tiny, intensely bright image of the sun. The amount of light so concentrated can make the paper used to produce the image burst into flame!

Only long-focal-length lenses will serve the purposes of producing a large, bright solar image. Consider the thin lens formula:

$$\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{F}$$

That is, the sum of the reciprocals of the image and object distances equals the reciprocal of the focal length of the lens. Not to worry; this can be simplified. With the distance of the sun being huge (d_0 approaching infinity for all intents and purposes), this equation reduces to $d_0 = F$. That is, the projection distance equals the focal length of the lens. Additionally, with the sun the focal length becomes the projection distance, s.

Because lenses work similarly to pinholes, the same image-size formula given above applies. That is,

$$D = 0.0093 * F$$

So, the image diameter produced by a lens of F = 300mm focal length (60mm diameter) will produce an intensely bright image some 2.8mm in diameter which is not very good for viewing purposes. A lens, or even a parabolic mirror, with a focal length of 3,000mm would be ideal. It will produce an image nearly 28mm in diameter.

Telescopic Prime Focus Projection

It is unfortunate that most of us don't have 3,000mm focal length lenses or mirrors laying around. Hence, we might want to consider using a telescope to project an image of the Sun using a prime focus approach. Telescopes typically have long focal length objectives that, when used without an eyepiece, can produce modest-sized images of the sun. Telescopes provide the added features that they can track the sun during an eclipse and a view screen attached to the moving telescope makes observing projected images of the sun most convenient.

Now, I have an Celestron CPC 11" f/10 telescope. What short of image can I get using prime focus projection? The focal length of my telescope is 11" x 25.4mm/1" x 10 = 2,794mm. Ergo, the objective alone with product an image 0.0093 x 2,794mm = 26mm. This is great you say, but not so fast!

Before you rush out and use your "big rig" to image the sun, consider the fact that large objectives will gather more light than needed, that internal components might melt and burst into flame due to the intense solar radiation, and if someone inadvertently looked through down the eyepiece drawtube at the sun, they would likely suffer physical harm. Most telescope users' manuals tell the owner NOT to view the sun without an appropriate solar filter in front of the objective. This warning is provided for a reason.

Telescopic Barlow Lens Projection

If you do have a small-aperture refracting telescope (that doesn't collect so much light), you might want to consider using it to project an image of the sun.

One of the drawbacks, it seems, is that image size is determined solely by the focal length of the objective. That's not so. One can use a cheap, single-lens 2-5X Barlow lens housed in a metal tube to effectively increase focal length of the objective and, therefore, the size of the projected image. A 2X Barlow effectively doubles of the focal length of the system and therefore doubles the size of the image produced (it also reduces the surface brightness of that image by a factor of 2^2 or 4 times). If you do want a larger, brighter image still, you'll need to "go" with eyepiece projection using a telescope in conjunction with a cheap, all-metal-and-glass, air-spaced eyepiece. Keep in mind that intense solar rays can literally burn the antireflective coatings off lenses; melt, burn, or discolor any balsam used to hold lenses together; wilt plastic lenses; and set cells ablaze that hold lenses if the light is misdirected. With that said, let's consider the next phase of image projection.

Telescopic Eyepiece Projection

What if I want a larger image than can be produced using either a prime focus arrangement or a Barlow lens? If that is what you want, then you need to include a cheap eyepiece in the system to further magnify the image. Such an approach is known as eyepiece projection.

Calculating the sun's image size now depends upon not only the focal length of the objective, but also on the focal length of the eyepiece, and must include a magnification factor determined by the eyepiece-to-projection screen distance. These factors come together as follows:

$$D = 0.0093 * P * F/f$$

where P is the projection distance (measured from the surface of the eyepiece to the surface of the projection screen), F is the

focal length of the telescope objective, and f is the focal length of the eyepiece.

Let's say we are using a 900mm focal length refractor with a 20mm eyepiece to produce an image on a projection screen located 250mm from the eyepiece. What image diameter can we expect?

$$D = 0.0093 * 250 * \frac{900}{20} = 105mm$$

Of course, one can use the above formula to determine what focal length eyepiece would be required to produce a given image size as well, say, 100mm which is ideal. With a 300mm focal length telescope, a projection distance of 250mm, what focal length eyepiece would be required to produce a 100mm wide projection?

$$f = 0.0093 * P * F/D$$

$$f = 0.0093 * 250 * \frac{300}{100} = 7mm$$

Sun Funnel Viewers

Now, there are several types of viewing screens, but the one with growing popularity today is the sun funnel viewer. Instead of using a white observing screen, rear projection screen material is used as an imaging surface. These viewers obey the same laws as telescopic eyepiece projection, and so you can make similar calculations for this helpful device.

Small refractors (50mm-90mm aperture) are best for use with the sun funnel; use of a catadioptric or Newtonian system is strongly discouraged because of the potential for the concentrated light of the sun to destroy secondary mirror holders.

One more thing to keep in mind is that to control the brightness of the image observers will need to place an aperture mask over the front of a telescope to "stop down" the amount of light entering the system. This will require a bit of experimentation to get the image brightness desired.

What Will I See?

You might notice in pinhole projection and reflection systems that meet the diffraction-limited criterion slight blue and red color fringes on opposite sides of the sun's projection. That is caused by refraction of Earth's atmosphere and is a real phenomenon. Another thing that can be clearly seen is solar limb darkening. Both observables appear in the image showing the operation of the mailing tube pinhole projector above.

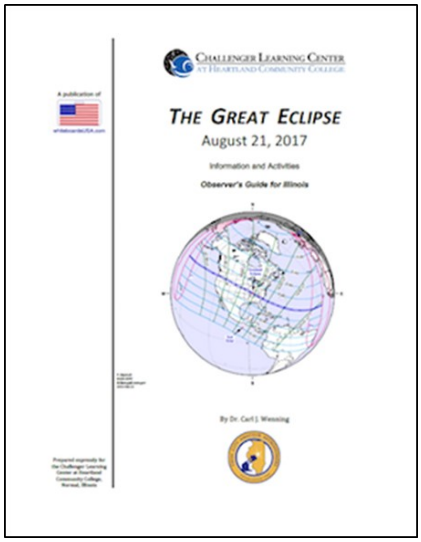
Unfortunately, most projections produced with the use of pinhole and mirrored projection will be dim and somewhat unfocused due to the requirements of diffraction-limited imaging that are not met due to the long projection distance required. These projections will not exhibit all the white light details that are directly viewable on the sun.

The advantage that the lensed projection system has over the pinhole projection system is that images of the sun can be produced that are brighter and sharper. When using lensed systems that are properly focused, one can clearly see the partial phases of the eclipse, as well as larger sunspots and limb darkening.

When an eyepiece is used with a lens for eyepiece projection, the rewards are greater still. Even sunspots will show fine detail if the quality of the projection screen is high and the image scale is large. Do note, however, that any dust present on the surface of any of the lens elements will show up in the image of the sun. The need for clean eyepieces is essential.

Now is the time to experiment with observing the sun using these different means of indirect observation. In the next issue of Northern Lights (Summer 2017) to be distributed next June, I'll return to the subject of viewing the eclipsed sun but this time using direct methods.

Challenger Learning Center of Central Illinois Publishes Eclipse Guide



The Challenger Learning Center (CLC) at Heartland Community College in Normal, IL, (co-host of NCRAL 2016) has published an updated version of The Great Eclipse 2017: Observer's Guide for Illinois. NCRAL members who attended NCRAL 2016 received a pre-production, draft version of this booklet.

This lavishly illustrated 24-page booklet is tailored to provide detailed information specific to Illinois observers, and includes scientific background, local circumstances of the eclipse, and a host of preparatory and eclipse day activities. Dr. Carl J. Wenning, member of the Twin City Amateur Astronomers and former director of the Illinois State University Planetarium, authored the publication.

The booklet is intended not only to inform the public about the August 21, 2017, total solar eclipse, but to provide observers with the information and basic tools in order to do so. Each copy of the Observer's Guide includes a set of certified-safe solar eclipse viewing glasses manufactured on behalf of the Astronomical League, the nation's largest association of amateur astronomers.

The distribution of this booklet is intended as a fundraiser for both the CLC and other educational non-profits willing to distribute this Guide. The author suggests that the publication either be sold for a minimum of $10 or given in recognition of those who donate $10 or more to a club, museum, or science center. The document is digitally printed on durable 80# velvet stock paper and is saddle stitched at two points near the center and trimmed on three sides.

BULK orders are now being accepted by the CLC. Guides MUST be ordered in multiples of 20 only. Guides will be available in exchange for a donation of $6.00 per copy to the CLC. Shipping and handling is included in BULK orders. Please remit your tax-deductible contribution (made payable to Challenger Learning Center – a federally registered 501(c)(3) educational non-profit) and mail it to the following address: Challenger Learning Center, Attn: Stacey Shrewsbury, Heartland Community College, 1500 West Raab Road, Normal, IL 61761-9446.