# The Blue Moon Observer
# July, 2017

The July general meeting of DPAS will be held on July 11, not on July 4. Enjoy your Independence Day! The main feature will be a preview of the Solar Eclipse of 2017 which occurs on August 12. Tom Minahan will present Astronomy Basics. Refreshments will be served.

Door Peninsula Astronomical Society

Mailing Address:
P.O. Box 331
Sturgeon Bay, WI 54235

www.doorastronomy.org



***Notes from Our Meeting***

June 6, 2017

**Tom Minahan** did a great job dubbing for our time-between-presidents. He began by announcing to the 27 folks there that we hired an intern for the summer. His name is Zach Meredith and he'll be starting the middle of this month, with a stipend made possible by Ray Stonecipher's legacy. Tom outlined a number of tasks that Zach will be assigned. More to follow, for sure. He then spoke of the great win of the International Dark Sky designation at Newport State Park and the sign that Jim Maki had crafted for them at the SB school: 6' wide and colored correctly to be placed on the entrance sign to the Park. Tom explained the long and careful process for a place to be named such, and Jim quipped: "The whole UP is a dark sky!" Tom then announced the choice of the Board for officers, with Gary Henkelmann as President: it required a vote of the members, and after a motion and second it carried with all present voting for Gary and the others.

**Dave Lenius** gave an excellent talk on ***Telescope Eyepieces***, demonstrating the relationship between the magnification and the field of view with his 2000mm, with the basic thought being the larger the magnification the smaller the field of view: a 2000mm offering, for instance, twice the magnification of a 1000mm but at ½ the field of view. But at higher power, you sacrifice sharpness and detail. The Maximum Usable Power is 60x the aperture in inches: on an 8" scope, the MUP is 8 x 60 or 480 power. (This is what telescopes we find in the local big box stores offer.) The field of view/apparent field is the chunk of sky you can see: the apparent field divided by the magnification, so a 50 degree at 100 magnification gives you a .05 degree field of view. Of eyepieces, he offered two types: the Plossl, with 4 or 5 elements, well corrected for a flat view, 50 to 52

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Who We Are

DPAS is a local club and chapter of the Astronomical League. We are also a club member of the International Dark-Sky Association and the Night Sky Network, teaching arm of the Astronomical Society of the Pacific. We meet on the first Tuesday of every month, with rare exception. Meetings are held at the Ray & Ruthie Stonecipher Astronomy Center unless otherwise announced. We operate and maintain the Leif Everson Observatory which houses a 14" Celestron Schmidt-Cassegrain telescope on a sophisticated tracking mount controlled by computer, a weather station housed in the observatory with current readings shown on our web site:

www.doorastronomy.org

The StarGarden near the observatory is used for viewing the sky with unaided vision, binoculars and members' telescopes. There are also binocular mounts set in concrete which allow viewers of different heights to view an object through the same binocular.

The Ray & Ruthie Stonecipher Astronomy Center, shown on the right at the top of this page, provides for storage, projects, meetings, warm-up and toilet facilities. It also houses a StarLab, an inflatable planetarium with a sophisticated projection system. The planetarium is available for group presentations.

An Analemmatic Sundial was dedicated on October 20, 2012.

The "astronomy campus" as described here is reached by taking Utah Street east to the stop sign and turning left through the gate onto Stargazer Way. Set your GPS to 2200 Utah.

**How, on Earth, do we measure the Universe?**

One of my fondest childhood memories, inspired by a great teacher who saw my interest in physics, revolves around borrowing the school telescope over the Christmas holidays. For a few cool, clear winter nights I was able to share with my family, some of the wonders of the sky. This was the first time that we had seen, first hand, details of lunar craters, the rings of Saturn, the Andromeda Galaxy as a disk as well as Jupiter's moons and stripes. With the enthusiasm of a twelve year-old, I was able to rattle off facts about the distances and sizes of these objects.

My mother brought me 'down to earth' with the question "but how do we know that these distances are true if we have never been there?" After getting over this blow to my faith in text books, a healthy curiosity was inspired as well as a realization that we have learned so much about distant space before we had ever ventured from the Earth. I became determined to understand how, on earth, we had measured so much about the Universe.

The tools needed to start on this journey are quite basic. With a methods to measure time and space (a ruler and a watch will suffice for now) and armed with a basic understanding of angles and triangles, we are ready to begin.

Let us start with the Earth. If we went to Syene, a city near the equator, around 2200 years ago, we may have met Eratosthenes. According to legend, Eratosthenes noticed that at noon on the longest day of the year, he could see the water at the bottom of a very deep well. He deduced that the sun must be directly overhead on this day and time. At the same moment, it was observed that the Column at Alexandria (around 500 miles away) cast a shadow. Knowing the height of the Column and the size of the shadow, he could (using the magic of triangles) determine the angle of the sun from the overhead. By multiplying this angle up to 360 degrees and the distance from Syeve to Alexandria by the same value he calculated that the Earth was 25,000 miles in diameter (amazingly, within 1% of true value) .

Turning our eyes to our nearest neighbor, the moon, using a simple 'similar triangle' apparatus then we know the angle that the moon represents in the sky. We just need to know either the distance to the moon or the size of the moon to calculate the other dimension.

Aristarchus of Samos, who lived around the same time as Eratosthenes, observed a lunar eclipse, where the moon passes through the shadow cast be the Earth. He timed how long it took for the moon to pass into the Earth's shadow (around an hour)

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DPAS BOARD

Gary Henkelmann, President
president@doorastronomy.org

Thomas Minahan, Vice President, Outreach Coordinator, and Board Secretary

Susan Basten, Secretary, Treasurer , ALCOR, and Membership Chairperson
treasurer@doorastronomy.org

John J. Beck, Past President and Editor
editor@doorastronomy.org

Jim Maki, Academic Coordinator

John W. Beck, Webmaster

Mike Egan, David Lenius, Jacque Axland, and Steve Ransom-Jones, Members at Large

Ray Stonecipher, in spirit

In addition, Barbara Henkelmann serves as the DPAS Archivist.

The business of the DPAS is largely conducted at the Board meetings to leave the general meetings open for programs. The Board meetings are scheduled for 7 PM on Monday, 8 days prior to the following general meeting, at the Astronomy Center. Members of DPAS are invited to attend Board meetings.

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degree Field Of View and good eye relief, and the Nagler with 6 or 8 elements and an 82 degree apparent Field Of View. He rated use of eyepieces as follows:

- 2mm-4.9 too much magnification
- 5-6.9 mm good planetary detail
- 7-9.9 good for the Moon
- skipping a couple: 18-24.9 good general purpose
- 25-30.9 good locator – the best overall
- a 31-39.9 and a Barlow lens which doubles everything.

Nice, neat, clear presentation.

**Tom** had brought the refreshments: two Bundt cakes, one with brown sugar and the other with orange flavor, washed down with grape juice or water. Tasty!

There followed the ***Genius*** series with Stephen Hawkins, "Where Did the Universe Come From?" We had seen this before, so if you had a feeling a "*deja vu* all over again", you were paying attention the first time. It all became clearer on the second showing. His assistants, Paul, Mestia (?) and Alejandro, did some fine work. They began with a the 12" x 12" Hubble photo taken of galaxies – 10,000 of them in one frame. The questions: how many galaxies are there? They had an 8" Celestron out on a golf course and asked how many of the squares it'd take to fill an imaginary sphere around them. They walked out 1000 feet to fill that FOV (thank you, Dave Lenius for the prescient presentation!), using the 1000 feet as the radius and multiplying it using 4-pi-squared and the 10,000 galaxies per picture gives us a tremendous number of galaxies out there, only a tiny fraction of which we can see!

Next was a demonstration of how far away the galaxies are to us. An electric VW bug at a ¼ mile drag strip with a siren on it and two of the assistants measuring the sound as the car whipped past at 138 mph gave us the Doppler effect of the sound waves. Colors work the same as sound: receding stars are red; approaching stars are blue. Taking the lines backward, they all appear to come from a single source. Penzias and Wilson found the echo of the Big Bang and gave us the reason for the hiss on a TV or radio: the hiss is background radiation coming from *every* direction. And the universe is expanding, with galaxies farther from us going faster as they go. What makes them move the way they move? A demonstration using leaf blowers and balloons shows that space is expanding, not just balloons. The impression observation gives is that we are the center of the universe.

The final challenge was the question: where did the Big Bang happen? Here the assistants used 2 screens, with images of the universe

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**Astronomy Quiz**

I. Which of the following is true?

A. A solar eclipse happens only during a new moon, and a lunar eclipse happens only during a full moon.

B. A solar eclipse and a lunar eclipse both occur only during the full moon.

C. A lunar eclipse occurs only during a full moon, but a solar eclipse is unrelated to the lunar phase.

II. During the Perseid meteor shower, the meteors are passing through the atmosphere at:

A. 5.9 meters/second

B. 59 km/second

C. 590 km/second

III. The International Astronomical Union has identified:

A. 88 constellations in the Northern Hemisphere

B. 88 constellations in the Southern Hemisphere

C. 88 constellations in the Northern and Southern Hemispheres.

*meeting notes from page 3*

projected ton them. Their task was to line them up. A task they couldn't do: each time they'd line up a star from one screen to match itself on the other, the relative positions of the other stars shifted. Where in the universe we are all depends on our perception. Everyone and every thing is the center of the whole shebang.

Mike Egan

**Solar Eclipse Trip**

The deadline for reserving a room for the Drury Inn in St. Peters for the 20th of August is July 19. Any remaining rooms will be released after July 19, and the group rate will disappear.

**Outreach**

**Outreach Committee: *Tom Minahan, chairman***

**July 26: Birch Creek** viewing. Back up night is July 27

**August 16 5:30pm:** Library Telescope Program at Sturgeon Bay Library. Solar filters.

**August 17, 11:00am:** Library Telescope Program at Sister Bay Library. Solar filters.

**August 19**: Viewing at Whitefish Dunes. Beach is inaccessible as a result of high lake level; we'll ask for parking lot #1.

**August 21**: Solar eclipse at the Astronomy Center. Zach Meredith is helping to arrange; Jim and Dave will host for Sturgeon Bay viewing **(11:53 begin, 1:16 83%, 2:37 end)**

**Summer Intern**

DPAS is delighted to welcome **Zach Meredith** to his experience as summer intern. Duties will include: planning for Astronomy Day in October, solar eclipse, observatory programming, NCRAL 2018, publicity, others. Be sure to meet Zach at a meeting if you have not already.

**NCRAL 2018**

Jacque Axland has been moving her committee and the project right along. Tentative budgets and schedules have been set, speakers have been secured, and help has been offered by IDA, NCRAL chairman, chairman of NCRAL 2017, and one of our speakers who chaired the 2012 combined NCRAL and ALCON.

**New Members**

Dennis & Patricia Meyer
Mary & Clement Grote

## Poetry Corner

Brother of Selene* drives the sun
Beyond the sky, Selene at his side
Behold! a moonless sky alight with stars
And patterns nebulous to human eye

Without a cloud or errant beam of light
The stars turn brighter as my longing eyes
Appreciate the spectacle of dark,
Dark skies alight with myriad brilliant points

I ponder, what a privilege to view
What most before they die will leave unseen
May we and generations yet unborn
Proclaim that darkness fills our skies with light.

John J Beck

**Moon goddess, brother of Helios, pronounced in 3 syllables with accent on the second syllable.*

***Pulse article from page 2***

and then pass completely through it (around two hours and thirty six minutes). His deduction was that the Earth's diameter was approximately 2.6 times that of the moon. His estimate was certainly of the right order of magnitude. Unfortunately the Earth does not project a fully cylindrical shadow out to the moon's orbit, but there is an area of partial shadow (known as a penumbra). This is due to the relative size and placement of the Sun and Earth. Once this was taken into account then the relative diameter of the Earth was refined to 3.7 times that of the moon. We can now use the magic of similar triangles to estimate the distance of the moon.

Aristarchus then turned his attention to measuring the distance of the Sun. The puzzle was to form a convenient triangle to solve this problem. He applied some deductive reasoning to an observation of the moon: when the moon is half illuminated, then the Sun must be directly overhead the moon. The rays of light from the sun, reflecting into our eyes from the half illuminated moon must therefore form a right angle. Aristarchus had created an imaginary right angled triangle between the Sun, moon and observer. If we can just measure the angle of the moon from the vertical then we could deduce the moon to Sun distance. Improvements of Aristarchus' The challenge for measuring astronomical distances is rapidly becoming one of measuring angles as precisely as possible.

nearby objects against the backdrop of distant sThe challenge for measuring astronomical distances is rapidly becoming one of measuring angles as precisely as possible.

One severe limitation when measuring vast distances using simple instruments is that it is easy to lose precision. Just a small measurement error makes a significant difference to the result. We need to make the 'instrument' triangles as large as possible to obtain the maximum precision. To obtain a better distance measurements (for either more accuracy or to measure greater distances), we need to use triangles with the largest possible base side. Astronomers were able to construct these large triangles by simultaneously making observations of the sun, moon or planets from different places on the Earth (using our whole planet as one side of the triangle). Small angles could be measured by looking at the apparent differences in the position of nearby objects against the backdrop of distant srough measurement eventually placed the sun at 390 lunar distances or 93 million miles.

*The preceding article by Steven Ransom-Jones was published in the Peninsula Pulse in June and used by permission of the Peninsula Pulse and doorcountypulse.com.*

## Astronomy Quiz Answers

I. A is correct. For a lunar eclipse, the moon, earth and sun must be inline with the earth between the sun and moon, as is the case during the full moon. For a solar eclipse, the moon, earth and sun must be inline with the moon between the sun and earth, as in a new moon.

II. B is correct. 59 km (37 miles)/ second.

III. C is correct. A total of 88 constellations are recognized by the IAU.



### Dedication of Newport State Park as a Dark Sky Park

On June 22 at 1 PM a dedication ceremony took place at Newport State Park, celebrating its designation by the International Dark-Skies Association as an IDA Dark Sky Park. This rare designation is reserved for sites where light pollution is virtually nil and policies help to keep it so. Years in the making, the late Ray Stonecipher was a prime mover and his memory was mentioned by many who spoke at the dedication, including comments by your president, Gary Henkelmann and by your editor. Susan Basten, Barb Henkelmann, and Zach Meredith also attended.

Gary estimates attendance at 50-80 people. Enthusiasm for the Park's new achievement was high within the DNR ranks as well as with the County tourism department and Friends group. Master of ceremonies was Michelle Hefty, park ranger for Newport and Rock Island state parks. She also was largely responsible for the IDA's decision to award the title.

Several who spoke stressed that our dark skies are a valuable Door County resource for many reasons and we hope to influence decision-makers to address appropriate lighting policies to maintain or improve our unique dark skies.

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## The Shape of the Solar System

By Marcus Woo

When Stamatios (Tom) Krimigis was selected for the Voyager mission in 1971, he became the team's youngest principal investigator of an instrument, responsible for the Low Energy Charged Particles (LECP) instrument. It would measure the ions coursing around and between the planets, as well as those beyond. Little did he know, though, that more than 40 years later, both Voyager 1 and 2 still would be speeding through space, continuing to literally reshape our view of the solar system.

The solar system is enclosed in a vast bubble, carved out by the solar wind blowing against the gas of the interstellar medium. For more than half a century, scientists thought that as the sun moved through the galaxy, the interstellar medium would push back on the heliosphere, elongating the bubble and giving it a pointy, comet-like tail similar to the magnetospheres—bubbles formed by magnetic fields—surrounding Earth and most of the other planets

"We in the heliophysics community have lived with this picture for 55 years," said Krimigis, of The Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland. "And we did that because we didn't have any data. It was all theory."

But now, he and his colleagues have the data. New measurements from Voyager and the Cassini spacecraft suggest that the bubble isn't pointy after all. It's spherical.

Their analysis relies on measuring high-speed particles from the heliosphere boundary. There, the heated ions from the solar wind can strike neutral atoms coming from the interstellar medium and snatch away an electron. Those ions become neutral atoms, and ricochet back toward the sun and the planets, uninhibited by the interplanetary magnetic field.

Voyager is now at the edge of the heliosphere, where its LECP instrument can detect those solar-wind ions. The researchers found that the number of measured ions rise and fall with increased and decreased solar activity, matching the 11-year solar cycle, showing that the particles are indeed originating from the sun.

Meanwhile, Cassini, which launched 20 years after Voyager in 1997, has been measuring those neutral atoms bouncing back, using another instrument led by Krimigis, the Magnetosphere Imaging Instrument (MIMI). Between 2003 and 2014, the number of measured atoms soared and

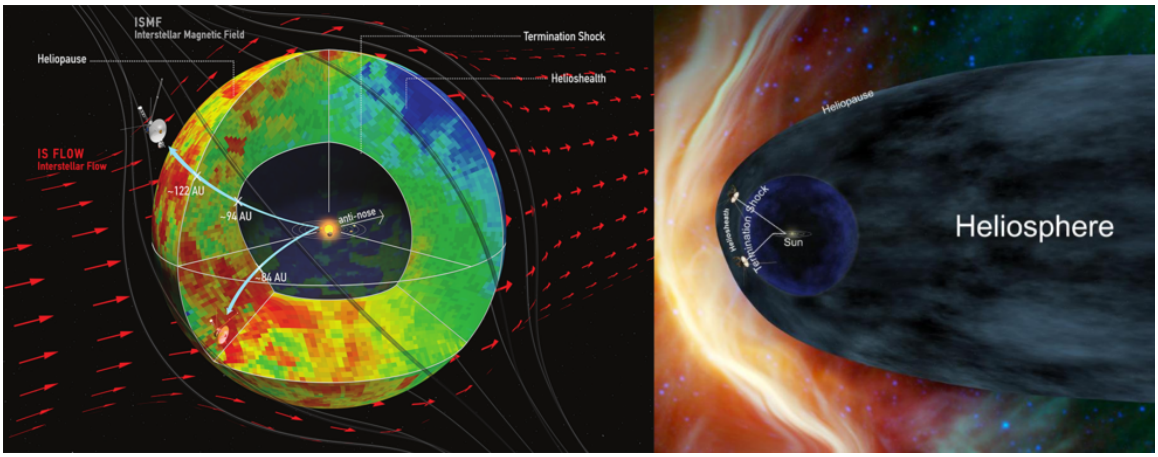
dropped in the same way as the ions, revealing that the latter begat the former. The neutral atoms must therefore come from the edge of the heliosphere.

If the heliosphere were comet-shaped, atoms from the tail would take longer to arrive at MIMI than those from the head. But the measurements from MIMI, which can detect incoming atoms from all directions, were the same everywhere. This suggests the distance to the heliosphere is the same every which way. The heliosphere, then, must be round, upending most scientists' prior assumptions.

It's a discovery more than four decades in the making. As Cassini ends its mission this year, the Voyager spacecraft will continue blazing through interstellar space, their remarkable longevity having been essential for revealing the heliosphere's shape.

"Without them," Krimigis says, "we wouldn't be able to do any of this."

To teach kids about the Voyager mission, visit the NASA Space Place: https://spaceplace.nasa.gov/voyager-to-planets




*Caption: New data from NASA's Cassini and Voyager show that the heliosphere — the bubble of the sun's magnetic influence that surrounds the solar system — may be much more compact and rounded than previously thought. The image on the left shows a compact model of the heliosphere, supported by this latest data, while the image on the right shows an alternate model with an extended tail. The main difference is the new model's lack of a trailing, comet-like tail on one side of the heliosphere. This tail is shown in the old model in light blue.*
***Image credits: Dialynas, et al. (left); NASA (right)***