The Blue Moon Observer

October 2018 Volume 20, Number 10

Door Peninsula Astronomical Society

PO Box 331
Sturgeon Bay, WI
54235

www.doorastronomy.org

The October general meeting of DPAS will be held at 7 PM on Tuesday, October 2 at the Ray & Ruthie Stonecipher Astronomy Center. The main program, "Beyond ROY G BIV", will be presented by Coggin Heeringa. John J. Beck will present the monthly "Eye on the Sky" portion. Guests are welcome.

Meeting Notes September 4, 2018

Gary Henkelmann welcomed 25 members and guests, and acknowledged the presence of our newest members, David and Christa Ott. He recapped a busy August of astronomy activity, expressing thanks to Steve Ransom Jones for single-handedly presenting both programs at the August membership meeting, and acknowledged Tom Minahan's huge commitment to our outreach effort by hosting the 5 Nights program at Newport Park August 10-14. The August 11 viewing night at the Astronomy Center drew a good crowd to see the Planets and meteor shower, and the outreach event at Whitefish Dunes State Park's Candlelight Walk on August 18 drew an estimated 700 visitors, with many lining up to see the moons of Jupiter, Mars, the rings of Saturn, and close-up views of the Moon through Susan Basten's and Gary Henkelmann's scopes set up on the beach.

Dave Lenius then announced that the funds had been received for the board-approved purchase of a new 16 inch Ritchey-Chretien reflector telescope for the observatory, which was to be ordered presently, with the expectation of being operational sometime in October. This recent optical design technology produces sharp images to the edge of the field, making it ideal for astrophotography, which along with the recent upgrades to the camera, computer, and software will give us a greatly enhanced observing and sharing capability. Gary then announced the plans for Astronomy Day 2018, which will be held on Saturday, October 20, 2018. Following the theme of "Waves", which the Wisconsin Science Festival has adopted for its' event at Crossroads earlier in the week, we will sponsor two major attractions: an afternoon session featuring hands-on activities for the family and a special Planetarium demonstration in the Astronomy Center, presented by Ansible technologies of Princeton Center, MA; and an evening lecture at the Collins Learning Center on Gravity Waves presented by St. Norbert College Professor Dr. Michael Olson. If the new L.E.O. telescope is operational we will feature that as well. Gary requested help from the members at the meeting to help out, and a good number signed up to assist. For those not present at the meeting, please contact Gary at (president@doorastronomy.org) to volunteer.

Before introducing the main program, John explained why he had included questions about the Higgs boson in the September issue of the Blue Moon Observer. Questions are often drawn from previous presentations and in about 2008, the late Ray Stonecipher introduced the topic of the Higgs boson as it was reported that it had actually been "seen" as a result of studies using the Large Hadron Collider. Just about a week before our September meeting, it was

continued on page 3

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, and a weather station housed in the observatory. Current weather readings are shown on our web site: www.dooraastronomy.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 the same object through the same binocular.

The Ray & Ruthie Stonecipher Astronomy Center 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 used 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. Or you can set your GPS to 2200 Utah.

October Milky Way

Even for those with little experience viewing the wonders of the night sky, October is a great time to view the Milky Way and other easily recognizable sights. Of course, one of the easiest ways to get started is to visit an event with amateur astronomers such as the Door Peninsula Astronomical Society's scheduled viewing night on October 6. Watch the Peninsula Pulse for events sponsored by other astronomical groups in the area.

The full or nearly full moon makes the Milky Way difficult to see well with unaided vision, so checking a calendar for moon phases is helpful. On October 2 this year the last quarter moon doesn't rise until about 4:45 AM in our location, so there's plenty of time for dark sky viewing. New Moon is on the 8th. The weekend of the 13th and 14th the moon sets between 9 PM and 10 PM, and on the 31st the last quarter moon doesn't rise until around midnight.

Astronomical twilight determines sky darkness in relation to sunrise and sunset. On October 2 the sky is darkest from about 8 PM to around 5 AM. That period is from about 8:30 PM to around 5 AM on the 31st. While you're waiting for the sky to get dark enough to spot constellations you may see Saturn in the southwest and Mars in the south.

Although the Milky Way is magnificent with unaided vision with clear skies and no light pollution, it's even more striking with binoculars. You don't need expensive binoculars to appreciate the myriad stars in the Milky Way. If you're in the market for binoculars and wonder which is best for astronomy, that's an entirely separate topic.

To find your way around, it helps to have a star map or planisphere. An October issue of Sky & Telescope or Astronomy magazine will have a sky chart, or you can download one from skymaps.com. Remember that with most sky maps you rotate it so that the direction you're looking is at the bottom of the chart, then hold it over your head. You'll notice that otherwise, west will be on the right of a north-south line instead of on the left.

Sagittarius the archer has moved westward since summer. Look for the easily recognizable teapot asterism near the southwestern horizon. You'll be looking toward the center of our Milky Way Galaxy, and the southwest end of the Milky Way. You'll also spot Saturn near the teapot; binoculars or a small telescope will show that it's a planet, not a star. You may even see the rings. With a telescope or binoculars you might view a globular cluster. Look for the symbols on your sky chart; there are several in the region. Each globular cluster is a tight bundle of hundreds of thousands of stars.

Following the Milky Way northeastward you'll encounter the bright star Altair. You can try to make out the constellation Aquila the eagle of which Altair is its brightest star. Then moving on to nearly directly overhead, look for the Northern Cross, the asterism that marks Cygnus the swan who is flying southwestward along the Milky Way. The relatively bright star at the tail of Cygnus (or top of the cross) is Deneb. The head of the swan or bottom of the Northern Cross is Albireo, nearly midway between Altair and the brightest star just north of the Milky Way, Vega. Even binoculars may show Alberio to be a double star with interesting color contrast between the two component stars. Vega marks the constellation Lyra the lyre, and telescope users have fun focusing on the Ring Nebula in that constellation. Lyra lies just northwest of the Milky Way. Between Aquila and Cygnus you may have noticed Sagitta the arrow and Vulpecula the little fox, and telescope viewers may find the Omega or Dumbbell nebula in that vicinity.

Continuing northeast along the Milky Way is that most recognizable

continued on page 4

DPAS BOARD

Gary Henkelmann, President
president@doorastronomy.org

David Lenius, Vice President

Thomas Minahan, Outreach Coordinator

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

Jacque Axland, Membership Chairperson and Recording Secretary of the Board

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

John W. Beck, Past President and Webmaster

Jim Maki and Dennis Sundin, Members at Large

Ray Stonecipher, in spirit

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 held at the Astronomy Center at 7 PM on Monday, 8 days prior to the following general meeting. Members of DPAS are invited to attend Board meetings.

Meeting Notes cont. from page 1

reported that scientists had "seen" the Higgs bosons to degenerate 60% of the time to two bottom quarks as predicted, further confirmation of the existance and properties of the Higgs boson. He briefly mentioned the relationship between subatomic particle physics and our understanding of the cosmos.

On to the video: "Cosmology in Einstein's Universe". John suggested that we watch for how Dr. Carroll distinguises between cosmic redshift and doppler redshift, and also how he hints at how, when he says that all galaxies are moving apart, yet we know that galaxies collide and the Andromeda Galaxy and the Milky Way galaxy are moving toward each other.

First, Dr. Carroll briefly reviewed two prior lectures and remined us that the density of galaxies is the same all over the cosmos, and that the cosmos is expanding. He reviewed how the expansion stretches the frequency of light waves so that the waves are farther apart and thus the measured frequency is lower in contrast to the doppler redshift in which two bodies are moving away from each other. He reviewed gravity from a cosmic perspective is represented by the curvature of spacetime. This lecture is about how a smooth universe which is expanding is explained in terms of Einstein's equasion of general relativity. What does the equasion, which is the relation between stuff in the universe and the curvature of spacetime, tell us about a smooth and expanding universe?

He asks, "How big is the universe?" and "Does the question make sense?" He answers his questions by stating that we don't know the answer to either. We don't see any limit to the size of the universe, and spacetime is dynamical. We do know the approximate age of the universe since the "Big Bang", about 13.7 billion years. And light travels at a finite speed. So even if the universe were infinite, we wouldn't be able to see it because the light couldn't reach us. "So it could be infinite, it could be finite—we don't know." So how can we talk about it expanding if we don't know its size and whether or not it's infinite or finite?

We know that galaxies are moving away from each other. So how many years until those distances are 10% or even twice what they are now? No matter what two galaxies we choose, the answer will always be the same, because the distances are proportional to their velocities. So we can talk about the relative size of the universe in relation to its size at some former or future time.

He went on to explain the meaning and use of the "scale factor", which by convention is set to 1. When the scale factor was 1/2, that means the distances between galaxies and thus the size of the universe was half of what it is today. Cosmologists ask what the scale factor was doing as a function of time. They can trace the scale factor back nearly to the "Big Bang". He reminds us that we know nothing of the Big Bang but we know a lot about what was happening seconds after the Big Bang. The Big Bang is "just a marker for our ignorance". Scientists think that the universe was expanding much faster in the early years than it is today, thus the scale factor presents a steeper slope after the Big Bang than it does now. However in the past 10 years cosmologists find that now the slope is increasing, thus the universe is expanding at an accelerated rate "and that is why we believe in dark energy".

Einstein's theory of general relativity tells us that it's "stuff" in the universe that leads us to the curvature of spacetime. He then asks, "What kind of stuff is there in the universe?" Also, what kinds could there possibly be? The things we see are made of particles, and the particles are bound together. Things like galaxies are bound by their mutual gravity. And here's the key to the question I posed in my introduction tot he program: bound systems do not expand. (We can think of the local group of galaxies as a bound system.)

continued on page 5

Astronomy Quiz

1. A telescope is advertised as using ED glass. What does ED mean?

2. What popular asterism in the sky is in an open cluster known as Brocchi's Cluster, Al Sufi's Cluster,or Collinder 399, and is located in the constellation Vulpecula near the border with Sagitta?

3. The Arecibo Observatory is:
a) in Peru
b) an array of radiotelescopes
c) a single dish 1000 feet in diameter
d) a Ritchey-Chretien telescope with 100 inch diameter glass mirror and adaptive optics.

4. As a "rule of thumb", the moon is about how many moon diameters from Earth?

5. As a "rule of thumb", the sun is how many times as far from Earth as is the moon?

6. A hydrogen alpha filter generally blocks all but light between 0.5 Angstroms and 1.0 Angstroms. What is the wavelength of the hydrogen alpha emission?

7. Astronomers Arno A. Penzias and Robert W. Wilson are famous for their serendipitous discovery of what?

8. Which is hotter, the sun's core or its surface?

Milky Way from page 2

asterism, the W which marks the constellation Cassiopeia the queen. If you continue northeast at right angles to the most northern pair of stars in the W, with binoculars you can enjoy the Double Cluster in Perseus. Continuing toward the horizon you'll see a string of stars in Perseus. Very close to the horizon you may see the bright star Capella and part of the constellation Auriga the charioteer, which completes our tour of the October Milky Way.

When we look at any stars in any direction, they all are within our Milky Way Galaxy. An exception is that when we view the Andromeda Galaxy with binoculars we're looking at an entirely separate galaxy but we can't begin to resolve individual stars. Picture yourself standing on Earth in our galaxy looking different directions. You can't see all around the galaxy because Earth blocks your view of about half of it, and what you can see appears to be tilted in relation to how you are standing. But when you look toward the edge that you can see, what you see is the Milky Way. When you were looking at Sagittarius at the beginning of the tour, you were looking toward the center of our galaxy.

Now you can count yourself as someone special because you were in Door County where, on a clear night with no surrounding light pollution, you've appreciated the Milky Way. Eighty percent of the people in the United States are unable to see the Milky Way because of light pollution!

More astronomy information for all ages will be presented at the fall Astronomy Day activities on October 20. Watch for details to be published in the Peninsula Pulse and elsewhere.

Questions or comments about this article may be addressed to editor@doorastronomy.org.

John J. Beck

Announcements

The Ritchey-Cretien telescope has arrived. This will replace the aging 14" Schmidt-Cassegrain in the Lief Everson Observatory. I promises to provide wider views and be preferable for astrophotography. While space around the telescope in the observatory is limited and somewhat trecherous, the view through the new 'scope will be able to be viewed on large screens and accommodate more viewers more safely.

Jim Maki no longer choses to serve as academic coordinator for DPAS. Anyone interested in this position is asked to contact any board member. See page 3.

Volunteers! There are plenty of opportunities for members to help out on Astronomy Day. Setting up, cleanup, directing visitors, helping to move equipment, taking photos, are a few of the areas where help is needed and appreciated. Let a board member know that you plan to help, or just show up! Gary Henkelmann is the point person for contact.

In addition to the new telescope for the Leif Everson Observatory, DPAS has obtained a large TV screen with audio sound bar which will make it possible to show images directly from the observatory as well as to be used in our general meeting presentations.

The DPAS Board has voted to loan the inflatable planetarium with its projection equipment and software to support the work of Kate Merideth, who has been displaced from the Yerkes Observatory. DPAS will be looking for other ways we can support her programs in hopes that the building and its telescopes may some day become available to those programs again.

Two more loaner telescopes have been provided to the libraries.

Poetry Corner

Wonder

Sky blue sky now faded by day's sun
Lingers as old gold and campfire hues
Bleed from west and blend as day-light stumbles
And night falls.

Oh, there it is! That pinprick in sky's globe
The evening star, the fickle Venus gleams
And lo, bright Vega pierces blue-black sky
As night proceeds to fall.

As if by wizard's wand more stars appear
And myriad mark the milky Milky Way
So vast yet seeming just beyond my reach
What else is out there?

Andromeda's beta star guides aided eyes
To neighbor galaxy that bears her name
Two million years and more the light it shed
Races to my eye

Just one of many spirals far beyond
Extent imagination fails to grasp
With seeming nothingness among the stars
What else is out there?

Worlds like our own, unlike our own are found
Revolving, orbiting 'round distant stars
Did creatures move on some or do they still?
What else is out there?

Dissecting atoms; incomprehensible
No longer smallest parts of earth and me
Particles by what dark forces bound
What else is in there?

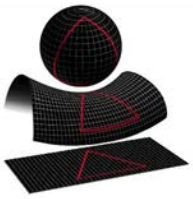
John J Beck

Meeting notes from page 3

Atoms do not expand, therefore the number of atoms per unit of volume is decreasing.

In other words, the universe is becoming more dilute. He tells us that to a cosmologist, matter is anything that is moving slower than the speed of light. According to general relativity, things get their energy from their mass. What $E=MC^2$ is actually telling us is that the *rest energy* of an object is equat to its mass times the speed of light squared. That's the minimum amount of energy that it can have. So the energy per particle is not changing if the object is moving slowly with respect to the speed of light. That's the distinction between matter and radiation: that which is moving at or near the speed of light. Particles moving at the speed of light have energy of zero. Instead, they get their energy from their frequency. Particles moving at or near the speed of light lose energy as the universe expands because of the cosmological redshift. The frequency gets stretched as the universe expands. So as the universe expands, matter becomes more dilute but radiation not only becomes more dilute but also loses energy. In other words, the energy density per particle decreases over time. So in the universe, the total energy in radiation goes down faster than the energy in matter despite the fact that both decrease over time. So we expect matter to win over radiation as the universe ages. In contrast, in the early universe it was radiation that was dominant in terms of the total energy in the universe. A cosmologist a few decades ago would recognize only two forms of energy: matter moving slowly in relation to the speed of light, and radiation moving at or near the speed of light. For the purpose of this lecture he asks us to imagine a smooth universe which makes the concept of the curvature of spacetime fairly simple. One way the curvature of spacetime can be explained is on the basis of an expanding universe.

The other model without expansion is that space itself is curved. He showed the three possible shapes of the curvature of space as imagined in a point of time: positively curved, negatively curved, or flat as in plane geometry. If you draw an equilateral triangle on the surface of a sphere, the angles add up to >180 degrees. Drawing it on a negatively curved area such as a saddle shape results in a sum of the angles being < 180 degrees while in plane geometry the sum is always 180 degrees.



Alexander Friedmann, in 1922, developed his equasion that tells us how the expansion of the universe "responds to the stuff inside the univese". It equates the energy density of the universe with its two components, expansion (represented by the Hubble Constant squared) and the curvature of space (represented by K). So if you know the rate of expansion and also the curvature of space you can determine the total energy density of the universe; there can't be anything else that you don't know about. He maintains that in another lecture he will present that "we" have measured the Hubble Constatnt and "we" have measured the curvature of space, so we know the total energy density of the universe. So if we add ordinary matter, dark matter, and dark energy, there can't be anything else. Future lectures will show how this information can be used to determine the energy density curve over time. The Friedmann Equasion* will be used to determine what the energy density was at some very early time, from that predict what it would be today, and test whether the answer matches what we observe today.
*see page 6

Astronomy Quiz Answers

1. Extra dispersion.

2. The coathanger.

3. c is correct. Arecibo is in Puerto Rico. It is the second largest single dish radiotelescope; the largest is in China.

4. The moon is about 100 moon diameters from Earth.

5. The sun is about 40 times as far from Earth as is the moon.

6. The hydrogen alpha emission line is at 656 nanometers or 0.656 Angstroms.

7. Wilson and Penzias were famous for their serendipitous discovery of the cosmic microwave background radiation using their radiotelescope.

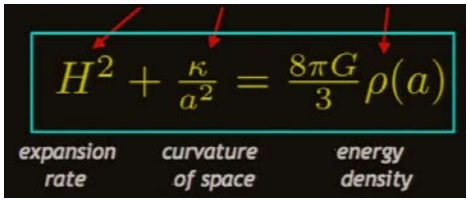
8. The core, at 15.6 million degrees Kelvin is hotter than the surface at 5,800 degrees Kelvin.

Viewing Nights 2018

October 6
October 20 (Astronomy Day, moon viewing)
November 10
December 8

New Members

Welcome:
Tom Gwilyn & Traci Schott
Omar Odland



The Friedmann Equasion (see page 5)

~~~~~~~~~~~~~~

Astronomy Day
News Release by Gary Henkelmann

On October 20, 2018 the stars will align at the Leif Everson Observatory and the Collins Learning Center on the Campus of the Crossroads at Big Creek in Sturgeon Bay. The DPAS 2018 Astronomy Day events include state of the art planetarium shows at the Stonecipher Astronomy Center in the afternoon, a special NASA-registered International Observe the Moon Night viewing session at dusk at the Observatory, and an up to the minute lecture on LIGO with a Gravity Wave measurement demonstration at the Collins Center in the evening. The day, will enthuse, entertain, and educate learners of all ages.

Beginning at Noon on Saturday, Princeton Junction, NJ-based Aram Friedman will demonstrate his Micro Dome planetarium and the latest planetarium software that frees us from "Earth-centered" shows, allowing us to view the Universe from any point within it.

Friedman writes:
"Join us on a tour of the observable universe, from our solar system to the furthest quasar. See the Exoplanets, other solar systems in our back yard, as we hunt for another Earth. View the invisible universe at wavelengths our eyes can't see. See evidence of the big bang. Explore our own Sun as it approaches solar maximum. And, ask the big questions: where did we come from, where are we going, what's out there in the darkness?"

Accompanying the planetarium shows will be family-appropriate "Wave"-themed exhibits and displays, guided tours of the Solar System "Planet Walk", Hands-on telescope and binocular tutorials, and an introduction to the Observatory's newest arrival, a 16 inch aperture hyperbolic-mirrored cousin of the Hubble space telescope. These and other attractions will be on display during this "Wisconsin Science Festival" event Hosted by DPAS.

Then, at 4:30 PM , with clear skies, the STAR Garden and Observatory at the Astronomy Center will host viewing of the rising Moon on this, NASA's International Observe the Moon Night. Seeing the Moon through binoculars or telescopes provides an eye-popping close-up of our only natural satellite. As the Sun sets we'll safely focus on it, and the other visible Planets in the evening sky.

Then, at 7:00 PM in the Collins Learning Center, St. Norbert College Associate Professor Dr. Michael Olson returns to Door County audiences to discuss the technology that has most recently demonstrated our ability to measure and "hear" the reverberations of collisions between Black Holes, and between Neutron stars.

Theory predicted that these collisions would produce Gravitational Waves, but until September 14, 2015 they remained only theory. Then, the LIGO facilities in Louisiana and Washington first detected and confirmed the existence of such waves.

Dr. Olson will demonstrate to the audience, using a video camera and table-top instrumentation, the technology used to sense these ripples in spacetime, and will convey an understanding of the sensitivity of these instruments and the enormous technical challenges that had to be overcome to detect them. The professor will talk of our evolving understanding of the true nature of space, or more precisely, spacetime, and will describe the biggest riddles facing 21st century astronomy.
~~~~~~~~~~~~~~