

SPECTRUM

Northern Cross Science Foundation Newsletter

April 2015

Looking Up

April 2, Thursday

General Meeting

7:00 p.m. - Astronomy 101

7:30 p.m. - Main Program

April 16, Thursday

Board Meeting

7:30 p.m.

Home of Jeff Setzer

April 18, Saturday

Movie Night

7:00 p.m. - 10:00 p.m.

Horicon Marsh

May 7, Thursday

General Meeting

7:00 p.m. - Astronomy 101

7:30 p.m. - Main Program

May 16, Saturday

Public Viewing

8:00 p.m. - 10:00 p.m.

Ackermann Grove

Washington County

May 23, Saturday

Public Viewing

8:00 p.m. - 10:00 p.m.

Pike Lake State Forest

May 24, Sunday

Street Festival

12:00 p.m. - 5:00 p.m.

Pt. Washington Downtown

Astronomy Day

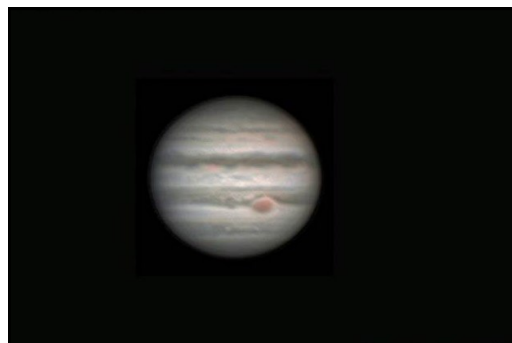
8:00 p.m. - 11:00 p.m.

Harrington Beach State Park

The Imaging Report...by Ernie Mastroianni

Mid-March was an active time for Northern Cross members who photographed a diverse selection of celestial objects from Harrington Beach State Park. On March 11, Chad Andrist pointed the club's Explore Scientific five-inch at Jupiter, recording thousands of frames, then stacking them into a crisply-detailed image of the giant planet and its Great Red Spot. Three days later, Jaime Hanson produced a wide-field image of the Rosette Nebula in Monoceros (near Orion) using his own 80mm refractor. On the same night, Ernie Mastroianni captured the classic Leo Triplet of galaxies - M65, M66 and NGC 3628 - through the five-inch.

Three completely different cameras were used to make these photos. Each was processed with several types of software. But the photos have one thing in common: all are image stacks, made of many single exposures (known as subs) then blended, using a variety of programs that winnow out noise but amplify the signal to produce a final image far superior to any single exposure. Cameras are hot linked to websites for detailed information, use Ctrl\Click.



Chad Andrist Photo of Jupiter

Jupiter: Andrist used a one-megapixel [ZWO ASI 120MM](#) high speed monochrome camera connected to a color filter wheel. He added a 2x barlow to the 5-inch refractor's imaging chain and recorded more than 35,000 frames through four separate filters during a 12-minute span. The camera can record up to 72 frames per second to freeze the best moments of seeing. He used Firecapture software to run the camera, AutoStakkert!2 to stack the frames, Registax to refined the stacks, and WinJUPOS to process the final image.



Jaime Hanson Photo of Rosette Nebula

Rosette Nebula: Hanson's 10-megapixel [QHY10C](#) camera is full color. To record the large but dim nebula, he took 14 exposures at five minutes each using his 80mm ED refractor and a Hutech light-pollution filter. His software suite included Nebulosity 3 for recording, PHD for autoguiding, Photoshop CS6 for combining the subs, and Imagenomic Noiseware to reduce the digital noise. He also took dark frames, essentially long exposures taken with the lens cap on. Even though no light reaches the sensor during a dark frame exposure, the sensor still makes digital noise. Once mapped, the noise can be removed by software, resulting in an image that has far fewer artifacts and much more real detail.



Ernie Mastroianni Photo of the Leo Triplet

Leo Triplet: Mastroianni used an unmodified 12-megapixel [Nikon D700](#) DSLR and combined 10 sub of eight minutes each at ISO 1250. The camera, which has a large sensor (the size of a 35mm film frame) recorded each sub frame in RAW format. For auto-guiding, he used an Imaging Source firewire camera, a MacBook, and PHD guiding software. The subs were processed and stacked using Photoshop CS6.

Nice Surprise -- Quantum Physics Just Got Less Complicated

Bu Guy Pirro

Here's a nice surprise: quantum physics is less complicated than we thought. According to Jenny Hogan of the Centre for Quantum Technologies at the National University of Singapore, an international team of researchers has proved that two peculiar features of the quantum world previously considered distinct are different manifestations of the same thing.

Patrick Coles, Jędrzej Kaniewski, and Stephanie Wehner made the breakthrough while at the Centre for Quantum Technologies at the National University of Singapore. They found that Wave-Particle Duality is simply the Quantum Uncertainty Principle in disguise, reducing two mysteries to one.

"The connection between uncertainty and wave-particle duality comes out very naturally when you consider them as questions about what information you can gain about a system. Our result highlights the power of thinking about physics from the perspective of information," says Wehner, who is now an Associate Professor at

QuTech at the Delft University of Technology in the Netherlands.

The discovery deepens our understanding of quantum physics and could prompt ideas for new applications of wave-particle duality.

Wave-particle duality is the idea that a quantum object can behave like a wave, but that the wave behavior disappears if you try to locate the object. It's most simply seen in a double slit experiment, where single particles, electrons, say, are fired one by one at a screen containing two narrow slits. The particles pile up behind the slits not in two heaps as classical objects would, but in a stripy pattern like you'd expect for waves interfering. At least this is what happens until you sneak a look at which slit a particle goes through. Do that and the interference pattern vanishes.

The quantum uncertainty principle is the idea that it's impossible to know certain pairs of things about a quantum particle at once. For example, the more precisely you know the position of an atom, the less precisely you can know the speed with which it's moving. It's a limit on the fundamental know-ability of nature, not a statement on measurement skill. The new work shows that how much you can learn about the

wave versus the particle behavior of a system is constrained in exactly the same way.

Wave-particle duality and uncertainty have been fundamental concepts in quantum physics since the early 1900s. "We were guided by a gut feeling, and only a gut feeling, that there should be a connection," says Coles, who is now a Postdoctoral Fellow at the Institute for Quantum Computing in Waterloo, Canada.

It's possible to write equations that capture how much can be learned about pairs of properties that are affected by the uncertainty principle. Coles, Kaniewski, and Wehner are experts in a form of such equations known as Entropic Uncertainty Relations, and they discovered that all the math previously used to describe wave-particle duality could be reformulated in terms of these relations.

"It was like we had discovered the Rosetta Stone that connected two different languages," says Coles. "The literature on wave-particle duality was like hieroglyphics that we could now translate into our native tongue. We had several eureka moments when we finally understood what people had done," he says.

Continued on Pg 3

Things to See in the April 2015 Night Sky *By Don Miles*

Mercury, Mars, & Venus: All of these planets are up at sunset, and all set right after the Sun. Earlier in the month, Mercury (-1.1) is still working its way around the "back" side of the Sun, but after later mid-month, will once again trail the setting Sun. It will pass above much fainter Mars (1.4 mag) by less than 1.5 degrees on the nights of the 20th/21st. Mars is the next to set, and will be about (9/8:45pm). It's pretty close to the Sun, so isn't worth the risk for the meager views you'd get. It'll remain in the glare of the Sun until early fall. Brilliant Venus (-4.0) is the next planet to set, and does so by about (10:30/11:30pm). This is the brightest object in the sky (besides the Sun & Moon)...Even Jupiter doesn't come close. It starts the month in the constellation Aries, but works its way eastward thru the month to wind up in Taurus. Since it's an inner planet, a view with a telescope can reveal a phase like our Moon. At first glance, it'll for sure be a round brilliant orb...but if you can cut down on some of the light by using a Moon Filter, or another dark filter, you may be able to detect the non-illuminated side of Venus.

Jupiter: Is the still the crowd pleaser this month as it is already up at sunset, and stays up most of the night. It transits about (9:30am/Sunset), and sets around

(4:30/2:30am). It's now at (-2.4 mag), and the views will keep getting better as it rises earlier and earlier throughout spring. There are numerous occasions of moon/shadow transits across its face and the famous Great Red Spot, so there is always something to see. Check the web for a current schedule for your favorite type of event. It remains in the constellation Cancer.

Saturn: Rises around (11:30/9:30pm) and is at (0.3 mag). Saturn remains almost stationary in the constellation Scorpius. The views will continue to get better as the season progresses as it rises earlier and will remain viewable as an evening object right into late fall. The rings are tilted at an excellent angle to view the gaps or "divisions".

Pluto, Neptune, & Uranus: Pluto will rise by about (2:30/12:30), and still in the constellation Sagittarius. It's still low in the sky, and still faint (14.2 mag), but if you have clear dark southern horizon, and you have good finder charts (or smart phone with a good app), it's possible with a modest telescope. Neptune is the next to rise, and will be about (5:30/3:30am). It remains in the constellation Aquarius. Uranus is the next to rise, but it will be too close to the Sun to be viewable this month. It won't be comfortable viewable until mid-late May.

Moon:

April 4th: Full Moon

April 11th: Last Quarter

April 18th: New Moon

April 25th: First Quarter

Special Events/Objects:

There is only one meteor shower this month that doesn't get completely washed out by the Moon, and those are the Lyrids. They peak the night of the 22nd with rates reaching 15-30/hr. They're known for their occasional fireballs.

Messier Marathon...The best dates for this year's event are the 17/18th or 18/19th. Good Luck to those who attempt it.



April General Meeting

101 Class...By Kevin Bert

Main Program By Jack Heisler

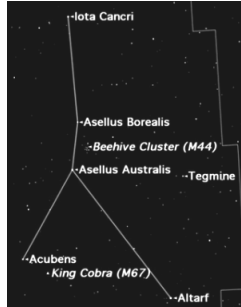
Kevin's talk will be on "MICROMETERITES"

Sundials

A sundial is a device that measures time by the position of the Sun. It measures local solar time. Before the coming of the railways in the 1830s and 1840s, local time as displayed on a sundial was used by government and commerce. Jack will discuss the history and use of sundials through time.

Constellation of the Month:

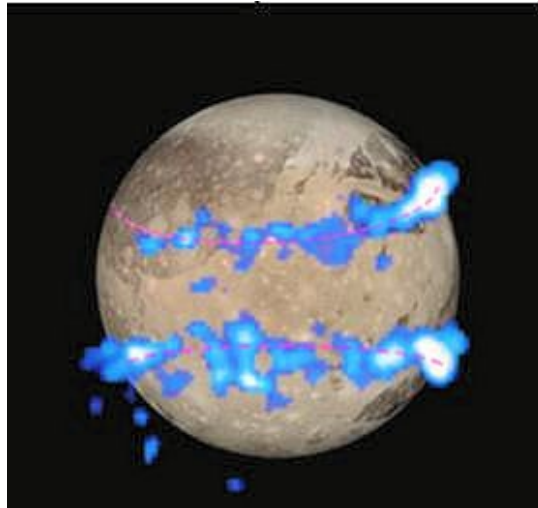
Cancer



Quantum Physics - Continued from Pg 2

Because the entropic uncertainty relations used in their translation have also been used in proving the security of quantum cryptography (schemes for secure communication using quantum particles) the researchers suggest the work could help inspire new cryptography protocols.

In earlier research, Wehner and collaborators found connections between the uncertainty principle and other physics, namely Quantum Non-Locality and the second law of thermodynamics. The tantalizing next goal for the researchers is to think about how these pieces fit together and what bigger picture that paints of how nature is constructed.



NASA Hubble Space Telescope images of Ganymede's auroral belts (colored blue in this illustration) are overlaid on a Galileo orbiter image of the moon. The amount of rocking of the moon's magnetic field suggests that the moon has a subsurface saltwater ocean.

Image Credit: NASA/ESA

The most recent observations were done in ultraviolet light and could only be accomplished with a space telescope high above the Earth's atmosphere, which blocks most ultraviolet light.

NASA's Hubble Space Telescope is celebrating 25 years of groundbreaking science on April 24, 2015.

It has transformed our understanding of our solar system and beyond, and helped us find our place among the stars. To join the conversation about 25 years of Hubble discoveries, use the hashtag #Hubble25.

Hubble is an international cooperation between NASA and ESA. Goddard Space Flight Ctr. In Greenbelt, MD manages the telescope. STScI (Space Telescope Science Institute in Baltimore conducts Hubble science operations.

Hubble Space Telescope's Newest Discovery: An underground ocean in Ganymede! NASA/Gov

A Team of scientists led by Joachim Saur, University of Cologne Germany came up with the idea of using Hubble to learn more about Jupiter's largest moon, Ganymede. "I was always brainstorming, how we could use a telescope in other ways," said Saur. "Is there a way you could use a telescope to look inside a planetary body? I thought, Aurorae, because Aurorae are controlled by the magnetic field, then you know something about the moon's interior."

If a saltwater ocean were present, Jupiter's magnetic field would create a secondary magnetic field in the ocean that would counter Jupiter's field. This "magnetic friction" would suppress the "rocking of the Aurorae. This ocean fights Jupiter's magnetic field so strongly that it reduces the rocking of the Aurorae to 2 degrees, instead of the 6 degrees, if the ocean was not present.

Scientists estimate the ocean is 60 miles (100 kilometers) thick - 10 times deeper than Earth's oceans - and buried under a 95 mile (150 kilometer) crust of mostly ice.

RELATED INFO

Leaders for Public Viewing

April 18

Horicon Marsh Visitor Center
Gene & Charlotte DuPree

May 16

Ackermann Grove Wash Cty PK
Gene & Charlotte DuPree

May 23

Pike Lake State Forest
Gene & Charlotte DuPree

May 24

Port Washington Downtown
Joyce Jentges

May 24

Harrington Beach State Park
Gene and Charlotte DuPree

STAR PARTIES

NCRAL 2015

Has been Cancelled

Wisconsin Observer Weekend

WOW

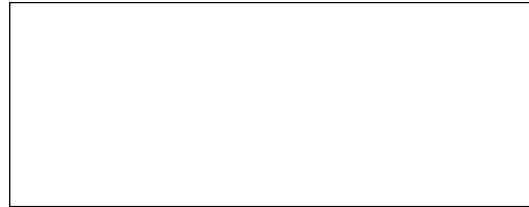
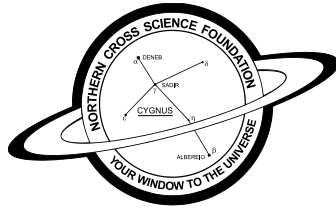
June 11 - 14th
Hartman Creek State Park,
Waupaca, WI
Register Form at
www.new-star.org/

Northwoods Starfest

August 14 - 16
Hobbs Observatory
Fall Creek, WI
cvastr.org@gmail.com



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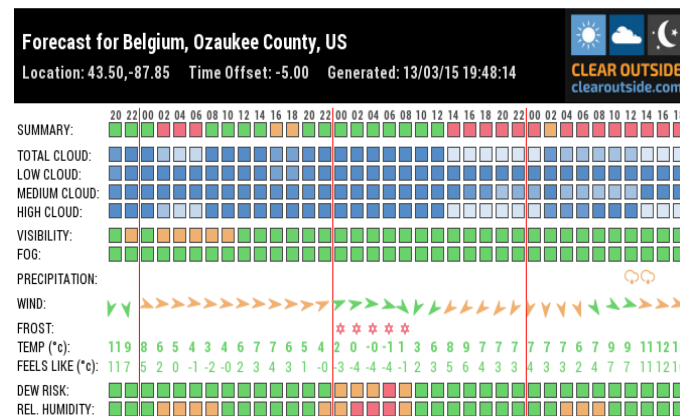
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Clear Outside...by Chad Andrist

Some of you may have come across this already, but there is a really nice app and website from First Light Optics called Clear Outside. It provides at-a-glance information on not only cloud cover, but darkness, humidity, sunrise/set, moon rise/set/phase, ISS flyovers, and more. It is uniquely tailored to astronomers and for me has been accurate enough to replace the ClearSkyClock as my choice of clear sky outlook software.



Data can also be embedded into a signature, website, or forum in 3 formats. Here's the large one:

Visit the website here: <http://clearoutside.com/forecast/43.50/-87.85> (this one is for Belgium, WI)

The android app is located in the Google Play Store: <https://play.google.com/store/apps/details?id=com.firstlightoptics.clearoutside>

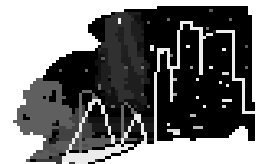
The iOS app is located in the App Store: <https://itunes.apple.com/us/app/clear-outside/id921555752?mt=8>

SPECTRUM

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This Issue, along with back Issues of SPECTRUM, can be found on the NCSF Web Site.

<http://www.ncsf.info>

Monthly Meeting Information

7:00 p.m. Astronomy 101
7:30 Main Program
Unitarian Church North
13800 N. Port Wash. Rd.
Mequon, WI 53097