THE FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

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Officers: President, **Dwight Harness** (1770 Hollonville Rd., Brooks, GA 30205, 770-227-9321, rdharness@yahoo.com); Vice President, **Bill Warren** (1212 Everee Inn Rd., Griffin, GA 30224, warren7804@bellsouth.net; Secretary, **Carlos Flores**; and Treasurer, **Truman Boyle**.

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Club Mailing Address: 1212 Everee Inn Rd., Griffin, GA 30224. FRAC website: www.flintriverastronomy.org.

Please notify Bill Warren promptly if you have a change of home address, telephone no. or e-mail address, or if you fail to receive your monthly *Observer* or quarterly *Reflector*.

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Club Calendar. Thurs., Jan. 12: FRAC meeting (7:30 p.m. at The Garden in Griffin, with lunar & planetary observing before and afterward; **Fri.-Sat., Jan. 27-28:** JKWMA observings (at dark).

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President's Message. Officer elections will be held at our Feb. meeting.

Sometimes new members think that, because they are new to FRAC or astronomy, they aren't qualified to serve as an officer in the club. Nothing could be further from the truth. Experience isn't important, neither is veteran status in the club. What's important is wanting to get involved.

If you're interested in serving in any of our elected positions -- president, vice president, secretary, treasurer or board member – in 2017, please let me know.

This is an exciting time for FRAC, with plans for a permanent observatory at UGa-Griffin well underway. We'd love to have you join our leadership team in 2017 in whatever capacity you're willing to serve.

-Dwight Harness

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Last Month's Meeting/Activities. Dwight Harness, Truman Boyle & yr. editor conducted a public observing for about 25 of **Dr. Richard Schmude's** Gordon College students on Nov. 17th.

Steven Hollander, Jeremy Milligan, Alan Rutter & yrs. truly attended our club observing at JKWMA on Dec. 2nd.

On the following evening, we had 23 attendees at our Christmas party: **Dan Pillatzki; Mike Stuart** & his granddaughter**, Hannah Delgado; Steven & Anna Hollander; Larry Higgins; Dwight Harness; Truman & Denise Boyle; Dr. Richard Schmude; Carlos Flores; Aaron Calhoun; Felix Luciano; Erik Erikson; Alan Rutter; Jeremy, Sarah, Emily & Delilah Milligan; Kenneth & Rose Olsen;** and **Bill & Louise Warren**. Alan received his Lunar Program certificate & pin; Dwight received an A. L. polo shirt with "FRAC President" on the back; and we gave out a ton of doorprizes and packets, ate like there was a famine coming in the morning and enjoyed the company of nearly two dozen of the nicest people on the planet.

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This 'n That. The preacher always dreaded delivering his annual sermon reminding his flock that it was time for them to renew their tithes. He took a deep breath, put on his winningest smile, looked out over the congregation and began. "And now, dear funds…"

In like manner, we remind you that, along with officer elections, February is also the month when your club dues are up for renewal in 2017. It's still $15 a year; cash is fine, but if you want to pay by check you should make it out to FRAC. Either way, you can give your dues payment to **Dwight** or **Bill** at the Feb. meeting or observing, or mail it to: **Bill Warren, 1212 Everee Inn Rd., Griffin, GA 30224.**

Larry Higgins doesn't need to do that, because one of his doorprizes at the Christmas party was a year's free membership in FRAC.

*Speaking of whom….Congratulations on your retirement, **Larry!** Now you'll have time to do all the things you've always wanted to do – sleep late, wear pajamas all day and solve mankind's most perplexing mystery: *Why do the weeds grow faster than the grass?*

*****After having problems with his camera, **Alan Pryor** recently bought a new main camera, a QSI 683 wsg with an 8-position filter wheel. Says Alan, "Every QSI camera purchase comes with a 90-day guarantee of cloudy weather." Thanks, Alan. Maybe we'll get some clear skies at JKWMA by March or April.

To make Alan's Christmas even better, his daughter **Miranda** bought him a membership and telescope time with itelescope.net, a firm which offers remote observing and/or astrophotography at observatories in New Mexico, California, Spain and Australia. "The 'scopes will be controlled by me," Alan explains. "Some of the 19 telescopes they use are larger than 0.5 meter in dia., and all of them are equipped with research-grade astrocameras that use the same format as mine."

Congratulations, Alan! We'll be looking forward to some fabulous photos of the **Large** and **Small Magellanic Clouds** and other wonders of the southern skies!"

***** Rainbow Symphony is selling solar filters for binoculars ranging in sizes from 50mm to 101mm. They cost $19.95, but two are required for binocular vision. To find out more about them, go to www.rainbowsymphony.com.

*At the opening ceremony of the "Century of Progress" World's Fair in Chicago in 1933, the lights were turned on by power generated by the star **Arcturus**. Light from Arcturus passed through a telescope and focused on a photoelectric cell that produced a current that tripped a switch that turned on the fair's lights.

(Wonder what they'd have done if it had been cloudy that night. -Ed.)

*Know that salesman who has been hitting on the gorgeous secretary in your office for months without success? Tell him to fret no more, here's an approach she won't be able to resist. He should walk up behind her and whisper seductively in her ear, "*Did you know that **NGC 6872**, a barred spiral galaxy in the constellation* Pavo the Peacock, *is the largest known galaxy in the universe? At 500,000 light-years in diameter, it's 46 percent larger than **Andromeda Galaxy**, and four times larger than the **Milky Way**!"*

(Oh, one other thing: while the salesman is whispering those sweet nothings in the secretary's ear, he should also be dangling in front of her the keys to a 2017 Lamborghini Venino Roadster. It looks like the Batmobile and sells for a cool $6.2 million plus tax.)

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Upcoming Meetings/Activities. Our club meeting will be at 7:30 p.m. on **Thurs., Jan. 12th** at The Garden in Griffin, with public lunar & planetary observing for visitors beforehand and afterward. Our speaker will be **Donovan Domingue**, a professor at Georgia College and State University in Milledgeville, Ga. Dr. Domingue's topic will be "Understanding Galaxy Pairs in Infrared."

Our Jan. JKWMA club observings will be on **Fri.-Sat., Jan. 27th-28th**. The gates will be open all night.

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The Sky in January. This month's observing highlight will come on New Year's Eve when **Mars** (mag. 0.8) and **Neptune** (mag. 7.8) will be less than 0.1^{o} -- that's $1/5^{th}$ of a **Moon** width – apart in *Aquarius*. No one alive today has ever seen those two planets that close before. The last time it happened was in 1308 a.d., 300 yrs. before **Galileo** aimed his little telescope at the sky.

Mars will be naked-eye, but Neptune is too faint to be seen that way. In binoculars, just find the Red Planet in the S sky and Neptune will be the tiny blue disk nearby. In telescopes, Mars will be larger and brighter than Neptune, which will look like a martian moon.

Elsewhere, **Mercury** (mag. -0.5) and **Venus** (mag. -4.2) will lie in the SW sky on Dec. evenings, and **Uranus** (mag. 5.8) in the SE.

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The Maunder Minimum and the Little Ice Age

article by Bill Warren

The "Maunder Minimum" was a 70-yr. period between 1645-1715 a.d. in which sunspot activity virtually came to a standstill. For example, in the 28 yrs. between 1672-1699, solar observers recorded less than 50 sunspots, whereas in modern times the total number of sunspots over an equivalent time period would be a thousand times greater. (Normally, sunspot activity increases and decreases in 11-year cycles.) This puzzling dropoff in sunspot production for nearly three quarters of a century was identified and studied in the 1890s by the British husband-and-wife solar astronomers **Walter & Annie Maunder.**

The Maunder Minimum marked the beginning of the Little Ice Age, a period dating from 1645-1850 a.d.. It wasn't a true ice age like the one 2.6 million yrs. ago when glaciers covered much of the planet; rather, it was a period when glaciers in the northern hemisphere expanded enough to produce longer and colder winters in Europe and North America. But it wasn't a global event because, for whatever reasons, the cooling apparently did not extend to the southern hemisphere.

Meteorology was not a highly developed branch of science in those days. For example, daily temperature highs and lows were not recorded for future reference. However, modern-day meteorologists generally agree that annual temperatures in the northern hemisphere dipped by an average of at least 3^{o} during the Little Ice Age.

While that may not seem like much, farms and villages in the Swiss Alps were destroyed by advancing glaciers, and normally ice-free waterways such as England's Thames River froze over in winter. Snowstorms were much more frequent during that period, growing seasons for crops were severely limited and, aside from infant mortality, hypothermia, flooding and famine were the leading causes of death. Native American tribes often cooperated to provide food for each other. Ice closed harbors and waterways for commerce and travel, livestock died in the harsh winters, and the despicable practice of witch-hunting may have originated at this time as people looked for someone to blame for their miseries. (On a more positive note, buttons and buttonholes first appeared during the Little Ice Age.)

The situation eased around 1850 as annual temperatures gradually rose. Several theories have been advanced as to what might have caused them to drop over a span of two centuries.

Undoubtedly, the lack of sunspots and reduced solar radiation during the Maunder Minimum was the primary contributor, but that 70-yr. period covered only 35% of the Little Ice Age. Other factors may have included increased volcanic activity, changes in ocean current patterns and climate change.

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The Big Bad Wolf

article by Bill Warren

Earth resides in our solar system's Goldilocks zone where conditions were – and still are, in our case – favorable for life forms to arise. But there's another way of looking at it: If our planet were Little Red Riding Hood instead of Goldilocks, the **Sun** would be Grandma and the Big Bad Wolf.

The Sun would be *Grandma* because it provides a safe haven for us within the deep, dark forest around us. Life on Earth could not exist without the Sun. But are we really safe?

Enter Grandma's alter ego: *the Big Bad Wolf.* Grandma has a dark side that, fortunately for us, she rarely displays – but when she does, *Watch out!* The Big Bad Wolf's teeth and claws are *very* sharp!

A hundred and fifty years ago, the U. S. was a much simpler place. To get anywhere, people walked or rode horses. Electric power didn't become available for home use until the 1930s, and

in rural areas it took a decade or two longer than that. Long-range communication 150 years ago consisted of horseback couriers or telegraph messages. So when, in 1859, the Sun briefly shed its Grandma disguise and became the Big Bad Wolf, the results were not nearly as severe as they would be today.

The Carrington Event. On Sept. 1, 1859 an English amateur astronomer, **Richard Carrington,** was sketching sunspots when suddenly two of them began to brighten…and brighten, until they became dazzling fireballs that doubled the Sun's brightness. Five minutes later they were gone, and things returned to normal on the Sun's fiery surface.

That wasn't the case on Earth, however. A few hours later, telegraph communications around the world began to fail. Telegraph lines overheated and melted, and the poles carrying them caught fire. Telegraph operators received shocks – some were knocked off their feet or rendered unconscious when they tried to send messages -- and sparks spewing from telegraph machines set fires in telegraph offices.

That night, all over the planet humans witnessed one of the most colorful and frightening displays of auroras in mankind's recorded history. Everywhere from Alaska to the equator to Australia, people were terrified by blood-red auroras that were so bright that it looked like the sky was on fire. Some people went outside to read because the night sky afforded more light than their candles gave off indoors. Farmers and laborers began their chores hours early, thinking that they had overslept sunrise. No fatalities occurred, but telegraph service was shut down, compasses didn't work and the auroras made a lasting impression on everyone who saw them.

Unmasking the Big Bad Wolf. The so-called "Carrington Event" was what is now referred to as a *solar superstorm* – a simultaneous occurrence of two instances of the Sun flexing its mighty muscles – *solar flares* and *coronal mass ejections (CMEs).* Both of them pack a wallop.

Solar superstorms do not produce the kind of heat energy that would fry our planet to a crisp. Their effect is more subtle, yet nevertheless instantly recognizable, powerful and far-reaching. They are magnetic disturbances that attack Earth's *magnetosphere*, the protective magnetic field that surrounds our planet. The fluctuations or changes that solar flare and CME shock waves produce affect our ability to transmit or use electricity.

Flares occur in active regions around sunspots; they emit radiation at all wavelengths from radio waves to gamma rays. When those ionized gases and charged particles interact with Earth's magnetosphere, they produce auroras at the north and south poles and disrupt radio transmissions.

Like solar flares, coronal mass ejections usually originate from sunspots (i.e., magnetic storms on the Sun's surface). Flares and CMEs don't always occur at the same time, but they are similar in origin and effect, at least superficially. For our purposes, we'll consider CMEs to be solar flares on steroids.

Combining the worst of both possibilities, the 1859 superstorm released into space the energy equivalent of 10 billion atomic bombs. It was the largest solar superstorm to hit the Earth head-on in the last 500 years. The results were predictable, if minor by today's standards.

There have been other solar superstorms. If you're 40 or older, you may remember the one that occurred on Mar. 10, 1989.

On that date, a CME that was 36 times larger than Earth damaged power grids all over North America and northern Europe. It destroyed the main transformer at a nuclear power plant in N. J. and caused a massive power outage in Canada as well, leaving New York City residents and at least 20 million other people in the northeastern U. S. and Canada without electricity for as long as nine hours.

"I'll Huff, and I'll Puff, and I'll Bloooooooow Your House Down!" Let's face it: we're spoiled.

When I was a child, my family didn't have a television set, an air conditioner or a refrigerator. (We used an ice box.) And we got along fine. (At least, *I* thought so.) But what if those things – and many others that we routinely take for granted today – were to suddenly vanish in the twinkling of a light bulb? And what if they didn't become available again for weeks? Or months? Or even years? What then?

Welcome to the unhappy scenario of post-solar superstorm existence. Here's what could happen if a massive solar superstorm were to come a-calling today like a solar hit man:

*Solar flares emit X-rays and gamma rays that can be dangerous to humans. Earth's atmosphere normally absorbs most of this radiation, but astronauts in orbit would be exposed to it. Those rays would also short out any unshielded satellites' electrical systems, rendering them inoperable.

*A really big CME – think of it as the Big Bad Wolf's big brother – would wreak havoc on Earth's magnetic field, disabling our ability to generate and transmit electrical power. Overloaded power lines would collapse; electric transformers – and even the power grids themselves – would fail; and massive, prolonged power outages would occur, not just in the U. S. but in every technologically advanced society on Earth.

As **Larry Higgins** points out, "Modern society is run by computers." All companies, large and small, use computers to conduct their business, transport materials, etc. Without electricity to power those computers we would be, in **Bob Berman's** words, "knocked back to the Stone Age." (*Astronomy*, Oct., 2016, p. 9) Berman estimates that it would take at least $2 trillion and 2-10 years to repair the damage to our power system. Imagine what your life would be like without electricity for the next 2-10 years.

Consider the plight of an elderly couple living on the 30th floor of a condo. It's their pride and joy – until they realize that, for the foreseeable future, at least, they'll be carrying their groceries up 30 flights of stairs because the elevators no longer work. Or traffic lights. Or their air conditioner, heating unit or refrigerator that stores their perishable foods. Or anything else that requires electricity. Emergency services would be diminished because generators require gasoline that cannot be delivered. And with the communications system down, the elderly couple (along with everyone else) would have no way of knowing if or when things might be getting better. We would literally be left in the dark at night, and powerless in the daytime as well. All the benefits that our technology provides would be unavailable to us without electricity to power it.

In short, we would instantly become a modern cave dwellers, only without the skills or resources necessary to handle the basics of survival.

Protecting Ourselves From the Big Bad Wolf. After a massive CME barely missed us in 2012, NASA estimated that there is a 12% chance of a solar superstorm hitting Earth before 2020. Obviously, those odds have dropped since then (although not over a comparable time frame into the future). Still…So what? A solar superstorm at any time would have the same effect.

There is, of course, no way to predict or prevent a solar superstorm. In his 1964 song *The Times, They Are A-Changin'*, **Bob Dylan** warned parents that "Your sons and your daughters are beyond your command." Well, so is the Sun. But there *are* ways to prevent its effects from destroying our way of life. They involve finding ways to protect the power grid from the Big Bad Wolf.

(The power grid is the network that delivers electricity from suppliers to consumers. It consists of three parts: generating stations; transmission lines; and distribution lines.

Generating stations are power plants where electricity is produced. *Transmission lines* carry that electricity in bulk to wholesale distributors [read: electric companies], who send out the electricity in smaller doses via *distribution lines* to individual customers [i.e., you, me and businesses].)

The problem is, our power grids are already working at near capacity levels. We need to expand them so they won't be as likely to overload and shut down when the Big Bad Wolf shows up at our door. And we need to find better ways to shield our power grids and satellites from the effects of a solar superstorm .

Those improvements would be fantastically expensive – but not nearly as costly as failing to address the problem now while there's still time to do it. The alternative is to wait until the unthinkable happens to start dealing with it. As **Benjamin Franklin's** "Poor Richard" noted, "An ounce of prevention is worth a pound of cure."

Echoing Franklin, astrophysicist **Sten denwald** said, "People think that because nothing too terrible has occurred in the past, it won't happen now. We've heard that kind of logic before, and we got Hurricane Katrina. The cost of not preparing for extreme space weather would be dramatic."

Conclusion. Most people are aware of the Sun's awesome power. All you have to do is spend a few

hours under the summer Sun at the beach without wearing sunblock or hiding under an umbrella to experience its effects on the human body. But sunburn is the least of our worries regarding the Big Bad Wolf.

Most people aren't astronomers or engineers. They know little or nothing about solar flares, coronal mass ejections or solar superstorms, so they don't worry about those things. And that's good, too, or else they would live their lives In fear. But someone – actually, a lot of *someones* – needs to worry about solar superstorms, because the problem is real, even if it hasn't slapped us in the face yet.

Rogue asteroids and comets that might impact the Earth with catastrophic results are real possibilities, too. We overlooked them for most of mankind's existence, but we are addressing the problem now because public awareness has been raised. We need to do the same thing regarding solar superstorms.

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Lower Left Corner: NGC 1333, a reflection nebula in *Perseus*. (Photo by **Alan Pryor.**) **NGC 1333** lies along the perimeter of the large **Perseus molecular cloud** star-forming region. NGC 1333 contains hundreds of very young stars, many of them less than a million years old and unseen within the dense blue nebulosity and dust in Alan's photo. This is the kind of turbulent environment in which our Sun was born.

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More from **Alan Pryor** regarding his venture into remote imaging: "I have made my first photography reservation on one of the telescopes at the Siding Springs Observatory near Coonabarabran in NW Australia. If the weather is good Thursday night (Dec. 22nd), I will shoot **NGC 1532**, an edge-on spiral galaxy in the constellation *Eridanus*. *(Note: Australia is on the other side of the International Dateline from us, so their today is our tomorrow. -Ed.)* I will be using a 20-in. Planewave CDK telescope at a focal length of 2240 mm. The camera is an FLI, which is pretty big and definitely sensitive.

"I would have tried it tomorrow night (Dec. 21st), but the weather in that part of Australia is predicted to be cloudy then. I think it's monsoon season down there.

"It took me most of the day to figure out how to properly make the reservation and write the script to program the telescope to do what I want it to do. The thing I had to watch out for was allowing enough time to complete the imaging within my reserved time. I'll be imaging for 84 minutes, but I ended up scheduling 150 min. to allow for slewing, focusing, changing filters, calibrations and download time for the images."

(Since to our knowledge none of us has ever attempted remote imaging or observing, we'll keep you up-to-date on Alan's progress. His image of NGC 1532 will appear in the Feb. newsletter. -Ed.)

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Finally: The heck with political correctness, we'll say it anyway: We hope that all of you had a very merry Christmas, and that you'll have a happy New Year!

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