THE

FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

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Club Calendar. Fri.-Sat., Sept. 7-8: Club observings (JKWMA, at dark); **Sun., Sept. 9:** "Art in The Garden" solar observing (1-4 p.m., The Garden in Griffin); **Sat., Sept. 15:** Club meeting/pool party/potluck dinner at **Bill Warren's** house at 1212 Everee Inn Rd., Griffin, GA (swimming & pool play from 5-7 p.m., dinner at 7:00, brief meeting afterward).

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President's Message. Our Lake Horton observing on July 20th set an all-time FRAC record for members participating in a public observing. Sixteen members gave a crowd of more than 150 Fayetteville visitors their first telescopic views of **Jupiter, Saturn, Mars, Venus** and the **Moon.** They were so impressed that many of them stayed until after 11 p.m.

Thanks, **Sean**, for arranging the event and encouraging our members to attend it. And thanks, too, to **Chelsea & Gianna Neckel, Felix Luciano, Carlos Flores, Mike Stuart, Joe Auriemma, Bill Warren, Marla Smith, Truman Boyle, Cindy Barton, Ken Harris, John Felbinger, Erik Erikson** and **Ken Olson** for answering Sean's request for help with such a great turnout.

How impressive was that turnout? The sixteen participants was twice as many as we had at our previous record-setting event, the Aug. 2017 total solar eclipse observing at The Garden!

To everyone who came, I think I know the answers to these questions but I'll ask them anyway: *Did you have a good time? And do you think our visitors did too?*

-Dwight Harness

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Last Month's Meeting/Activities. Four magical evenings:

1. July 20th had all the ingredients for a memorable observing at Lake Horton: clear skies (most of the time, anyway); four bright planets, the **Moon** and a huge crowd of Fayette Co. residents who were eager to see them; and *sixteen* FRACsters who came early and stayed late. When our visitors left, they understood why we buy telescopes to look at the sky.

2. Twelve members – **Tom Moore, Sean & Gianna Neckel, Ken Harris, Carlos Flores, Eva Schmidler, Rose & Kenneth Olson, Steven Hollander, Erik Erikson, Dwight Harness** and **yr. editor –** and two guests, **Rebekah Reynolds** and **Dennis Nelson,** heard and/or participated in **Felix Luciano's** outstanding presentation on how to clean eyepieces.

Also at that meeting, Gianna received two A. L. observing certificates and pins, *Outreach* and *Sky Puppy*. It's the most pins ever earned by a child in FRAC. That's quite an accomplishment for a young lady who just turned eleven years old.

3-4. Clear skies brought 15 attendees to our Aug. Joe Kurz observings: **Sean & Gianna Neckel, Dwight Harness, Aaron Calhoun & yr. editor** (both nights); and **Mike Stuart, Steven Hollander, Erik Erikson, and Jeremy & Delilah Milligan** (Sat. night). Besides a plethora of planets on both nights, Sat. evening featured meteors galore (including at least six fireballs), a weather balloon, a very long ISS transit and mag. 6 skies that made us feel like nothing in the universe was beyond the reach of our telescopes.

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This 'n That. Final Thoughts About Mars. Spectacular events such as this Mars opposition merit broad coverage, and we've given you that. But enough is enough. Two more paragraphs and we'll close the book on Mars for this opposition.

The movement of carbon dioxide on Mars produces profound seasonal changes at the surface and in the atmosphere. Every summer, solar radiation sublimates so much solid dry ice at the polar ice caps into CO_2 gas that the thickness of those caps shrinks by 3 to 4 ft. At the same time, the gases increase the CO_2 in the atmosphere by as much as 1/3 during the summer months.

Every winter, the process reverses itself, and the seasonal changes in the amount of dry ice at the surface produce tiny but measurable differences in the planet's gravity.

***CubeSats**. In the fast food industry, super-sizing your order expands both your waistline and the proprietor's financial status. NASA has taken that concept and stood it on its head by developing CubeSats – miniature satellites that function in the same manner as satellites that once were as large and heavy as a compact car or a schoolbus. Since the cost of lifting a payload into space varies according to its weight, tiny cube-shaped satellites measuring 4 in. to 24 in. in size and weighing 3 lbs. or less are vastly more affordable.

After a successful launch on May 5th, two CubeSats of the Mars Cube One (MarCO) mission are on their way to **Mars**, where they will monitor and relay data regarding NASA's Mars Insight lander's touchdown, which will occur on Nov. 26th. Although CubeSats have been deployed in Earth orbit successfully before and their usage is becoming commonplace, this is their first venture into deep space.

***Three Trivia Questions…**

1. *How large would the **Sun** appear to someone standing on the surface of **Mercury**?*

Answer: Assuming that you could stand on a surface that, at 800° F, is hot enough to melt lead, the Sun would be more than three times larger than we see it, and nearly seven times brighter.

2. *The coldest possible temperature is -459.67° F, or Absolute Zero; is it true that all molecular motion ceases at that temperature?*

Answer (courtesy of **Fraser Cain**, publisher of the *Universe Today* website): "As you probably learned in high school physics or chemistry, the temperature of a gas depends on the motion of its particles. As you cool a gas down by extracting heat from it, the particles slow down. You would think, then, that by cooling something down to Absolute Zero, all particle motion in that something would stop. But that's not true…There's always a little motion, even at Absolute Zero."

So *No*, molecular motion wouldn't stop at Absolute Zero, it would just be reduced to near zero. Molecules would still vibrate with what is called *zero-point energy*. But motion as we normally think of it requires heat energy, and at Absolute Zero there would be no usable heat energy available.

(We say "would be" because Absolute Zero temperature has never been reached anywhere in the universe. Even in the isolated depths of intergalactic space, the temperature is nearly 5° F above Absolute Zero.)

Two places qualify for the title of "The Coldest Places in the Universe." Both of them have recorded temperatures of 1° or less above Absolute Zero. One of those places may surprise you.

Despite what we wrote in an earlier issue of the Observer, **Boomerang Nebula (PGC 3074547)** in *Centaurus* is not the coldest place in the universe. With a measured temperature of -458.6° F, it ranks just second on the list. The coldest place is in a laboratory on **Earth**, where scientists have generated temperatures less than 1/2° F above Absolute Zero.

3. *A basic principle of physics states that matter can be neither created nor destroyed. So where does the light come from when I turn on my flashlight?*

Answer: Actually, the principle states that "Matter can be neither created nor destroyed, it simply changes forms." But light is a form of energy, not matter, although both are composed of particles. Still, the principle applies to light as well as matter.

Until you turned on your flashlight, the photons (light particles) it generates were *potential energy* stored in its batteries. The batteries will continue to produce light until their potential energy is used up. (Murphy's Law dictates that it will happen when

you don't have fresh replacement batteries of that size.)

***And Three Ifs…**

1. If you can see **Andromeda Galaxy (M31)** naked-eye, you can see something that is 14.7 billion billion mi. away.

2. If the **Sun** were the size of a ping pong ball, **Proxima Centauri**, the nearest star, would be 680 mi. away.

3. If the theory of cosmic inflation is to be believed – and presently there is no compelling reason why it shouldn't be – in the first trillionth of a trillionth of a trillionth of a second after the Big Bang the universe grew from the size of an apple to more than 100,000 times larger than the **Milky Way**. (Source: **Mara Johnson Groh**, "Inflation Leaves Its Mark," *Astronomy*, Aug. 2018, p. 33.)

That expansion rate is, of course, much faster than the speed of light, which takes 10 billion years or more to travel that far. And since nothing can exceed the speed of light, clearly something impossible happened to account for that early expansion.

In 1980, American cosmologist and theoretical physicist **Alan Guth** proposed that, for a brief period after the Big Bang, the universe suddenly expanded at a rate that violated all known laws of physics.

Not all cosmologists or physicists agree with Guth's theory – after all, it's difficult to verify an event that happened nearly 14 billion yrs. ago. But in the 38 years since Guth proposed his theory, no one has come up with a better explanation of how the visible portion of the universe could have grown to a size of 93 billion light-years in dia. in just 13.82 billion years.

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Upcoming Meetings/Activities. Now that you have clean eyepieces, you need to try them out at our JKWMA observings on **Fri.-Sat., Sept. 7th-8th**. The gate will be open all night, so don't close it when you enter or leave.

Every year, UGa-Griffin sponsors an "Art in the Garden" event at The Garden in Griffin, and FRAC participates in order to partially repay them for allowing us to hold our meetings at The Garden. This year's event will be from 1-4:00 p.m. on **Sun., Sept. 9th**. It always draws a large crowd, so we'll need as many FRAC participants as possible. We'll have solar sunglasses available for you to show the **Sun** with if you don't have a solar-filtered 'scope.

On **Sat., Sept. 15th**, we'll have our annual pool party and potluck dinner meeting at **Bill Warren's** house at 1212 Everee Inn Rd. in Griffin. (**Note: This event will take the place of our regularly scheduled club meeting. We will NOT meet at The Garden in September.)**

We'll eat at 7 p.m., but the pool activities will begin at 5 p.m. Bring the entire family: we have pool toys for the kids, so bring swimsuits for all. We don't have water wings; bring them along for small children who may need them, and plan to take a dip in the pool yourself. You can change clothes in the bathroom or laundry room.

After the meal, we'll have a very brief meeting -- no more than 10 min., tops. Stay as long as you like after that, whether swimming or just sitting around talking.

As for what food to bring – FRAC will supply KFC chicken and liquid refreshments (non-alcoholic, of course). FRAC will also supply cups, plates, eating utensils, napkins, ice, etc., so just bring one item of the sort that you'd bring to a church picnic: another meat item or more chicken; potato salad, beans, chips, congealed salad, dessert, or any specialty item that you like to prepare for such an event.

So holy guacamole!, by all means plan to come. Swim, eat like there's a famine coming and let your family spend some quality time with us. It's a rain-or-shine affair: if it rains, we'll eat and hold our meeting on Bill's large carport and screen porch.

To get to Bill's house from, say, Hampton on U. S. 19/41, continue south on the 4-lane past the stoplight at Ga. 92 (to Fayetteville), get in the left-hand (U. S. 19) lane and stay on it past the Griffin exit, the Ga. 16 (Griffin-Newnan) exit and the Ga. 362 (Williamson Rd.) exit. Turn left at the stoplight at Airport Rd., and then turn right at the 4-way-stop at Everee Inn Rd. Go one block and turn left at Roberts St. Bill's 3-car driveway is the first one on the left. Either park there or drive past, turn around and park beside his backyard fence.

Bill's G.P.S. coordinates are: 33º 13' 15.37" N, -84º 16' 54.77" W. Or, 33.220933, -84.281907.

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"But it does move."
-Galileo,
after recanting his views on the motion
of the Earth around the **Sun** when he appeared
before the Inquisition in 1633

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Above: M1 (Crab Nebula). Photo by **Alan Pryor**.

Gone With the Winds of Time
by Bill Warren

On July 4th, 1054 a.d., a star in the constellation *Taurus* went supernova. The light from that explosion was bright enough to be seen in the daytime for more than three weeks. Today, more than 950 yrs. later, the gases from that fiery blast still can be seen at night as a faint, hazy blur in our telescopes. They are a *supernova remnant*, the only one in **Charles Messier's** catalog. It was the first cometary look-alike that Messier recorded, which explains its designation, **M1.**

Messier didn't discover M1, he independently re-discovered it in 1758. It was first identified by English astronomer **John Bevis** in 1731, although Chinese astronomers recorded the appearance of a bright new star in 1054 and Japanese and Arabic astronomers could still see it 200 yrs. later in the 13th century. (M1 is no longer bright enough to be seen without a telescope or large binoculars.)

M1's familiar nickname, **Crab Nebula,** was given to it by the Irish astronomer **William Parsons, the Third Earl of Rosse,** who observed and drew it in 1840 while using a 36" telescope. Lord Rosse said that his drawing of the nebula looked like a crab, and the nickname stuck.

As mentioned earlier, we can still see the Crab today – but that won't always be the case**.** The gases that were sent hurtling into space by the explosion are still rushing away from the neutron star they left behind. They will grow dimmer as they continue to expand at a rate exceeding 2 million mph, until eventually they will vanish altogether.

The same is true of **Dumbbell Nebula (M27), Ring Nebula (M57)** and all of the other planetary nebulas that we enjoy so much: their expelled gases will expand and dissipate until we will no longer be able to see them. It won't be any time soon – but it *will* happen.

For that matter, much the same fate is in store for everything that is moving away from us – and that includes virtually all of the galaxies in the universe.

In fact, it is already happening.

Presently, the observable universe is thought to be 93 billion light-years in diameter, but the actual size of the entire universe, although unknown, probably exceeds that distance by an unimaginably large number of powers of ten. And since the farther we look into space, the faster galaxies are receding from us, that distance, whatever it might be, is growing larger by the second. Larger and more powerful telescopes are extending our view of the observable universe, but we will never know what lies beyond the part we can see. The universe is growing faster than the ability of humans to see to its actual boundaries or measure them. Our technology will never catch up with the expansion because "A little more than 5 billion years ago, the repulsive force of dark energy began to overpower the attractive force of gravity…This caused the universe to expand at an increasing rate, and this expansion will continue accelerating forever." (**Liz Kreusi,** "The Weird Mystery of Dark Matter," *Astronomy*, Aug. 2018, p. 51).

(To repeat a point that we explored recently, we know that those distant galaxies are moving away from us because the collective blue light of their hot young stars is being stretched toward the red end of their spectra as they recede. Astronomers say that the universe's expansion is speeding up because the farther away the galaxies are, the farther toward the red end of the spectrum their light is stretched.)

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"I swung (the 18-in. Schmidt telescope on Mt. Palomar) to our next search area, then sneered as a bright glow almost swamped the view in the telescope's finder. 'Dollars to doughnuts,' I cried out, '**Jupiter's** in this field!' Nevertheless, we took three exposures of the region before the clouds thickened.

"(Studying the images later), suddenly **Carolyn (Shoemaker)** straightened up in her chair. 'I don't know,' she said, 'but it looks like…like a squashed comet.'

"Indeed, hovering amid the stars was the strangest object we had ever seen. It looked like a comet, all right – but instead of having a nice round coma, this one was rectangular! Was it a light streak? No, because it appeared on all three photos."

-David Levy, describing the evening of March 24, 1993 when he, along with Carolyn and her husband, **Gene Shoemaker**, discovered **Comet Shoemaker-Levy 9**. At the time, they had no way of knowing that the comet already had been torn apart into 21 fragments during an earlier flyby of Jupiter in 1992 – or that, a year after their discovery, in July 1994 those fragments would crash into Jupiter, one after another, like cars in a chain collision on a highway. It's the first and only time that such an event has been witnessed since the invention of the telescope. (Source of Levy's statement: *Sky & Telescope,* July, 1993 as quoted in the July, 2018 issue, p. 7.)

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<u>Muddled History – A Prof. Stargazer Interview</u>

In addition to being the world's leading expert on astronomy, cosmology and jokes that aren't funny, **Prof. Stargazer** is also a highly respected historian. Four FRACsters recently visited him at his home to discuss prominent figures in astronomy history.

"I'm constantly amazed at astronomers' ridiculous names," the professor began. "For starters, there's **Ejnar Hertzsprung** and **Vesto Slipher.** But there's also **Lubos Kohoutek, Janszoon Blaeu, Pierpoint Langley, Gemimino Montarani, Philibert Melotta, Darquier Pellepoix, Adalbert Kruger, Dalmiro Brocchi** – and the list goes on and on. There are even two John the Baptists, **Giambattista Vico** and **Giovanni Battista Hodierna.**

"Where do parents get such weird names for their children? They must –"

At that moment the professor's wife stuck her head out from the kitchen and said, "Supper's ready. Will your friends be staying for dinner, Theophilus?"

Here was their interview, conducted between spoons- and forksful of octopus soup, fried squid and mouth-watering deep-fried mountain oysters.

Sean Neckel: What can you tell us about **John Bevis**, the English physician and astronomer who discovered **M1 (Crab Nebula)** in 1731?

Prof. Stargazer: Well, he discovered M1 (Crab Nebula) in 1731. (Did I mention that he was an English physician and astronomer?)

Sean: No, but I did. We were hoping for a little more information than that, Professor.

Prof. Stargazer: How about this? When Bevis rushed inside to tell his wife about his discovery, her response was, "You left the door open, Butthead!"

Marla Smith: Is it true that the Danish astronomer **Tycho Brahe** lost part of his nose in a duel, and for the rest of his life he wore a prosthetic nose made of copper?

Prof. Stargazer: Yes, that's correct. The duel resulted from a disagreement about a mathematical formula. When Tycho mentioned "Pi r square," a listener -- the local baker – replied, "That's not true, you fool! Everyone knows that pi are round!"

Things went downhill from there.

Later, Tycho's student **Johannes Kepler** quipped, "In the race for mathematical superiority, Tycho lost by a nose."

Marla: Is any of that true except the part about Tycho losing his nose in a duel over a math formula?

Prof. Stargazer: No, but I thought it would get a laugh. Apparently, I was wrong.

John Felbinger: Did **Isaac Newton** really discover the law of gravity when an apple fell on his head?

Prof. Stargazer: No, that's just astronomy folklore. Actually, he was doing a scientific experiment to determine which weighs more, a pound of iron or a pound of feathers. So he had

someone climb a tree and drop a pound of feathers on his head, and then…

When Newton came to, he reached two conclusions. 1. A pound of iron is heavier. 2. I think I have a fractured skull.

Later, he added a third conclusion, namely, that gravity makes things fall.

Incidentally, John, since we're talking about Isaac Newton you may be interested in this: **Queen Anne** knighted him in 1705 to celebrate his formulating the laws of gravity. Later, when Newton invented the reflecting telescope, she offered him a second knighthood. But Sir Isaac turned down her offer, explaining that "Knighthood is like marriage, Your Highness. As my wife puts it, 'Once a knight's enough.'"

Dawn Chappell: Why is **Robert Goddard** known as "The Father of American Rocketry"?

Prof. Stargazer: He married a Saturn V rocket. They named their offspring Isaac Cassini Brahe Messier Goddard, but everyone called him ICBM.

Is everyone ready for dessert? We're having my wife's specialty: frozen yogurt with pureed spiders, vinegar, soy sauce, and – Wait! Where are you going?

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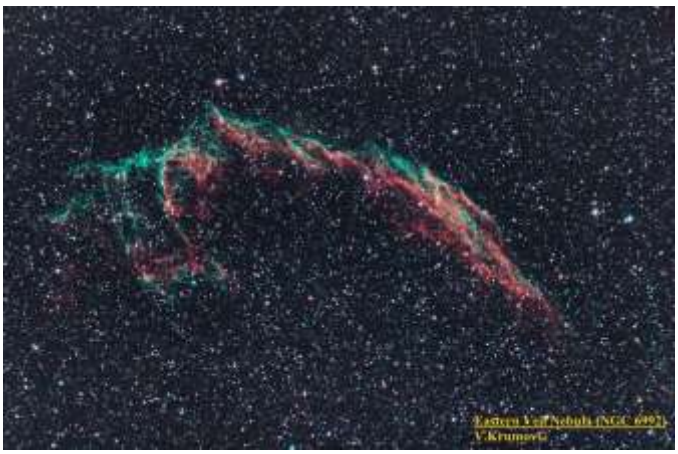
Upper Right Corner: NGCs 6992-6995, the eastern portion of the parentheses-shaped **Veil Nebula** supernova remnant (SNR) in *Cygnus*.

You won't see **Vencislav Krumov**, who took this incomparably beautiful photo, at our meetings or observings because he lives in Sofia, Bulgaria. (Venci joined FRAC a couple of years ago while spending a year serving as lawyer for a hydro-electric project near Columbus, Ga. Venci paid an additional three years' dues before he left.)

Although easily visible in 10x50 binoculars on a dark, clear evening, the E half of this lovely SNR is too large to fit into a low-power telescopic field of view. You'll have to pan N and S to see all of it; an O-III filter provides the best view. You won't see the stunning colors of Venci's photo, but high magnification will show the fine wisps that lend the E segment of the **Veil** a nickname of its own, i.e., **The Filamentary Nebula.**



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Below: Lagoon Nebula (M8) and **Trifid Nebula (M20)** in *Sagittarius*. (Photo by **Alan Pryor**.)
The **Lagoon** and **Trifid Nebulas** are literally two of the brightest highlights of the summer sky.

The Lagoon, larger and brighter of the two, is visible to the naked eye on clear, dark nights as a smudge above the Sagittarius **Teapot**. The "lagoon" is the darker, curved area extending downward from the center; above and to the right of it lies open cluster **NGC 6530**. The entire nebula glows from radiation from hot young stars that heats the nebula's gases.

The Trifid also glows pink – and blue -- in Alan's photo (but not in your telescope or binoculars; like the Lagoon, it will appear greenish-gray). The blue nebulosity is is due to light reflected by the star at its center. Prominent dust lanes give the nebula the appearance of a piece of popcorn.

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