THE

FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

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Officers: President, **Sean Neckel**; Interim Vice President/Secretary, **Aaron Calhoun**; Treasurer, **Jeremy Milligan**; Board of Directors: **Larry Higgins; Cindy Barton;** and **Felix Luciano;** Program/Observing Coordinator: **Sean Neckel**; Alcor/Facebook Coordinator: **Aaron Calhoun;** Webmaster: **Tom Moore;** Newsletter Editor: **Bill Warren**; NASA Contact: **Felix Luciano.**

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Club Calendar. Fri.-Sat., Oct. 25-26: JKWMA observings (at dark); **Fri., Nov. 1:** Lake Horton public observing (7:00 p.m.); **Mon., Nov. 11: Mercury** transiting the **Sun** (7:35 a.m.-1:04 p.m.); **Thurs., Nov. 14:** FRAC meeting (7:30 p.m., The Garden in Griffin); **Sat., Nov. 16:** High Falls State Park public observing (5:30 p.m.); **Fri.-Sat., Nov. 22-23:** JKWMA observings (at dark).

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Vice President's Message. Astronomy inspires the imagination in ways that no other hobby can. As one man put it, "The universe is not only stranger than we imagine, it is stranger than we can *possibly* imagine."

Take a drinking straw. Hold it up to the night sky at arm's length, and look through the hole. Imagine what you'd see if your eyes were as powerful as the largest telescope. There are countless galaxies of all shapes and sizes, unseen by our eyes, within that hole's width. Each of them contains from hundreds of thousands of stars (dwarf galaxies) to trillions of stars in the largest galaxies.

Now imagine that the entire sky above us is filled with other straw circles, each hole containing more galaxies and stars than we can possibly imagine. That's our universe, the one we live in, not an imaginary one. We can't see all of it, no matter how hard we try. It's too big. There are untold billions of galaxies whose light has not yet had time to reach us; we may never see them, because the universe's expansion is speeding up, not slowing down.

Finally, imagine this: The small part of the universe we can see is 93 billion light-years across -- but the entire universe may be 150 sextillion times larger than that! (If you're not a math wizard, that's a 15 with 22 zeros after it – and we're talking about *light-years*, not miles!)

One of the most important things that atronomy has taught me is patience. If I can't find an object I'm looking for after 10 min. of searching, I'll go to something else. I can always look for it later on. The way I see it, the fun is in the hunt. Sometimes the deer get away. Failure can be a great teacher, as long as you have fun and use your imagination.

Finally, I am happy to welcome back to FRAC ex-president and Ga. Sky View star party founder/coordinator **Steve Knight**. Steve brought his 14-in. scope to our Sprewell Bluffs observing, and he rejoined the club at our High Falls observing.

-Aaron Calhoun

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Previous Meetings/Activities. Ten members – **Sean Neckel; Cindy Barton; Mark Grizzaffi; Aaron Calhoun; John Felbinger; Ken Olson; Steve Hollander; Jeremy Milligan; Truman Boyle;** and **Dennis Nelson** -- enjoyed Dr. Richard Schmude's excellent talk on "The Southern Polar Ice Cap of Mars" at our Sept. meeting.

Six FRACsters, including **Dwight Harness; Mike Stuart; George Ruff; Elaine Stachowiak; Felix Luciano;** and **Steve Knight**, who rejoined the club that evening – showed the sky to about 30 guests at High Falls State Park on Sept. 21st.

On Oct. 4th, **Sean & Chelsea Neckel; Bill Honea;** and **Mike Stuart** had their hands full showing the sky to 100 Fayette Co. residents at Lake Horton. As always, though, their performance was exquisite and the guests went away happy at what they had seen.

Phil Sacco's talk on "My 25 Years in Astronomy" highlighted our Oct. meeting, which was attended by **Sean Neckel; Erik Erikson; Elaine Stachowiak; Steve Hollander; Ken Olson; Eugene & Nyssa Pennisi; Joe Auriemma**; **Tom Moore; George Ruff; Dwight Harness;** and **Truman Boyle.**

Although probably best known by most FRAC members for his talks on celestial mythology, Phil is well known throughout the southeastern U. S. During his terms as president of the Atlanta Astronomy Club in the 1990s, the AAC became the largest astronomy club in the southeast with a membership exceeding 450. Phil also organized and led the Charlie Elliott Chapter of the AAC; he served for more than a decade as the A. L.'s representative to SERAL (the Southeast Region of the A. L.); and in 2001 he became just the 11th Person to earn the A. L.'s prestigious Master Observer Award. FRAC is indeed fortunate to have had Phil address our club regarding his long and storied career in astronomy. (Thanks, Phil; you're a very special person, and I'm sorry I couldn't be there to enjoy your talk. You will never know how many astronomers' lives you have influenced and enriched over the years. Mine was one of them, and I thank you for it. -**Bill**)

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This 'n That. Nov. 14th marks the 50th anniversary of man's first return trip to the **Moon**.

After a shaky beginning during a thunderstorm, Apollo 12 astronauts **Pete Conrad, Dick Gordon** and **Alan Bean** settled down for a 10-day mission that included two moonwalks totaling 7 hrs. and 45 min. over two days spent on the lunar surface by Conrad and Bean. (Gordon remained in orbit in the command module.)

The Launch. A front stopped dead in its tracks over the Kennedy Space Center on the morning of the launch, but NASA decided to go ahead with the mission anyway. Within the first minute after liftoff, the rocket was struck by lightning twice, causing minor damage to the command module's electrical system. However, the Saturn V rocket was not affected and the rest of the trip to the Moon went exactly as planned.

The Landing. Four months earlier, in July, 1969, in trying to find a level landing site for the *Eagle* **Neil Armstrong** overshot his destination in the Sea of Tranquillity by four miles. Apollo 12 had no such problem: Conrad steered the *Intrepid* lunar module (LM) to a point just 200 yds. from where the unmanned Surveyor 3 spacecraft landed two years earlier in the Ocean of Storms.

Mission Accomplished. During their 2 moonwalks, Bean and Conrad collected 75 lbs. of Moon rocks; they set up a package of equipment that would allow scientists to study things like the solar wind, seismic activity and more; they walked to four craters in the area (Head, Sharp, Bench and Surveyor); and they visited Surveyor 3 and brought back 22 lbs. of parts for scientists to study how the lunar environment affected equipment.

***Historic Words**. After stepping down onto the Moon Neil Armstrong uttered those famous words, "That's one small step for (a) man, and one giant leap for mankind."

When Pete Conrad, who was a diminutive 5'6" tall, hopped off the ladder at the base of the LM to become the 3rd person to walk on the Moon, he said, "Whoopee! Man, that may have been a small step for Neal, but that was a *long* step for me!"

*Back in the 1950s-'60s, one of the most popular booths at county fairs was the shooting gallery. For a quarter, you could take five shots at cutouts of little metal ducks parading across your field of view. When you hit one, it would flop over onto its side as the parade continued.

Twenty-five years ago, the solar system staged its own shooting gallery. This time, though, in July, 1994 the target was **Jupiter** and the "bullets" were remnants of the shattered **Comet Shoemaker-Levy 9**. Aligned like ducks in a row, 21 remnants of the comet plowed into Jupiter's upper atmosphere, one after another, over a 7-day period beginning on July 16th, leaving behind dark stains that were easier to see in our FRAC telescopes than the **Great Red Spot**.

The comet, which had been captured and pulled into a Jovian orbit some 20-30 years earlier, passed close enough to the planet in July, 1992 for Jupiter's awesome tidal forces to tear it apart. Eight months later, in March, 1993 the comet hunting team of **Eugene & Carolyn Shoemaker** and **David Levy** discovered the fragments, using the 18-in. Schmidt telescope on Mt. Palomar.

When the comet's trajectory was plotted, astronomers determined to their delight that a year later the fragments would begin a lemming-like series of death plunges into Jupiter.

And so it was. The impact scars, some of which were larger than Earth, were visible for several months.

The comet was the ninth one discovered by the Shoemakers and Levy; thus its name. Shoemaker-Levy 9 was the first comet ever to be discovered while orbiting a planet. Its breakup and impact with Jupiter provided astronomers with the first direct observation of a collision between objects in the solar system.

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Upcoming Meetings/Activities. We'll begin the festivities with JKWMA observings on **Fri.-Sat., Oct. 25th-26th.**

We'll conduct a public observing at Lake Horton at 7:00 p.m. on **Fri., Nov. 1st**. A huge crowd of guests attended our Oct. 4th observing; your assistance this time around will be greatly appreciated.

Our FRAC meeting will be held at The Garden in Griffin at 7:30 p.m. on **Thurs., Nov. 14th**.

We'll return to High Falls State Park for another "Astronomy in the Park" observing on **Sat., Nov. 16th**. The event will begin at 5:30 p.m.

Finally, we'll wind up another busy FRAC month with club observings at JKWMA on **Fri.-Sat., Nov. 22nd-23rd**.

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The Planets in November. If you don't do anything else today, jot down this date and time on your calendar and underline it in red: **On Mon., Nov. 11th from 7:35 a.m. until 1:04 p.m., Mercury will pass across the Sun's face.** If you have access to a telescope and a solar filter – h alpha or white light – for 5-1/2 hrs. on that date you can watch tiny Mercury inch its way slowly from ESE-WNW across the backdrop of the Sun's disk.

Such events are hardly commonplace. Many FRAC members observed the last Mercury transit on May 9, 2016 – but if you didn't see that one and miss the one on Nov. 11th, you'll be 30 yrs. older when the next opportunity comes along in 2049. Here's hoping we'll have a bright sunny morning on Nov. 11th.

Observing tips: 1. Mercury will be too small to see in solar sunglasses, #14 welder's glass or by making a pinhole projector if you don't have a solar filter for your telescope. 2. Telescopically, a filtered view of Mercury will show a small but well-defined disk (unlike sunspots, which can be any size or shape). Just be sure that your solar filter fits snugly over the objective lens of your refractor or the open end of your reflector.

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Color Vision and Night Vision: Part I
by Bill Warren

*(Editor's Note: Thanks to **Truman Boyle** and **Alan Pryor** for their expertise and technical advice while I was preparing this article. Whatever mistakes you find, if any, are **yr. editor's** fault, not theirs.)*

Question: *Why do we see colors?*

Answer: When light waves reach an object, some of the light is absorbed and the rest is reflected. Different objects – and even different parts of the same object, in many cases -- reflect light at different wavelengths. Which wavelengths are reflected depends on the chemical properties of the object. Those wavelengths correspond to the colors of the spectrum: infrared, red, orange, yellow, green, blue, indigo, violet and ultraviolet.

As marvelous as our eyes are, they are not sensitive enough to detect light at the ultraviolet and infrared ends of the spectrum. But there is virtually an unlimited number of wavelengths within the visible spectrum that yield an equally diverse range of color combinations that our eyes can detect and our brain can interpret. For example, we see an object as red – or green, blue, yellow or any other color except white or black – because the object reflects the wavelength that corresponds with that color (or a shade thereof).

White objects do not absorb any of the light they receive, but reflect all wavelengths. So white is the result of all colors of the spectrum mixed together in equal amounts.

Black objects, on the other hand, absorb all of the light they receive and reflect none of it. (That explains why it is unwise to wear black clothing in the summertime, and why asphalt road surfaces are hotter than dirt roads: black retains light and heat.)

When you look at an object, the light waves reflect off the object and strike the light-sensitive retina at the back of your eye. Millions of tiny photoreceptors in the retina – *rods* and *cones* – are stimulated by the light they receive. Rods gather light and allow us to distinguish objects from their background in very dim light, but they do not detect color. Cones, on the other hand, do not collect light but they let us see color. However, they don't work in dim light except with bright objects such as stars, which are tiny points of concentrated light in the darkness surrounding them.

When light from an object reaches the cones, it stimulates them to transmit signals along the optic nerve to the visual cortex of the brain, which processes that information and translates it into the object's color(s).

There are three kinds of cones in the human eye. They are responsible for all of the colors we see. But some insects, birds and fishes also possess a fourth type of cone that enables them to see ultraviolet light, thereby revealing patterns that humans don't need to see. And out of necessity, nocturnal hunters and their prey see far better at night than we do, due to abnormally large eyes (e.g., owls) or eyes that contain many more light-gathering rods than we have (e.g., lions, wolves and the animals they feed on). It's possible that early humans possessed both of those traits, ultraviolet vision and night vision, but lost them when mankind developed sophisticated weapons and hunting techniques that moved us to the top of the terrestrial food chain.

Question: *Why is our color vision so limited at night?*

Answer: As previously noted, when you take away light, black is the result. But let's compare what we see at night with what a camera sees.

Our eyes collect (but do not store) the light they receive. This is not a problem during the daylight hours when bright sunlight reveals colors in all their shades of glory. At night, however, darkness reduces the effectiveness of our rods and cones, and the visible light and colors fade away into shades of gray or black after the **Sun** goes down.

That is far different from how a camera works.

If you aim your telescope at, say, **Veil Nebula**, and snap a photo the way you take pictures in the daytime, the photo will show even less than you'd see in a telescopic view of the Veil. Why? Because although your eyes don't store light, you're collecting the Veil's light continually while you're looking at it, whereas a camera stops collecting light when the shutter closes.

If you open the camera's shutter and leave it open, however, the camera will begin storing light and color as your telescope tracks the nebula across the sky. Keep the shutter open long enough, and you'll see all the color and detail that your telescope is capable of revealing. But if you keep the shutter open too long, you'll over-expose the image. That's usually what happens when people photograph **Orion Nebula**: in keeping the shutter open long enough to reveal the lovely pinks and blues in the nebula, M42's beautiful little quartet of young white stars, the **Trapezium**, becomes an over-exposed blur of white light.

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Color Vision and Night Vision: Part II

by Truman Boyle and Alan Pryor

(Editor's Note: Some of the information that Truman and Alan gave me could not be fitted into my article. Here's what else they told me.)

Truman: Night Vision

The light-gathering rods in our retinas contain a chemical called *rhodopsin* that is produced by carotene (vitamin A). Carotene is responsible for the orange color of carrots. That's why eating carrots is associated with improving vision: Rhodopsin is extremely sensitive to light, and thus enables us to see in low-light conditions. Without the rhodopsin in carrots and certain other vegetables and fruits, we would not be able to see anything at night, or to contrast objects from their background in darkness.

White light breaks down rhodopsin into other chemicals that do not transmit light. That explains why, whenever anyone shines a white-beam flashlight at night, we become momentarily night blind. When the white light is turned off, however, those chemicals slowly recombine back into rhodopsin, thereby restoring our night-adapted vision. That process takes anywhere from a few minutes to as long as half an hour, depending on the intensity of the white light. Even white stars affect our night vision, although not as much as a white-beam flashlight.

Rhodopsin is ineffective in collecting light when that light is white -- but is there any other color that does not affect rhodopsin or hinder our ability to see at night?

You guessed it: *red light*. Rhodopsin doesn't break down when exposed to red light, so a red-beam flashlight permits us to retain our night-adapted vision.

Alan: Color Vision

It takes a lot of photons (light particles) to activate the cones that produce color vision. This is not a problem in the daytime; in fact, there is so much light available during the daylight hours that our pupils contract and our eyes secrete a substance that makes them less sensitive to the overabundance of light.

At night, however, the process is reversed: Our pupils dilate in order to gather more of the available light, and our eyes stop secreting the substance that inhibits our sensitivity to light. But there are still not enough photons present to activate the cones even though their sensitivity is higher, so the only visual signals that our brain receives at night are input from the rods – with one exception:

When you look at a star, you see it as a bright point of light. Usually there are enough red, green and blue photons in that point of light to oversaturate the red, blue and green receptors in your retina. (Those are the three types of cones that process colors in humans.) Most stars appear white because all of the cones for all colors are saturated to their maximum. But when a star emits one color rather than a mix of colors, we see it as, say, a red star because it is emitting red photons and there are no blue or green photons to saturate the other types of cones.

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Three Questions for Bill Warren

Question #1: *What is your most memorable experience in astronomy?*

Answer: Actually, three occasions stand out most vividly in my memory. Taking them in reverse order of their importance, they are:

#3. **Making Friends With M42**. When I got my first telescope for Christmas in 1993, I immediately set out to find the Messiers. Trouble was, I was so inexperienced that practically the only Messier object I could find was **Orion Nebula**. I'd find it in my scope, marvel at its beauty, and then look for something else nearby like **M78** (also in *Orion),* **M41** in *Canis Major,* **M35** in *Gemini* or **M36, M37** or **M38** in *Auriga*. When I couldn't find them, I'd go back for another look at M42.

Eventually I got better at finding things through practice and persistence. The **Moon** and the naked-eye planets were easy to find -- but the only thing that kept me from giving up on the Messiers early on was that lovely nebula. Finding M42 over and over reminded me that, no matter how bad I was, I wasn't a complete failure as a beginning deep-sky observer.

That's why I've always loved M42 – and why I've always advised observers that, when starting out in an observing program, you should always find the easiest (i.e., brightest) objects on the list before looking for the more difficult faint fuzzies. Those initial successes will give you the confidence to keep on keeping on when you tackle the harder ones that you don't find immediately.

#2. **My First Two Comets**. In 1996-97, two splendid comets appeared: **Hyakutake** (1996) and **Hale-Bopp** (1996-97). Both of them were lovely, although in different ways.

Hyakutake (pronounced: HIGH uh kuh TAHK ee) was my first comet. Its dust tail was incredibly long. My 6x35 binoculars had a 7^{o} field of view (fov); when I saw Hyakutake for the first time at Dauset Trail, that tail was *seven fov-widths long, and stretched ¼ of the way across the sky*! Hyakutake was bright, but it didn't stay with us long.

Comet Hale-Bopp, on the other hand, was tiny, but so bright that it could be seen naked-eye at night for a year and a half, a 1/8-in.-wide equilateral triangle in the northern sky. It was larger in binoculars; I didn't have a tripod, so to steady the view I placed my binocs on top of an inverted mop. My telescope showed the bright coma, the bluish gas tail and the slightly longer brownish dust tail.

After spending 18 months observing Hale-Bopp at every opportunity, when it left I felt the same emptiness that parents feel when their child goes off to college or moves away from home. Even today, many years later, Hale-Bopp remains as sweetly embedded in my memory as my first kiss.

#1. **The Egleston Kids**. As fondly as I recall my experiences with M42 and Comets Hyakutake and Hale-Bopp, they pale in comparison to my encounter with the Egleston kids.

As members of the Atlanta Astronomy Club (AAC) in 1995, **Larry Higgins, Ken Walburn** and I participated in a summer camp observing for children from the Egleston Children's Hospital in Atlanta. Bringing smiles of joy and excitement to the faces of those children, who suffered on a daily basis in ways that children should never have to endure, generated powerful emotions within me that I had never previously associated with astronomy. Nothing else I have ever done in astronomy is even remotely as important or meaningful to me as that evening I spent with the Egleston kids.

I learned a very important lesson about public observings that night, namely, that *Every child (and adult) who steps up to my telescope needs and deserves to experience the same delight and awe that we brought to those wonderful Egleston children.* Public observings may not save lives, but they improve the quality of our visitors' lives, one scope at a time, if only for an hour or two.

Question #2: *Why isn't co-founding FRAC on your list of most memorable experiences?*

Answer: Because FRAC was Larry's idea, not mine. I just went along for the ride. (In fact, I was initially opposed to the idea of starting an astronomy club because I didn't know diddly squat about astronomy or how to run an astronomy club at the time.)

When I met Larry in 1994, he and Ken were members of the AAC. I visited a meeting with them, joined the club, and during the next year or so we car-pooled to meetings at Fernbank and Emory Univ. in downtown Atlanta.

We hated every second we spent battling the Atlanta traffic. Larry nagged us constantly for months on end, saying that the three of us should start a club of our own in the Griffin/Flint River area. We refused to do it for a long time, though, because Ken didn't know any more about astronomy than I did. We finally gave in when Larry said he'd be president and do all the work. All we'd have to do, he said, was serve as vice president and newsletter editor (me) and secretary-treasurer (Ken).

You know the rest of the story. FRAC survived and thrived – but it was Larry who started it all. Without Larry Higgins's vision and the leadership he provided, there never would have been a FRAC.

Question #3: *What advice would you give to someone who has recently joined the club?*

Answer: Get involved.

Whether you're new to astronomy or a seasoned veteran, it's natural to feel like the new kid on the block when you don't know anyone in the club you just joined. But consider this: *Everyone in FRAC was once the club's newest member.* All of us felt the same way that you do – but we got over it. You will too.

You would do well to remember this, too: You may feel like an outsider initially – *but we don't think of you that way!* To us, you're a family member that we've never met before, like Uncle George from Pigeon Forge. We want to know you better, and the best way is for you to attend meetings as often as possible. Try to arrive early and/or stay awhile after the meeting so we can become friends through our common interest, *astronomy*.

If you get involved, two wonderful things will happen:

1. With our help, you'll attain whatever goals you set for yourself in astronomy; and
2. You'll find out, as many others before you have found, why we consider FRAC to be the friendliest astronomy club in America.

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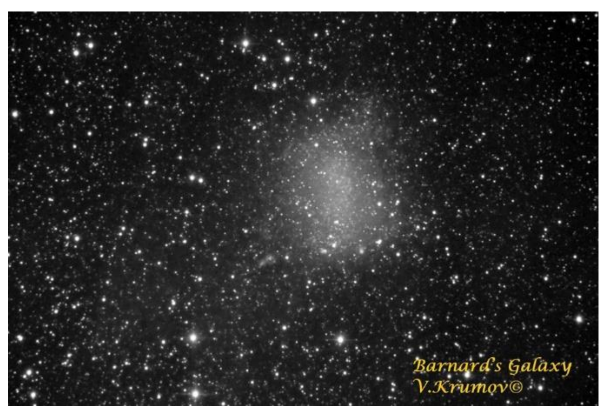

Above: NGC 6822 (Barnard's Galaxy). Photo by **Vencislav Krumov**.

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