THE FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

Vol. 19, No. 4 June, 2015

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, **Carlres**; Treasurer, **Roger Brackett**.

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Club mailing address: 1212 Everee Inn Rd., Griffin, GA 30224. FRAC web site: 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* from the A. L.

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Club Calendar. Thurs., June 11: FRAC meeting/ lunar observing (7-10 p.m., The Garden in Griffin); **Fri.-Sat., June 19-20:** club observings (Joe Kurz Wildlife Management Area Site #3, at dark).

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President's Message. After a long, cold winter and a rainy spring, the lazy, hazy, crazy days of summer are here again. That means heat and mosquitos, but if you go to our website and read (or re-read) **Smitty's** article, "Attack of the Martian Mosquitos," you shouldn't have any problem observing comfortably during the summer months.

I hope you'll try to join us at our JKWMA observings this summer. We always have fun, and we always learn a lot from each other. If you're new to astronomy or observing, we'll teach you what you need to know and help you get started. And if you're an experienced observer, we'll learn from you. That's what astronomy clubs do.

Finally, here's a "WELCOME TO FRAC!" to our newest members, **William Murray, Melvyn & Lenawee Silver.**

-Dwight Harness

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Last Month's Meeting/Activities. Twenty members and visitors attended our May meeting. The members included: **Dwight Harness; Steve Bentley; Doug Maxwell; Tom Moore; Alan Pryor; Andy Hasluem; Ron Yates; Steven "Smitty" Smith; Aaron Calhoun; Joel & Risa Cox; Truman Boyle; Erik Erikson; Felix Luciano;** and speakers **Dawn Chappell** and **Bill Warren** (a.k.a. **yr. editor**). The visitors were: **David Clay**; and **Melvyn & Lenawee Silver** and **William Murray**.

The program consisted of a slide presentation on **The FRAC 50 Observing Program** (which Dawn co-created). She and yr. editor went through the program from **A (Albireo)** to **Z**zzzzzz – the sound of Steve B. snoring in the back of the room. (Actually, Steve wasn't snoring, he was just resting his eyelids loudly. [Hey, we're only teasing: in fact, he was listening throughout, except for the club news, discussions and the FRAC 50.])

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This 'n That. The Camera Bug, Atlanta's only astronomy store, closed back in Dec. when its owner, **Tim Nix**, passed away unexpectedly. Neither of Tim's two surviving sisters wanted to reopen the store, so they plan to hold a liquidation sale of Tim's entire stock of astronomy and camera gear. The event probably will take place around the end of May.

If there is anything you want to buy that you think the Camera Bug might have, contact **Dwight Harness** at 770-227-9321 or **Truman Boyle** at

770-468-8242 asap and they'll check on it and give you a price if it's available.

*****Our beautiful new **FRAC 50 Observing Program** award certificate was unveiled at the May meeting. How do you earn a certificate? It couldn't be simpler. Just check off the objects one-by-one as you find them, and let **Bill Warren** or **Dwight Harness** know when you're finished. You don't have to write anything down or keep an observing log unless you want to: the FRAC 50 program is an honor system, much like the A.L.'s Lunar Program – and you can use GoTo or PushTo technology if you have it.

It will take awhile to finish the project, since the winter objects are already gone and the fall objects won't be visible for another three months unless you stay up very late. But that's what observing programs are designed to do, i.e., give you a good reason to go out and observe regularly.

Although there is considerable overlap between seasons, as a rule of thumb there are nine FRAC 50 objects in the spring sky, six in the summer, 17 in fall and 18 in winter.

If you lost the list that was handed out at the May meeting, we'll have copies available at JKWMA – or, you can go to our club website and run off a copy.

*One other point regarding the FRAC 50: all but one of the objects appear in at least one A. L. observing pin program. So if you keep an observing log while working on the FRAC 50 – and you certainly don't have to – you can use your FRAC 50 observations in any other A.L. observing program in which they appear.

For example, five of the FRAC 50 objects appear in five different A.L. programs; nine others appear in four; twelve are in three programs, thirteen are in two and ten are in one program. The only one not in an A.L. observing program is **Whiting's Asterism, the Mini-Coathanger).**

That's what we meant at the meeting when we said that *these are the most popular non-Messier objects in the sky*. The A. L. thinks so, too.

So if you find, say, the **Blinking Planetary Nebula**, if you keep an observing log you can also apply that observation to the A.L.'s Caldwell, Deep Sky Binocular, Herschel 400, Planetary Nebula and Urban programs. You won't have to find and observe it six times for six programs.

You can find a copy of "The FRAC 50 in A. L. Observing Clubs" on our website. (Or just ask **Bill Warren** for a copy.)

*Over the years, **yr. editor** has half-heartedly attempted to calculate how large the universe is. In the June '15 issue of *Astronomy* (p. 9), editor **David Eicher** writes, "Because of space-time's curvature, we know the universe is at least 93 billion light-years across."

Well, that simplifies the math somewhat. Since one light-year is 5.8 trillion miles, using Eicher's calculations the distance from one end of the universe to the other is at least 539 sextillion, 400 quintillion miles. Or, if you like zeros, it's 539,400,000,000,000,000,000,000 miles, give or take a mile or two.

So here's your question: *Driving at an acceptable freeway speed of 70 mph, how long would it take for you to get from one end of the universe to the other?* (Bonus questions: *If your vehicle gets 30 mpg, how much gas would it take to make the trip? How many times would you have to stop and walk the dog? And how many times would the kids in the back seat ask, "Are we there yet?"*)

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Upcoming Meetings/Activities. Our June FRAC meeting and lunar observing will be held at UGa's "The Garden" facility in Griffin from 7-10 p.m. on **Thurs., June 11th**. Our program will feature Chapter 9, "The Edge of Forever," from the original 1980 *Cosmos* series that was written and hosted by **Carl Sagan.** In this segment, Sagan leads viewers on awesome trips – to a time when galaxies were beginning to form; to India to explore the infinite cycles of Hindu cosmology; and to show how 20th-century humans discovered the expanding universe and its origin in the Big Bang. Then he disappears down a black hole and reappears in New Mexico to show viewers an array of 17 telescopes probing the furthest reaches of space.

Thirty-five years have passed since this series first aired. Like the universe itself, astronomy has expanded dramatically since then, as has the technology to produce visual effects relating to space. Yet the original *Cosmos* far outshines the **Neal DeGrasse Tyson**-hosted sequel that aired in 2014. If you didn't see the original Sagan *Cosmos*, you owe it to yourself to find out why it remains the most-watched astronomy documentary in TV history.

Our June JKWMA club observings will be held at Site #3 **on Fri.-Sat., June 19th-20th**.

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"This Little Light of Mine…"

article by Bill Warren

After writing countless articles for the *Observer* in the past 18+ years, I surprised myself recently by finding a topic that I've never written about. In order not to give away too much too soon, all I'll say here is that all of these celestial light shows except the last one can be seen naked-eye. The only special equipment you'll need to see them is the most specialized equipment of all: *your eyes.*

So gather round, kiddies, it's time to shed some light on an important topic: familiar lights in the sky producing spectacular visual effects.

The **Sun** and the **Moon** are our most important natural light sources. It's hardly surprising, then, that they help in producing things like *rainbows, moonbows and icebows; auroras; zodiacal light; gegenschein; sun pillars; sundogs;* and *earthshine*.

As a p.s., I've also included *ashen light,* a phenomenon associated with the planet **Venus**. But I've left out others such as my personal favorite, the *green flash*, on the grounds that ya gotta stop somewhere. Anyway, I wrote about the green flash in the Dec., 2014 *Observer* (p. 5).

Above: The end of the rainbow.

1. Rainbows, Moonbows and Icebows. **Rainbows** form in the sky when the Sun reappears after a rainfall and its rays are refracted and reflected off moisture-laden clouds on the opposite side of the sky. This action creates an arc of prismatic colors, with red on the outer edge, orange, yellow and green at the center and blue (and possibly indigo) on the inner edge. Other colors – infrared and ultraviolet – lie beyond those edges on either side, but we can't see them.

Above: Moonbow over Hawaii. A solitary star at the upper right shines above a moonbow (which in turn shines above a lava outburst on the Big Island).

Moonbows are rainbows formed by indirect sunlight reflected off the surface of the Moon onto atmospheric water particles on the opposite side of the sky. Since even a full moon reflects far less light than the Sun generates, moonbows are not as bright as rainbows. Except in long-exposure photos (see above), moonbows usually appear as white arcs because the light that produces them tends to be too weak to trigger the color receptors (cones) of our eyes.

Four conditions must be met for a moonbow to appear: the Moon must be very bright – full, or nearly so; it must be low in the sky (and the lower, the better); the sky must be very dark; and it has to be raining on the opposite side of the sky. Since the night sky is bright under a rising or setting full moon, the best time to observe a moonbow under those restrictive conditions is 2-3 hrs. before sunrise or 2-3 hrs. after sunset, when the full moon's glow is farthest from the opposite horizon.

The first historical reference to moonbows was by the Greek philosopher **Aristotle** around 350 b.c.

Like rainbows, moonbows can be created in other ways, such as moonlight reflecting off the spray or mist of waterfalls. Cumberland Falls near Corbin, KY is a favorite site for moonbow watchers, as are some locations in Hawaii. (Road trip, anyone?)

Above: Icebow.

Icebows (a.k.a. **lunar halos**) are, as might be expected, halos or circles of light around the Moon. They are caused by moonlight interacting with ice crystals suspended in moisture-laden clouds 3-6 mi. above the Earth. The ice crystals act as tiny prisms and mirrors, refracting moonlight off their faces and reflecting it outward to form a 22^{o} circle around the Moon.

Before meteorology came along, icebows were an elementary and familiar form of weather forecasting: a halo around the Moon meant that it was going to rain in the next 24 hrs. More often than not it was true, too, since the cirrostratus clouds that produce lunar halos are both high-altitude and heavily laden with moisture. Their presence, like the icebows they produce, usually signifies an approaching frontal system – and often rain.

Lower left corner: Aurora borealis. This is one of an infinite number of forms and colors an aurora may assume.

2. Auroras. The word <u>aurora</u> is Latin for "sunrise." It also was the name given to the Roman goddess of the dawn -- but when auroras are present in the sky, they can last all night long.

Auroras are colorful light displays associated with (but not restricted to) Earth's polar regions. In the northern hemisphere, there is the *aurora borealis*, or northern lights; its southern hemisphere counterpart is the *aurora australis*, or southern lights.

Auroras result from high-energy solar particles bombarding Earth's upper atmosphere, usually due to solar flares and the solar wind. This bombardment causes the atoms there to glow. Because the solar particles – protons and electrons -- are electrically charged (ionized), they are deflected by Earth's geomagnetic field to the magnetic poles. As a result, most auroras are seen at far northern or southern latitudes. During periods of peak solar activity, however, sometimes they can be seen as far away as the equator.

Visually, auroras take different forms and appear in several different colors. They can appear as arcs, curtains or rays, or as a diffuse, colorful glow encompassing the entire sky. Their color is determined by the altitude at which solar particles are interacting with atoms in Earth's atmosphere.

At extremely high altitudes, the auroral glow may be red, scarlet, crimson or carmine – but because there are fewer atoms at high altitudes and our eyes are less sensitive to red, we usually see red auroras during intense solar activity periods but not at other times. At Chiefland, FL a number of years ago, FRAC members saw the entire night sky painted red with auroral glow. It was an impressive sight: when I saw it I thought it was a forest fire; what else could do that to the sky? **Larry Higgins** explained that it was an aurora.

At lower altitudes, collisions between ionized solar particles and atoms in the atmosphere are more common, and therefore brighter. They produce green auroras, often appearing as curtains that shimmer like a flag waving weakly in the wind.

At still lower altitudes, auroras may be blue or purple – again, during peaks of solar activity.

Beyond that, auroras occasionally may appear as orange, yellow, pink or yellow-green. In all cases, auroras rank among the most awesome, eerie and colorful displays in the night sky.

Above: **Zodiacal light.** It's at its brightest near the Sun.

3. Zodiacal (pronounced: ZO dee ack ul) **light** is a diffuse glow in the night sky that extends upward from the vicinity of the Sun along the zodiac and the eclipse. Hence its name. It can extend across the entire sky.

This faint, wedge-shaped white glow is widest near the Sun and best seen just after sunset in the spring and just before sunrise in autumn, when the zodiac is tilted farthest away from the ecliptic. (The *ecliptic* is the apparent path the Sun follows as it moves across the sky from one zodiac constellation to the next.)

Zodiacal light is caused by sunlight scattered by a thick, flat cloud of dust in the solar system that parallels the plane of the ecliptic. That light is so faint that moonlight or even light pollution can render it invisible to us, which explains why we don't see zodiacal light more often in the spring or fall months.

4. Gegenschein (pronounced: GAYG in shine) is a German word meaning "counterglow." The term is appropriate, since gegenschein's glow is seen directly opposite the Sun – a faint brightening of the night sky in the east when the Sun is setting in the west and vice versa. It is caused by sunlight reflecting off interplanetary dust in the solar system.

Closely allied in origin with zodiacal light because both are associated with the Sun, space dust and the ecliptic, gegenschein is a somewhat brighter luminous glow than zodiacal light when they are on the same side of the sky.

Above: Gegenschein. In the photo, Gegenschein is the brighter portion of the bluish zodiacal light extending from the upper left to the lower right.

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5. A **sun pillar** is a vertical column of light that extends above and/or below the Sun when it is an orange ball near, or even below, the horizon. This optical phenomenon is due to sunlight reflected off ice crystals suspended in the atmosphere or clouds.

Above: Sun pillar above and below the Sun

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6. Sundogs are small, bright spots that appear on both sides of the Sun and at the same elevation above the horizon as the Sun. Like sun pillars, sundogs are caused by sunlight interacting with ice crystals in clouds or the atmosphere. Sundogs are often seen with arcs of light extending through them and connecting them to form a very faint 22^{o} circle around the Sun.

Sundogs can be seen anywhere on Earth during any season, but they aren't always conspicuous or bright. They are most easily seen when the Sun is near the horizon.

Above: Sundogs on either side of the Sun

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Above: Earthshine with a crescent Moon**.**

7. Earthshine. On some evenings just before or after the new moon when the Moon is a thin crescent, the darkened part of the Moon is faintly visible. This effect is due to **earthshine** -- sunlight reflected off Earth. If you were standing on the Moon at that time, Earth would appear as a full moon, only much larger, brighter and more colorful.

8. Ashen light. This one is a bit iffy, since the existence of ashen light has never been proven.

In 1643, the Italian astronomer **Giovanni Riccioli** reported seeing a faint glow on the night side (i.e., the unlit portion) of **Venus**. Other noted astronomers who have seen this subtle glow – which has been described as being similar to earthshine, only not as obvious -- include **Sir William Herschel** and **Sir Patrick Caldwell-Moore.**

The cause of this phenomenon – if indeed it exists -- is presently unknown. Two theories are that (1) if the night side of Venus experiences a large number of lightning strikes over a short period of time, it could produce a visible glow on that side of the planet; and (2) when researchers using the Keck I telescope in Hawaii saw a faint greenish glow on the night side of Venus, they thought it might be due to the effect of the Sun's ultraviolet light on carbon dioxide in the Venusian atmosphere.

So does ashen light really exist? Probably. I'm not going to be the one to question the observing skills of Sir William or Sir Patrick; if they said they saw it, they did. Besides, too many other observers have seen it simultaneously – including professional astronomers – for it to be regarded as unreal or nonexistent simply because it is unexplained.

Whatever the case, if you want to look for ashen light on Venus when the planet is partially lit, you'll need to use an *occulting bar* – a device to block the brightly sunlit portion of the planet.

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Four (Fore!) Questions for Prof. Stargazer

A group of FRACsters caught up with Prof. Stargazer on the fourteenth green of a golf course. He agreed to answer a few interview questions while his partners were putting.

Doug Maxwell: We all know that light travels at a speed of 186,000 mi. per second, sir; but does anything else travel nearly as fast?

Prof. Stargazer: Larry Higgins does when he has the green apple quick steps.

Truman Boyle: What is a *parsec*?

Prof. Stargazer: It's the distance a *par* travels in one second.

Truman: What's *par*?

Prof. Stargazer: Four on this hole, but the next hole is a par three.

Ron Yates: I've always wondered, Professor: Why are some galaxies irregular?

Prof. Stargazer: They don't get enough fiber in their diets.

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