THE FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

Vol. 20, No. 12 February, 2018

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**; Treasurer, **Jeremy Milligan**.

Board of Directors: **Larry Higgins; Aaron Calhoun;** and **Alan Rutter.**

Facebook Coordinator: **Laura Harness;** Alcor: **Carlos Flores;** Webmaster: **Tom Moore;** Program Coordinator/Newsletter Editor: **Bill Warren**; Observing Coordinator: **Sean Neckel;** NASA Contact: **Felix Luciano.**

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.

* * *

Club Calendar. Thurs., Feb. 8: FRAC meeting (7:30 p.m. at The Garden in Griffin); **Fri.-Sat., Feb. 16-17:** JKWMA observings (at dark).

*** * ***

President's Message. As my mother used to tell me, "If you don't have anything nice to say, don't say it." So I won't mention that we lost electric power twice in recent cold snaps.

I'll leave the arguments about global warming to others, but while I'm thawing out I'm looking forward to some temporary local climate change.

And with that, I'll turn over the newsletter to **Bill.**

-Dwight Harness

* * *

Last Month's Meeting/Activities. A nearly standing-room-only crowd of 27 attended our Jan. meeting: **Ken Olson; Truman Boyle; Tom Moore; Cynthia Armstrong; Ken Harris; John Felbinger; Erik Erikson; Carlos Flores; Dr. Wayne Gardner; Carol & Ryan Force; Felix Luciano; Marla Smith; Neila & Chuck Davis; Steve Benton; Cindy Barton; Alan Pryor; Elaine Stachowiak; Joseph Auriemma; Jonathan & Kamara Heard; Sean & Gianna Neckel; Dwight Harness; yr. editor;** and visitor **Alfred McClure.** Sean was named our new observing chairman**,** and everyone enjoyed the **Alex Filippenko** dvd "In Search of Extraterrestrials."

At the other end of our attendance scale, temps in the low 30s kept everyone but Sean & Gianna home during our Feb. 19th JKWMA observing. The following evening, with temps in the 40s they were joined by **Chelsea Neckel, Dwight Harness** and **yr. editor.** The sky was clear on both evenings.

*** * ***

This 'n That. A reminder: Your membership renewal is due this month. You can give your check (payable to FRAC) or cash to **Dwight Harness, Bill Warren** or **Jeremy Milligan** at the Feb. meeting, or mail it to Bill c/o: Bill Warren, 1212 Everee Inn Rd., Griffin, GA 30224.

* * *

Upcoming Meeting/Activities. Our meeting will be held at 7:30 p.m. at The Garden in Griffin. It will conist of three phases: officer election; a brief dvd and an equally brief book review by **Erik Erikson;** and our FRAC 21st birthday party. We'll have refreshments – FRAC will provide a birthday cake, chips, nuts and soft drinks, but you can bring home-made cookies if you like – and with our

abbreviated program we'll have ample time to socialize and get to know each other better.

About the dvd: it's "Powers of Ten," a short 1989 film by **Charles & Ray Eames.** In the brief span of 8 min., it takes us on an incredible adventure in magnitudes.

Starting at a picnic in Chicago, we are transported out into the farthest reaches of space. Every ten seconds we view the starting point from ten times farther out, until the Milky Way is visible only as a speck of light among a multitude of others.

Then, after returning to Earth with breathtaking speed, we move inward – into the hand of the sleeping picknicker – again, with ten times more magnification every ten seconds. Our "powers of ten" journey ends inside a proton of a carbon atom within a DNA molecule in a white blood cell.

* * *

Questions and Answers

by Bill Warren

***Question:** *What is Universal Time?*

Answer: Earth rotates as it orbits the **Sun.** While half of the planet is experiencing various stages of daylight, the other side is experiencing corresponding stages of darkness or night. To accommodate those differences, the U. S. and the rest of the world are divided into time zones.

Since the Earth is a 360^{o} globe and there are 24 hrs. in a day, each time zone encompasses 15^{o} representing (in most cases) one hour. The entire system is centered on 0^{o} longitude -- the prime meridian at Greenwich, England.

Universal Time (UT) is used to standardize those time zones around the world; it is expressed in terms of a 24-hr. clock, like the system used by the U. S. military. One a.m. is 0100 hrs. (or 01:00, either way is acceptable), and 1 p.m. is 1300 hrs. or 13:00. If you see a reference to, say, 1459 UT or 14:59 UT, it means that the writer is referring to 2:59 p.m. Greenwich Time. To translate that into our time, subtract 5 hrs. because we are five time zones west of Greenwich. (Subtract 4 hrs. during Daylight Savings Time.)

Including Hawaii and Alaska, there are six time zones in the U. S.: Eastern Standard Time (EST), Central Standard Time (CST), Mountain Standard Time (MST), Pacific Standard Time (PST), Alaska Standard Time (ALST) and Hawaii-Aleutian Standard Time (HAST). Each zone is one hour later than the next-westernmost because the Sun rises one hour later there. For example, when it's 3 p.m. in Griffin (EST), it's 2 p.m. in Alabama (CST) and 10 a.m. in Hawaii (HAST). And going the other way it's 8 p.m. in Greenwich.

****Question:*** *Is the space between galaxies empty?*

Answer: No. Intergalactic space contains reservoirs of hot gases that can be detected in X-ray photos. Recent research also indicates that countless numbers of individual stars inhabit the void of intergalactic space, having been flung out of their galaxies through gravitational interactions with other stars. There are enough of these solitary stragglers out there to make the universe slightly brighter than the combined light of all the galaxies can account for.

So **yr. editor** has been wrong when he has written that every star is gravitationally bound to a galaxy and functions as a member of that galaxy. That's part of the reason why astronomy is so complex, and so fascinating: for practically every rule, there is an exception.

***Question**: *Why do events like eclipses and the appearance of bright comets bring so many people into astronomy?*

Answer: They don't. They bring people *back* to astronomy.

Virtually everyone is (or was, at least) interested in astronomy. Children learn about things like the **Sun, Moon**, planets and black holes in school, and although they don't learn much about those things, most of them are fascinated by what they see and hear. They want to become astronauts and visit other planets.

However, astronomy education is just a tiny part of what children learn in school and in life. Over time, astronomy takes such a distant backseat to everything else involved in growing up that most – but not all – of what was learned about astronomy is forgotten. What remains for most adults is the spark of interest that kindled their youthful enthusiasm to learn about the universe when everything in life was new to them.

For many people, that spark is re-ignited when an event like an eclipse – especially a total solar eclipse -- a meteor storm or a naked-eye comet gathers worldwide attention. It reminds them of their childhood dreams of seeing for themselves what's out there in space. And while it's too late for them to become astronauts, it's never too late to learn more about the universe they live in, so many of them become amateur astronomers.

That's why we conduct outreach activities. We do it partly in the hope of attracting new members, of course, but our primary goal is far simpler: to show children (and remind adults) how marvelous our universe really is. In doing that, we enrich their lives at least momentarily, regardless of whether they decide to become astronomers themselves.

***Question:** *Is it true that the universe is expanding, and that everything in it is expanding away from everything else?*

Answer: The answers to those questions are *Yes*, *No* and *Yes*. (The 2nd part requires two answers.)

1. *Yes*, the universe is expanding. Everything we know about the universe suggests that the Big Bang kick-started that expansion. The universe is still expanding; in fact, the deeper we look into space, the faster it is expanding.

2a. No, not everything in the universe is expanding away from everything else. For example, the **Milky Way** and **Andromeda Galaxy** are moving toward each other, and they will merge into one supergalaxy called **Milkomed**a about 4 to 5 billion years from now. Still…

2b. On a cosmic scale, that merger is comparable to two atoms bouncing around on an elephant's back. It has no effect on what the rest of the elephant is doing. So *Yes*, the universe is expanding, and on that immense scale everything in it is indeed moving away from everything else. Here's how it works:

Imagine the universe as a raisin cake baking in an oven. As the yeast rises, every raisin (galaxy) in the cake is carried farther away from all of the other raisins/galaxies by the actions of the yeast (space). Exceptions exist, such as Milkomeda, but they are no more than momentary blips on the radar screen of cosmic space-time. They too eventually will expand away from other galaxies because the expansion is drawing everything apart while on a smaller level gravity momentarily draws some of the pieces of the cosmic jigsaw puzzle closer together.

(Here's where the raisin cake analogy breaks down: the rising yeast has a central point. When the cake rises, everything within its borders expands away from the center. With the universe, however, the central point is *everywhere*, i.e., wherever you happen to be. Space isn't just expanding at the outer edges of the universe, it's expanding everywhere.)

At any rate, *that's* the expansion of the universe that **Edwin Hubble** discovered in 1925. He didn't see galaxies moving through space, he saw them being carried away from us by the expansion of space itself. Intelligent beings anywhere else in the universe would see the same thing, only from their perspective it would be *us* moving, not them. That's why cosmologists say that the universe has no center.

All of which brings up an obvious question:

***Question**: *Will the universe continue to expand forever?*

Answer: No one knows the answer to that question, of course. But there are two better questions, one of which *does* have an answer: *Will the universe have an end? And if so, how will it end?*

Scientifically, at least, the first question is easily answered.

There's not much that scientists agree on 100%, but all of them agree that *Yes*, the universe will end trillions of years from now. As for how it will end, they offer three possible scenarios: the "Big Crunch," the "Big Rip" and the "Big Freeze."

The Big Crunch. This theory holds that, although the universe presently is expanding, there is enough mass in it (including dark matter and dark energy) to eventually halt the expansion. When that happens, gravity will take over and the universe will yo-yo back on itself like the Big Bang in reverse – a shrinking universe in which matter will be crunched together, smaller and smaller, until the cosmos is as small as it was immediately after the Big Bang. Or maybe it will shrink out of existence altogether.

The Big Rip. In this theory, there is not enough mass in the universe to halt its expansion; as a

result, gravity eventually will weaken to the point where it loses its ability to hold the universe together, causing all matter in the cosmos to be ripped apart. Galaxies, stars and even atoms will be torn apart, and whatever remains – if anything -- will be as far apart as supergalaxy clusters are right now. (Or maybe even farther apart than that. By then, it won't matter.)

The Big Freeze. Of the three scenarios involving the end of the universe, this is the one that cosmologists consider to be the most likely.

The universe will continue to expand forever. Over trillions of years, all of the stars in the universe will expend their energy and die. The universe will become very cold and dark, because expansion will prohibit new stars from forming out of the gases expelled by dying stars. Photons of the remaining light will be stretched to the point where they are no longer detectable at any wavelength.

Deprived of energy sources, heat and light, the universe will become infinitely dark and cold. The cosmos will consist of nothing but impotent matter and black holes that eventually will expire along with everything else due to escaping Hawking radiation.

At that point, the universe will enter an infinitely inactive state known as heat death. As *Astronomy* editor **David Eicher** put it (Dec., 2015, p. 6), paraphrasing the poet **T. S. Eliot,** "The cosmos may have started with a bang, but (it) will most likely end with a whimper." Everything in the universe will be in infinitely large cold storage, with nothing to re-ignite it.

* * *

Muddled Thinking: A Slightly Inebriated Interview With Prof. Stargazer

There were three old friends in the room last New Year's Eve: **Bill Warren, Prof. Stargazer** and their long-time companion **Jack Daniels**. But Jack was gone long before the interview began, which perhaps explains why it quickly degenerated into insults and name-calling.

Bill: The besht – excuse me, *best* -- I can tell *(hic!)*, everything in the universe except space itself is composed of simthung – *something*! Matter, energy and light – all of them exist in space, or they wouldn't exist at all. Why are we lying on our backs on the floor?

Prof. Stargazer: To keep it from moving around. But now the ceiling is moving.

Bill: I'm not finished with my question. Quit interrupting me.

Space, on the other hand, has no competition – *composition*! Space is composed of *nothing*. But if space is nothing -- *burp!* -- it doesn't exist because nothing exists. And if nothing exists, the universe doesn't exist, and neither do we. How can that be? If we don't exist, who am I talking to?

Prof. Stargazer: Tha'sh gotta be the silliest thing I've ever heard! Shpace exists, all right. (*Hic!*) There'sh an acre or two of it between your ears. Are you kin to **Tom Moore**?

Bill: Are you trying to insult me?

Prof. Stargazer: No, actually I was trying to insult Tom.

Bill: I'll have you know that I'm a highly suspected – I mean *respected!* – astromoner! I've forgotten more astromony than you'll ever know!

Prof. Stargazer: That'sh the problem, you senile old fool: *you've forgotten it!* Your mind is an open book, but all the pages are blank. Have you ever wondered why there's sawdust on your pillow when you wake up in the morning?

Bill: You're one to talk, you old fraud. You once told me that **Newton's** first name was **Fig!** If ignorance is bliss, you're the happiest man on earth. I'm *twice* the astromoner – *astronomer!* – that you are! *(Burrrp!)*

Prof. Stargazer: That'sh true. *(Hic!)* And if you don't lay off the second and third helpings of banana cream pie at mealtime, you'll be *four times* the ashtronomer that I am! Where do you get your ashtronomy facts, from a Ouija board?

Bill: Hey, I'm an *expert* astromoner! (Is that my stomach growling, or do you have a dog?)

Prof. Stargazer: If I had a dog, he'd know more about ashtronomy than you do! You're an exshpert, all right: an *ex* is a has-been, and a *shpurt* is a drip that fizzled. Sort of like this interview.

Bill: Isn't there anything we can agree on?

Prof. Stargazer: Well, let's see…Jack Daniels has left the auditorium, but Jim Beam is in the pantry; whaddaya think?

Bill: I'll drink to that!

Prof. Stargazer: Either it's midnight, or my watch is upside-down. Hap-pee New Year, Bill!

Bill: Happily Yew Near, Pruhfoosher – Purfusher – Whoever you are! I'm glad to meet you. My name is Bill Warner – Wermur – whatever.

What was I saying? Oh yeah: Have you met my friend Perfooshuh Garstazer? (He's an old windbag, but don't tell him I said that.)

* * *

Above: NGC 1097 in *Fornax*. (Photo by **Alan Pryor**.) Fornax is a small, faint constellation in the southern hemisphere. It contains seven celestial masterpieces, one of which is the bright barred spiral galaxy **NGC 1097**. This shapely spiral lies 45 million l. y. from Earth, and the black hole at its center is 140 million times as massive as our **Sun.**

Although visible in binoculars, 1097 is best seen in a 10-in. or larger telescope, where it appears as a large oval glow – the central bar – containing a small but bright oval core. (It takes a 16-in. or larger 'scope and clear, dark skies to see the faint, **S**-shaped spiral arms formed by the the bar ends.)

Four arc-minutes to the left of 1097 in Alan's photo, peculiar elliptical galaxy and companion **NGC 1097A** can be seen in most 'scopes as a faint, circular glow.

This interacting galaxy pair is located 2^{o} N of the 5^{th}-mag. star **Beta Fornacis**.

* * *

Above: The **Moon**. (Photo by **Ryan Force**.) Ryan is one of our newest members. He is interested in learning about photography with his new astrocam. Lovely photo, Ryan. You're off to a great start!

* * *

Above: NGC 1491, an emission nebula in *Perseus*. (Photo by **Alan Pryor**.) This thumb-width-sized nebula is a Herschel 2 target. (From yr. editor's H2 observing notes: "**NGC 1491** was fairly bright, triangular in shape and measured 5' to 5'1/2' in dia., with an 11^{th}-mag. star along the E edge. Although easily seen without a filter, my best view of it came when I used my narrowband light-pollution filter (i.e., nebula filter)."

NGC 1491 is an easy find, located on a line extended from **Eta** to **Lambda Persei** and beyond, half as far from Lambda as Eta is.

##