THE

FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

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Club Calendar. Fri., Nov. 30th: High Falls State Park public observing (6 p.m.); **Sat., Dec. 8:** FRAC Christmas party (6:30 p.m,., Brian's Buffet Restaurant in Griffin).

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President's Message. I couldn't attend our Lake Horton observing, but by all accounts it was a great evening. **Sean** prepared a page of guidelines for our visitors, and the Rec Dept. coordinator gave copies to everyone who signed up to attend. He also placed solar lights along both sides of the path to the observing site.

The Fayette Co. folks really enjoy our observings, and the Rec Dept. is working hard to help us make those occasions special. It's always nice when our hosts go out of their way to show how much they appreciate our visits. We look forward to going back there later in November, and many times in the future.

Last but certainly not least, here's a big **"WELCOME TO FRAC!"** to our newest member, **John Killian**, who comes to Griffin from Big Sky country (Montana). John joined FRAC at the Nov. meeting and attended our JKWMA observing. We specially ordered some chilly weather so he'd feel at home.

We're glad to have you in our happy little club, John. Be sure to let us know how we can help you.

-Dwight Harness

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Last Month's Meeting/Activities. Dr. Richard Schmude was a featured speaker twice – once in the morning and again in the afternoon – at GRAM (the Ga. Regional Astronomy Meeting) that was held at Emory University in Atlanta on Oct. 27th. **Carlos Flores** gave a shorter presentation, telling the audience about FRAC and our outreach program.

Seven FRACsters – **Sean, Chelsea & Gianna Neckel; Mike Stuart; Felix Luciano; Cindy Barton**; and **yr. editor** – showed everything the sky had to offer to 115 enthusiastic visitors at our Lake Horton public observing on Nov. 3rd. Gianna handed out handi-wipes for women to wipe off their mascara, and Cindy converted our visitors' white-beam flashlights to red-beam. Thanks, ladies.

A stalwart crowd of fifteen -- new member **John Killian**; **Dwight Harness; Tom Moore; Steve Benton; Carlos Flores; Alan Pryor; Sean & Gianna Neckel; Dennis Nelson; Felix Luciano; Truman Boyle; Steve Hollander; Erik Erikson; Cindy Barton;** and **yr. editor** -- ignored the dreary weather conditions to attend our Nov. meeting.

We were clouded out of one of our JKWMA observings, and only three FRACsters – **Alan Pryor**, new member **John Killian** and **Felix Luciano** – braved temps in the high '30s the other night. Alan had a special incentive: trying out his new 22" 'scope at JKWMA!

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This 'n That. Re the **Geminids Meteor Shower** *(see pp. 2-3):* We told you last month that asteroids do not produce dust tails and meteor showers the way that comets do. But that's wrong: Two meteor showers -- the **Geminids** in Dec. and the **Quadrantids** in Jan. – are the result of rock dust

outgassed by the asteroids **3200 Phaethon** and **2003 EH 1**, respectively. Their meteors are thought to be due to unusually close approaches to the **Sun** by those asteroids in their orbital paths, which heated their surfaces enough to open cracks, releasing dust and granules that previously were unexposed.

*The **Trapezium** is a tight cluster of four very young, very hot stars located near the center of **M42 (Orion Nebula).** Known collectively as **Theta^1 Orionis**, they are less than 500 million years old. They vary in brightness between mag. 5.1 and 7.9 and are visible in small telescopes, where they look like little white eggs in a nest of nebulosity.

Here's the kicker, though, in the form of a trivia question: *Who discovered the Trapezium?*

Before you can say "Who cares?," here's the answer: **Galileo** discovered it on Feb. 4, 1617. (Actually, he saw only three of the four stars; the faintest one was first seen in 1673 by other astronomers.) By 1888, observers had identified four more components, two of which can be seen in a 5-in. telescope or larger. But none of those astronomers was using a telescope as small as Galileo's.

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Upcoming Meetings/Activities. We'll conduct another High Falls State Park observing at 6 p.m. on **Fri., Nov. 30th**. To get there from, say, Griffin, take I-75 South to Exit 198 (High Falls Rd.). Turn left onto High Falls Rd., and the park's Day Use Area will be 1.7 mi. ahead on the left, beyond the main entrance to the park and after you cross the bridge. Turn left into the Day Use Area, pass the pay station and park on the left. The observing site is between the parking area and the pavilion. See http://goo.gl/maps/RQFN3gmvgTA2.

Our annual Christmas party will be held at 6:30 p.m. on **Sat., Dec. 8th** at Brian's Buffet Restaurant in Griffin. **This will be our only club activity in December.** We won't have our regular club meeting or JKWMA observings due to the demands of the holiday season, so bring your entire family for frolicking fun, fellowship, festivities, food and a flock of fabulous door prizes. (We won't tell you here what they are, of course, but we'll give you a hint: ten of the prizes were made especially for FRAC.)

To get to Brian's if you're coming south from, say, Hampton on U. S. Hwy. 19/41, stay on the 4-lane past the Hardee's/McDonald's stoplight at Ga. 92 in Griffin. Go two stoplights farther and turn right. Bryan's parking lot is on the immediate left, just beyond the movie sign.

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"We can readily imagine the ancient scene: As the sun set over the broad Euphrates River, three Babylonian priests made their evening climb up the mammoth ziggurat temple…to watch the stars come out.

"In the east the Moon was rising, and in the west **Venus** shone high above the sunset. Just beside it **Jupiter** could be seen, dimmer and yellower. The priests had been watching the pair for some weeks now, but tonight there was a difference. The two planets were closer together than anyone had seen them in many years. As the sky darkened this brilliant 'double star' sank lower, the planets drawing nearer and nearer. At last…they fused into one, gleaming like a great beacon over Judea…

"What these wise men saw may have been the Star of Bethlehem."

-author unknown

Sky & Telescope (Dec., 1968)

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The Sky in December. Mark this down as a "must-see" observing event: On the evening of **Fri.** or **Sat., Dec. 6th** or **7th**, go out and find **Mars** shining brightly, low in the W sky. Then find the Red Planet in your telescope. At low magnification, you'll also see the little blue-gray disk of **Neptune** in the same field of view. It's a rare conjunction of an inner terrestrial planet and an outer ice giant planet.

Elsewhere, one of the best annual meteor showers – the **Geminids** – will peak throughout the evening and early morning hrs. of **Fri.-Sat., Dec. 13th-14th**. During that period you might see 120 Geminids meteors per hour – but you're likely to see more than that: you may also see meteors from other minor meteor showers (i.e., the **Sigma Hydrids, Puppid-Velids**, **Monocerotids** and **Northern Taurids**) or other sporadic meteors that aren't part of any meteor shower. But *Gemini* rises around 9 p.m. on that date, so you're also likely to

see "earth-grazers," or fireballs that enter Earth's atmosphere at shallow angles and glow brightly as they carve long paths across the sky before burning up or exploding like fireworks.

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Target: Earth (Part Two)
by Bill Warren

(Note: In case you're new to astronomy, a meteoroid *is a space rock, large or small, that has not entered Earth's atmosphere. Rocks and debris that enter our atmosphere are meteors. Bright meteors that glow like sparklers as they zip across the sky are fireballs, and meteors that reach the ground are meteorites.)*

Most of the time our planet is a fairly safe place. But there is always a chance, however small, that a presently unknown comet or asteroid on a collision course with Earth could appear, giving us a few months, weeks or maybe even days to prepare for it. The threat to human life would depend on many factors, including the object's size, speed and where the impact occurs.

The "Gravest" Threats. Here in a nutshell is what you need to know about the big impactors lurking out there:

Impacts involving meteors 6 mi. wide or larger occur about once every 100 million yrs. For 3-mi.-wide meteors, it's about every 10 million yrs. For meteors a mile wide, it's 500,000 yrs., and for meteors ½ mi. wide, 200,000 yrs. (A meteor ½ mi. wide would destroy an area about the size of the state of Virginia.)

Dealing With a Planet Killer. As noted above, the odds against a large meteor impact occurring in our lifetime are incredibly low. And that's very good news, too, because presently there's not much we could do to destroy a really big space rock or re-direct it away from Earth. As more than one astronomer has put it, **Bruce Willis** (*Armageddon*) couldn't save us. Three solutions have been proposed, but none of them is presently considered a high priority due to the awesome expense of such a project. As NASA folks will tell you, it hasn't been easy to convince Congress to fund the building of spacecrafts to explore Mars or other places in the solar system; it would be next to impossible to persuade them to spend billion$ of dollars building rockets to protect our planet that probably will not be used in our lifetime.

Anyway, here are the three methods under consideration:

1. A spacecraft could serve as a *gravity tractor*, using its own mass to gravitationally divert the object away from its Earth-bound path. Unless the meteoroid is truly enormous, it wouldn't take much to nudge it into a new trajectory that would miss us. (Unfortunately, this approach presently exists only in theory.)

2. A *kinetic impactor* could be sent to crash into the object at high speed, transferring its own momentum to the object in order to change its velocity and trajectory. As pointed out earlier, we'd have to have a rocket standing by for such a purpose, and presently we don't.

3. A *nuclear bomb* could be detonated at or near the rock to blow it to smithereens. We might still face considerable damage from individual fragments, but that would be a small price to pay in order to save the planet. (In military terms, it's known as *collateral damage.*) (Source: **Peter Tyson,** "Space Invaders" [*Sky & Telescope, June, 2018, p. 15]*.)

Smaller Impactors. Every day, thousands of small meteoroids pass by unnoticed within a **Moon's** distance of Earth without entering our atmosphere.

Every day, thousands of others enter our atmosphere. Most of them are no larger than dust motes, grains of sand or pea-sized, and they quickly burn up in the atmosphere. And every year about 500 of them are large enough to explode in the air and create strewn fields of small meteorite fragments.

Not until meteoroids reach several yards in dia. are the NEO groups able to spot and track them in their telescopes. They have done that several times in recent years, tracking incoming meteoroids and determining where they will land. But those rocks have posed no threat to us because they have landed in uninhabited areas such as the ocean or mountainous, desert or polar regions.

Earth is a very large place, and most of it is uninhabited. Most of humanity is crowded into sprawling urban areas. (We didn't know about the

2013 Chelyabinsk meteor until it arrived as a *bolide* [unusually bright fireball] and exploded in the atmosphere.)

At any rate, meteors as large as 4 ft. in dia. arrive about once a year. For those that are 10 yds. wide, it's once a decade; 20 yds. wide, once in 60 yrs.; 100 yds. wide, 5,200 yrs.; and 300 yds. wide, 73,000 yrs.

We might be able to send a nuclear device to destroy a small but potentially lethal object on an Earth-bound course, given sufficient advance warning. (That's why we're constantly searching for NEOs.) But what could we do if, for one reason or another, the detonation strategy fails?

Ya Gotta Believe. Here's where a bit of good old-fashioned optimism helps: In a best-case scenario, we'd have time after discovering the object to figure out how large it is, where (and when) it will come down and how large an area will be affected.

Let's assume for the sake of argument (and our ongoing mental health) that we know the incoming object to be small enough to inflict local but not widespread damage.

Let's further assume that the impact site is expected to be somewhere in the vicinity of Griffin, Ga. How would we deal with it here in Griffin or the surrounding area?

I'll answer that question with another question: *If you lived at the beach and you knew that a Category Five hurricane was coming, what would you do?* You could, of course, wait for it to arrive and hope for the best. But if you're even marginally more intelligent than a doorknob, you and your loved ones would evacuate the area, travel to a safe haven as far away as necessary to escape the effects and wait until the danger is past. In the case of a meteor, what you would return to would depend in part on whether it exploded in the air or on impact. (Either way, though, the damage could be immense.)

The 2013 Russian meteor was 20 yds. wide and exploded high in the air above Chelyabinsk. It left no crater, and damage was minimal under the circumstances. No one was killed, and injuries were limited to cuts inflicted by windows that were shattered by shock waves from the blast.

Fifty thousand yrs. ago, a 50-yd.-wide meteor exploded on impact 18 miles west of present-day Winslow, Ariz., carving out a crater ¾ mi. wide and 560 ft. deep. The area of devastation and damage was much greater than Chelyabinsk, of course. Such an impact today would demolish a city the size of Atlanta.

Griffin's fate hopefully would lie somewhere near the lower end of those extremes. Either way, though, by evacuating before the blast occurred you and your family would live to face another day, and where there's life there's hope.

As for the worst-case scenario (i.e., a planet killer getting past whatever defenses we might throw at it) – well, it's not worth losing sleep over. It could happen, but the odds against it happening in your lifetime or the foreseeable future are unimaginably small. You're far more likely to win the Powerball lottery than to die via a meteor strike.

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Above: Sirius A and **Sirius B** (the little blue dot to the lower left of Sirius A, photo by **Alan Pryor**)

Return of the Pup

article by Bill Warren

Most of the people who attend our public observings know at best just one or two facts about **Sirius**. For example, they know that it is the brightest star in the night sky. They may not know when it's up or where to find it, but they have no trouble seeing it when it's pointed out to them. Sirius is almost twice as bright as the next-brightest star (**Canopus**), but they don't know that.

The other thing that our visitors are likely to know about Sirius is that it is sometimes called the **Dog Star**, although most of them probably don't know why. (It's the brightest star in the

constellation *Canis Major, the Big Dog.*) The ancient Greeks believed that when Sirius rose in August every year, its brightness added to the **Sun's** heat to make the days even hotter than usual. That's why, even today, people refer to the "dog days of summer" – the hottest time of the year.

Beyond those two simple facts – that Sirius is the Dog Star and the brightest star in the sky – most non-astronomers know practically nothing else about it. For instance, few if any of them know that Sirius is actually a binary star system composed of **Sirius A** (the bright star that we see) and **Sirius B,** a fainter companion star with the appropriately cute nickname **the Pup**.

Once upon a time (actually, about 120 million yrs. ago), Sirius B was larger and brighter than Sirius A. At that time the Pup wasn't a little dog star, but a red giant star. Eventually it shed its outer layers and collapsed to become the white dwarf that it is today.

That's where our story begins – and what an incredible story it is! In human terms, it's the story of a dieter who lost size without losing weight. (That's not precisely true, but you'll see what I mean.)

As noted, in a heartbeat or so Sirius B shrank from an XXXL-sized red giant star into an itty-bitty little mini-star. That sudden compression squeezed a mass equal to the Sun's into a space a million times smaller, i.e., the size of the Earth. The result, as might be expected, was some of the most densely-packed material this side of a neutron star. (Imagine **Dwight Harness** crammed into a Speedo…on second thought, don't do that, it will ruin your day.) A teaspoonful of the Pup's contents would weigh about five tons on Earth! (Dwight doesn't weigh half that much.)

Most amateur astronomers have never seen Sirius B except in photos. There are three reasons why this is so. First, the two stars, A and B, lie very close together both physically and visually. The Pup orbits Sirius A at an average distance of just 20 AU (astronomical units: one AU = 93 million mi., the average distance from Earth to the Sun.) So the Pup is about as far away from Sirius A as **Uranus** is from the Sun. As seen from a distance of 8.6 light-years away, they are always close together in our view.

Second, at magnitude -1.46 Sirius A is 25,000 times brighter than its smaller nextdoor neighbor. That translates into a brightness of mag. 11.1 for Sirius B. We have no trouble seeing stars that faint in our telescopes, but there's a third problem involved.

Although the Pup lies very near Sirius A, it moves so slowly that it takes 50 yrs. for Sirius B to orbit its big brother. As a result, most of the time the Pup is unseen in the overwhelming glare of Sirius A.

Here's the good news: They have moved far enough apart – 10" (arc-seconds) in our view -- for us to see Sirius and the Pup in our backyard telescopes as two separate stars, especially if you take your time and use the highest magnification you have. (Don't expect Sirius B to shine in the night like an automobile headlight: that honor is reserved for Sirius A and the other bright stars in the sky. If you allow Sirius to drift west across your field of view, the Pup will be nearby to its east, following it.)

More good news: We'll be able to see them as separate stars for the next decade. They may or may not be easy to split, depending on the seeing conditions on any particular evening, but there is something to be said for seeing an object that most astronomers alive today have never seen until now.

Beyond all that, I mentioned earlier that the story of Sirius B is incredible; well, you ain't heard nothin' yet! Here, to use the late **Paul Harvey's** phrase, is "the rest of the story." It's a mystery worthy of **Sherlock Holmes**!

The Dogon (rhymes with shogun) are an African people, and one of the most primitive groups on Earth. (If you saw the delightful 1980 movie *The Gods Must Be Crazy*, you already know about the Dogon. The movie is a humorous fictional account of what happens after a modern-day bush pilot flying over the area tosses out a Coke bottle that is picked up by a Dogon tribesman who has no idea what it is or what it's used for. He thinks it's a tool sent by the gods.)

The Dogon are cliff dwellers who live in an arid, semi-desert region of Mali. The area is so isolated from the outside world that their existence was unknown to Europeans until 1931, when a French anthropologist, **Marcel Griaule**, found a Dogon tribe and lived among them for an extended period. He visited the tribe many times over the next 25 years, studying their life style, language, culture and

religion. His reports and the books he wrote totaled more than 3,000 pp.

One evening after the scientist finally gained the tribe's trust and friendship and learned their weird, click-filled language, he was taken to their blind spiritual leader/shaman/witch doctor, a tribal elder named **Ogommeteli**, who proceeded to share some of the tribe's deepest secrets with him. Ogommeteli instructed a Dogon to point to Sirius, and then to punch a hole in the sand with a fingertip. "Sigu tolo," he said, telling Griaule that *sigu tolo* was the brightest star in the night sky.

Next, he instructed the Dogon to punch another hole in the sand a few inches away and draw an oval around the first hole. "Po tolo," he said, indicating that *po tolo* moves around sigu tolo. He told the scientist that po tolo was "the smallest thing there is," and that it moved around sigu tolo over a period of time equal to 50 of our years.

None of that meant anything to Griaule: he was an anthropologist, not an astronomer, but he recorded the information anyway. Upon returning to France, he published a scientific paper that included the Sirius B story.

The questions raised by that report and others (and two later books by Griaule) have intrigued astronomers ever since, and the mystery remains unsolved today: *How did the witch doctor of one of the most isolated, primitive groups on Earth know that Sirius has a tiny, unseen companion? And how could he possibly have known its orbital period, or that its path around Sirius is elliptical rather than round?* He could not have learned those things from previous explorers, because the French scientist was the first Westerner to visit that tribe. Obviously, the Dogon tribe didn't have a telescope – but even if they had, they wouldn't have known what it was, how to use it or understood what it showed them. They were so far removed from civilization that, until the European's arrival, they had never seen things like a camera, flashlight, matches, pencils or paper.

Ogommateli didn't know when the story originated. He said it was part of their ancient lore that had been passed down orally from one generation to the next for hundreds of years. (It was so sacred to them that even today they celebrate each po tolo orbit of sigu tolo with a *Sigui* festival.) The shaman could not have made up the story because it contained facts that he had no way of knowing or even imagining.

Had enough? I hope not, because here's where the Dogon myth gets downright creepy.

Ogommeteli said the Dogon had learned about sigu tolo and po tolo from a strange race of beings called the Nommos who came to them from the sky in the distant past, arriving in a tumult of fire and thunder. The Nommos said they came from a world near sigu tolo, and taught them about that star and its tiny companion. The Nommos also pointed out two other bright objects in the night sky -- **Jupiter** and **Saturn** -- and told their hosts that one had moons circling it, and the other had a ring around it.

Naturally, astronomers have discounted the alien visitation theory, but the rest of the blind tribal elder's story is not so easily dismissed. **Carl Sagan** and **Ian Ridpath** (among others) said that the Dogon probably were visited by other Westerners who were knowledgeable about astronomy before Marcel Griaule's arrival in the 1930s. But no evidence exists that any such visits ever occurred.

Other critics of the Dogon myth have contended that it was Griaule who told Ogommeteli about Sirius A & B, and the wise man incorporated it into the tribe's oral history. However, that doesn't account for the Sigui festival tradition that began long before Griaule arrived in 1931. Those events were recorded in simple hieroglyphic-like symbols in Dogon artifacts – etchings on clay tablets and cave walls.

The only remaining possibility is that the anthropologist might have made up the entire story of his conversations with Ogommateli. If that was the case, Griaule was a superb fiction writer, because those conversations were both lengthy and extremely detailed: They encompassed a sizable portion of the antropologist's reports and books.

Further evidence of Griaule's honesty was evidenced when other scientists visited the tribe. The witch doctor repeated the sigi tolo/po tolo story to them, and showed them the Sigui artifacts. That's why no one has ever accused Griaule of fabricating the story of Sirius B and the Dogon.

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Together with FRAC's officers, I want to wish everyone the merriest Christmas ever, and a happy, healthy and safe New Year! - Dwight Harness