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

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Club Calendar. Fri.-Sat., May 31-June 1: JKWMA observings (at dark); **Thurs., June 13**: club meeting (7:30 p.m. at The Garden in Griffin); **Fri., June 21**: Lake Horton public observing (8:45 p.m.), rainout date **Sat., June 22** (same time); **Fri.-Sat., June 28-29**: JKWMA observings (at dark).

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President's Message. After a long and distinguished career as an educator, UGa-Griffin's **Wayne Gardner** is retiring.

Dr. Gardner, mere words cannot adequately describe our gratitude for your offering us a meeting facility and helping us to arrange our schedule of activities at The Garden. Your work on our behalf went far beyond the call of duty, and we wish you many happy, healthy and productive years in your retirement.

Finally, I want to give a warm "Welcome!" to new member **Jeff Hoffman**. We're excited to have you join our club, Jeff; please let us know how we can help you in any way.

-Sean Neckel

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Last Month's Meeting/Activities. We had eleven members and guests at our May meeting: **Sean & Gianna Neckel; Erik Erikson; Dwight Harness; Aaron Calhoun; Tom Moore; Larry Higgins;** and **Jeff Hoffman** (who joined that night) – and visitors **Steve Hyde** and **Grant & Priscilla Sawyer**.

Our solar observing at The Garden on May 19th was a resounding success. Hundreds of area residents attended the event, and many of them stopped by to see the **Sun** in all its glory through our telescopes. Ten FRACsters – **Sean & Isabella Neckel; Truman & Denise Boyle; Ken Olsen; Eugene & Nyssa Pennisi; Richard Schmude; Wayne Gardner;** and **yr. editor** – and a non-member, **Stephen Rahn,** who brought two solar scopes -- attended the event. The sky was virtually cloudless throughout, and our many visitors were duly impressed with what we showed them.

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This 'n That. One of the items discussed at the recent board meeting was a suggestion by **Jeremy Milligan** that we offer certificates of achievement to visitors at our public observings who complete checklist of objects that we show them. **Felix Luciano** explains how such a system might be done: "Once on the field, FRAC's coordinator for that event, knowing how many telescopes are available, would list easily visible objects such as planets, the **Moon**, constellations and/or bright deep sky objects such as **M42 (Orion Nebula),** and designate which object(s) each member should show.

"Visitors who want to participate would be given an observing log form to take around to the various observing stations, where club members would help the guests make very basic entries indicating that they observed the object. Guests would bring their completed forms to the FRAC event coordinator or FRAC table to have their name and the date added to the certificate they receive."

Unresolved snags exist, so it remains to be seen whether that system will be adopted. Still, it's worth consideration.

*__Aaron Calhoun__ is our new Facebook Coordinator. Aaron has begun posting and sharing astronomy-related items, and he encourages all FRAC members to visit our site and do likewise.

*While we're on the subject of social media, we are very proud of our website at www.flintriverastronomy.org.

Tom Moore is our webmaster; thanks to Tom's diligent efforts our website is attractive, well organized and easy to navigate. It contains a wealth of information regarding FRAC, what we do and how we do it. For avid readers it also contains downloads, articles and a complete collection of past newsletters and special editions. They will tell you everything you need to know in order to understand and enjoy astronomy to the fullest extent possible.

If you haven't already done so, we urge you to visit our Facebook and web sites.

***A Letter To the Editor**: "Re your article in the May issue about pronouncing the names of the stars ("Call 'Em As You See 'Em"): I couldn't care less about the names of the stars. Except for their roots in mythology, star names mean nothing. If civilizations exist on other worlds, the names they give to the stars and constellations are very different from ours." -**Aaron Calhoun**

(__Yr. editor__ responds: You're right, of course. __Larry Higgins__, who probably knows more about astronomy than the rest of us combined, says he knows about a dozen stars by their familiar names. The others aren't important. But Larry also could show you at least two dozen constellations, because he uses them to find things. He may or may not know the correct way to pronounce Eridanus *-- I certainly don't – but he knows where to find it in the night sky.*

Naming the constellations and stars simplified the task of recognizing and locating them from one season or year to the next.

We often point out certain stars to our visitors at public observings. Identifying them by their familiar names gives them a sense of importance that would not exist if, say, we referred to __Betelgeuse__ as "that bright orange-yellow star in Orion,*" or __Albireo__ as "the star at the bottom of the Northern Cross." But beyond that and their connection to the mythology of the night sky – well, as you said, star names are irrelevant. That's another reason why it doesn't matter how we pronounce them.)*

*A meteorite striking the **Moon's** surface appears in a photo on p. 72 of the June issue of *Astronomy*.

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Upcoming Meetings/Activities. We'll hold JKWMA observings on **Fri.-Sat., May 31st-June 1st**, and again at the end of the month on **Fri.-Sat., June 28th-29th**.

Between those dates, our club meeting will be on **Thurs., June 13th**, at 7:30 p.m. at The Garden in Griffin. To prepare for next month's 50th anniversary of **Neil Armstrong** and **Buzz Aldrin's** historic moon walks, we'll watch **Alex Filippenko's** *Our Moon, Earth's Nearest Neighbor*. Then, in July, we'll return to the Moon, this time via *Apollo 11* with Armstrong, Aldrin and **Michael Collins**.

We'll conduct a Fayette Co. Rec Dept. public observing at Lake Horton at 8:45 p.m. on **Fri., June 21st**. In the event of clouds or rain, we'll try again on **Sat., June 22nd**, same time and place.

To get to Lake Horton from, say, Griffin, go 10.6 mi. toward Fayetteville on Ga. 92 from the stoplight at U. S. 19/41 and turn left at Woolsey Rd. (It's just past a gas station on the right.) Go 0.7 mi., and turn left at the stop sign at Antioch Rd. Go 0.4 mi., and continue straight toward Lake Horton at the stop sign where the main road curves to the right.

The park entrance is 1.0 mi. ahead. After passing through the gates, turn right at the black asphalt road about 50-100 yds. beyond the entrance. That winding road through the woods leads to a large parking lot; that's where we'll meet. We'll set up our 'scopes on the grassy hill between the parking lot and the main road, then drive our cars back to the parking lot.

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The Planets in June. Jupiter (mag. -2.6) will shine brightly in *Ophiuchus* all month. On the evenings of June 17th and 18th, **Mercury** (mag. 0.1) and **Mars** (mag. 1.8) will lie less than a Moon-width apart, low in the W sky 30 min. after sunset.

Saturn (mag. 0.2) will rise an hour or two after sunset. Blue-gray **Neptune** (mag. 7.9) and blue-green **Uranus** (mag. 5.8) will rise after midnight. Both will be visible in binocs and small scopes.

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Basic Telescopic and Observing Terms
by Bill Warren

Regardless of whether you observe regularly or occasionally – or whether you even own a telescope – you should have a basic understanding of the equipment and terms that astronomers use in observing the universe. Even armchair astronomers should be familiar with the tools of the trade.

Telescopes

A telescope is an instrument that gathers, magnifies and focuses the light from distant objects.

Basically, there are three types of telescopes, and all of them consist of three parts: a *base*, a *mount* and an *optical tube assembly (OTA).* The base usually -- but not always-- consists of a tripod upon which the mount and OTA lie. (Dobsonian reflectors feature a flat base.) The mount connects the base and optical tube assembly; its function is to permit the OTA to be moved horizontally and vertically. The OTA consists of the tube that gathers light, and everything within it including lenses, mirrors and a focuser that brings it all together to be delivered to the eyepiece.

*__Refracting telescopes__ gather light through an objective lens at the enclosed upper end of the tube and deliver it to a diagonal mirror at the lower end. That mirror bends (refracts) the light upward to the eyepiece.

*__Reflecting telescopes__ gather light at the open upper end of the OTA and deliver it to a concave *primary mirror* at the lower end. The primary mirror reflects the light back toward the open end, where a small, flat diagonal *secondary mirror* directs the light to the focuser and eyepiece. Reflecting the light permits the OTA to be shorter per inch of aperture than a refractor.

*__Compound, or cassegrain, telescopes__ bounce the light back and forth between mirrors at both ends before delivering it to the focuser, resulting in even more compact tubes.

Mounts

There are several kinds of mounts, but basically they fall into two categories: alt-azimuth and equatorial.

*__Altazimuth mounts__ must be moved manually upward (altitude) and laterally (azimuth).

Dobsonian mounts are altazimuth mounts consisting of a free-swiveling, “lazy-susan”-type base upon which the OTA rests. Dobs are responsible for the array of inexpensive, large-aperture telescopes on the market today. Unless specifically adapted for such purposes, they cannot track objects across the sky or be used for astrophotography.

*__Equatorial mounts__. When the altitude mechanism is locked in place, an equatorial mount will track objects across the sky, whether manually or by motor drive. Astrophotography requires an equatorial tracking system.

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Telescopic Equipment

*A **finderscope** is a small telescope mounted on a larger scope as an aid to finding celestial objects. All but the smallest new telescopes come with a finderscope attached; they offer magnifications ranging from 6x to 8x or higher.

Finderscopes normally require collimation prior to observing – and it should be done in the daytime, since alignment involves using distant terrestrial objects such as treetops, utility poles or the like.

Telrads offer a zero-magnification alternative to a finderscope. Mounted on the OTA, a Telrad features three concentric red circles of 1/2^o, 2^o and 4^o in dia. that are used to point your scope toward where you want to look for an object. An upright version of the Telrad called a *Rigel Quickfinder* is easier to see through but uses just two red circles of 1^o and 2^o. An even simpler variation is the *red-dot finder*, which consists of a single red dot to point you toward your target. Red-dot finderscopes have been used on BB guns for many years.

In buying any zero-magnification finder, be sure that it includes a dimmer switch that reduces the brightness of the red circles or dot, or else you won't be able to see the stars around the point you're aiming at.

*__Filters__ attach to eyepieces; they can be used to soften the harsh glare of the **Sun** or the **Moon**; to reduce the effects of light pollution; or to bring out details in planets, nebulae and other celestial objects by blocking certain light frequencies and allowing others to pass through.

*__Rich-Field Telescopes__. These are telescopes – normally, small ones – that offer a larger field of view than conventional telescopes.

You might think that the way to see more stars is to buy a larger telescope. But while a large-aperture scope will show you more faint stars, its field of view will be smaller and you'll see fewer bright stars. If, say, you want to see all of the stars in a large open cluster such as the **Pleiades (M45)** or the **Beehive Cluster (M44)** in a single fov, you need a rich-field telescope. That's what it's for.

*__GoTo__ and **PushTo** are computerized devices that simplify the task of finding objects in the night sky. With GoTo, you punch in the name of an object (e.g., **M31**) on a hand-held keypad, and the telescope will turn itself to aim at that object. With PushTo, you move the scope manually and the hand-held device will show you when you've located it.

Those devices – especially GoTo – have become extremely popular in recent years. Many scopes – even small ones that cost $300 or less – come equipped with GoTo capability.

*__Red-beam flashlights__ feature a red filter that converts ordinary white light to red light, thus preserving the user's adapted night vision.

*__Laser pointers__ direct a thin but powerful green laser beam into the sky. We use them primarily to pinpoint the location of stars, etc., but they can also be used as a zero-magnification finder by attaching the laser pointer to the telescope's tube. However, that usage is extremely risky because an aircraft might wander into its path and damage the pilot's eyes.

*__Star charts/phone apps__. A star chart (a.k.a. *star atlas*) is a roadmap of the night sky in print form. Star charts range in complexity from simple (i.e., a few maps showing the constellations and naked-eye stars) to extremely complex collections of hundreds of small charts showing the locations of thousands of fainter stars and deep-sky objects. Until the advent of GoTo technology and phone apps, star charts were the only way to find deep-sky objects. Every monthly issue of *Sky & Telescope* and *Astronomy* contains a current all-sky star chart in fold-out form.

A *planisphere* is a special kind of star chart consisting of two disks that rotate on a common axis. The lower disk is stationary and contains a chart of all of the constellations and bright stars visible in northern latitudes. The upper disk contains an oval cutout that reveals only a portion of the sky. By rotating the upper disk to the appropriate date and time, you'll see only the stars and constellations visible at that time.

Phone apps are downloadable programs that show the portion of the sky that you're aiming at. They don't help you find objects in your telescope the way that GoTo and PushTo do, but they show you where objects are located.

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Observing Terms

*__Aperture__ refers, not to the width of the optical tube, but to the dia. of the primary mirror (reflectors) or objective lens (refractors). Generally, the larger the aperture, the fainter the objects that can be seen and the greater the resolution. (While resolution normally refers to the telescope's ability to split close double stars into separate components, it can also refer to the ability to show greater detail (e.g., revealing individual stars in globular clusters).

*__Deep-sky objects__ lie beyond our solar system – star clusters, nebulae and galaxies.

***Field of View (fov).** The portion of the sky seen through an eyepiece. The greater an eyepiece's magnifying power, the smaller its field of view will be, and the less time it will take for an object to drift out of view.

To determine the size of the fov of a given eyepiece, select a star near the celestial equator – say, **Altair** in *Aquila, the Eagle* – and place it at the E edge of your fov. Then time how long in seconds it takes for the star to drift across the center of the field to the W edge. That time, divided by 4, gives the diameter of the fov in arc-minutes. (60' [arc-minutes] = 1°; 30' = 1/2°; 15' = 1/4°, etc.) If your fov is 1/2°, the Full Moon will fit nicely in it.

***Collimation.** The alignment of the optical elements of a telescope or finderscope at the correct angles to the light path. A poorly collimated instrument will distort images (esp. away from the center of the field of view) into elongated stars, hazy planetary images and unresolved double stars.

With a reflecting telescope, both the primary mirror and the flat secondary mirror may require periodic collimation; the former is easy, the latter is more complicated but seldom necessary.

Refractors, on the other hand, are enclosed. They are collimated at the factory prior to sale and do not require further collimation.

***Eye relief**. The distance your eye must be from the eyepiece to see the entire field of view. The greater an eyepiece's magnifying power, the smaller its viewing aperture will be – and the closer your eye must be for you to see the whole fov. That's why people who wear glasses often have trouble observing with their glasses on. The effective (but expensive) solution is to buy eyepieces that offer adjustable eye relief.

***Magnification**. To determine the magnifying power of an eyepiece, divide the eyepiece's focal length (f. l.) into the focal length of the telescope you're using. (Both figures are expressed in millimeters; eyepiece focal lengths are usually listed on the eyepiece, and you can Google your telescope model to find its f. l. if you don't already know it.) If your telescope has a f. l. of 1200mm and your eyepiece is 10mm, the magnification for that eyepiece is 120x.

There are limits beyond which high magnifications tend to cause images to lose contrast with the sky around them, spreading and dimming the light that affords clear images at lower magnifications. Those limits are roughly 50x for a 2.5-in. scope, 100x for a 4.5-in. scope, 150x for a 6-in. or 8-in. scope, and 175x-200x for a 10-in. scope. To get clear images beyond those broad limits, you need exceptionally good seeing conditions and a Pentax, Nagler or Televue eyepiece.

Magnitudes (of brightness). A number indicating the relative brightness of a star or other celestial object. The brighter the object, the higher its negative number or lower its positive number will be. For example, **Sirius**, at mag. -1.46, is brighter than **Arcturus** (mag. 0), which in turn is brighter than **Pollux** (mag. 1.1).

A difference of one full magnitude of brightness between two objects means that one is 2.5 times brighter than the other; a 2-mag. difference indicates that one is 6.25 times (i.e., 2.5 x 2.5) brighter than the other; and 3 mags. of difference = 15 times brighter (2.5 x 2.5 x 2.5). The Full Moon is mag. -12.6, and the Sun is -26.7.

With deep-sky objects, the *stated magnitude* refers to the brightness an object would have if all of its light were concentrated into an area the size of a single star. For example, the face-on galaxy **M33 (the Pinwheel Galaxy**) is listed as mag. 6, but due to its large size – it's about twice the size of the Full Moon – M33 can be difficult to see under less than ideal observing conditions. Large, faint objects with high stated magnitudes are said to have *low surface brightness*.

The term <u>limiting magnitude</u> refers to the faintest star you can see naked-eye. (See below.)

***Transparency**. The clarity of the sky as evidenced by the faintest star that can be seen naked-eye. *Seasonal Star Charts* will help you here because it lists the magnitudes of all of the naked-eye stars down to mag. 5.5. Other star charts depict relative brightnesses in terms of how large the stars appear on the charts.)

***Seeing**. The relative stillness or turbulence of the atmosphere through which light is passing. Poor seeing conditions negatively affect the resolving power of any telescope, limiting the amount of magnification that can be applied successfully under those conditions. Seeing is measured by the *Antoniadi scale*.

If you find a bright star and move it slightly out of focus, the star will become a black ball with spikes radiating outward from it. The Antoniadi scale indicates how much air movement is occurring at any given time. On that scale, 1=no movement of the spikes; 2=occasional, slight quivering of the spikes; 3=occasional major quivering; 4=constant quivering; and 5= severe quivering in which images fairly dance across the field of view.

(Note: Many of the A. L.'s observing programs require an estimate of the transparency

and seeing on that evening. Any experienced observer in FRAC can show you how it's done. -Ed.)

***Direct vision**. Looking straight at an object.

***Averted vision**. In the dark, the outer edges of the retina are more sensitive to light than the center. When observing objects such as faint galaxies, nebulae or unresolved clusters, looking slightly to one side of the object allows that object's light to fall on the more sensitive outer part of the retina, revealing detail that might otherwise escape notice when looking directly at the object.

That's why the **"Blinking Planetary"** (**NGC 6826** in *Cygnus*) appears to blink on and off like a turn signal when viewed at low power: When you look straight at it, the faint central star cannot be seen and the planetary's outer gaseous halo is revealed. But when you look away slightly – say, half an inch in any direction – the outer portion of the retina collects the light, the central star "blinks" on and the halo disappears. (This effect normally does not occur at high magnification.)

***Star Hopping**. Locating celestial objects manually by moving to them in a series of small telescopic steps, or "hops," from known stars or other objects – say, by using portions of a Telrad fov to move ever closer to your target.

***Triangulation**. Locating celestial objects by using two known stars or other objects to form a triangle with the suspected location of the target, and starting the *scanning* process at that point.

***Scanning**. Locating celestial objects manually by slowly and systematically moving the tube – usually at low power – up, down, back and forth through the target's suspected location. Everyone develops his/her own scanning technique, and there is no one correct way to do it as long as you cover the entire area. (Best advice: *Scan slowly*.)

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Above: Abell 1060, a galaxy cluster in *Hydra*. (Photo by **Alan Pryor**.) **Abell 1060** is located 157 million l.y. from Earth – well outside our own galaxy cluster. The cluster spans 10 million l. y., and contains more than 150 elliptical and spiral galaxies. (Alan's photo shows a small portion of the cluster; it was taken over three evenings.) Alan notes that "The galaxies' orange color is due partly to their distance and receding velocity. The two bright red giant stars in the photo are foreground stars in the **Milky Way**."

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Above: Solar eclipse photo by ex-FRAC member **Brendon O'Keeffe** exhibited in the science building at Columbus State University. (The photo of the photo was taken by Brendon.)

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