THE

FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

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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. Sat., Dec. 5th: FRAC Christmas party (6 p.m. at Ryan's Buffet Restaurant in Griffin).

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Vice President's Message. On behalf of **Dwight Harness** and FRAC's other officers, I want to wish everyone a very merry Christmas filled with joy and all the presents Santa can cram into your stocking, and a happy, healthy, safe and sober (pick any three) New Year's. We hope you'll be able to attend our Christmas party at Ryan's on Saturday, December 5th.

I'm pleased to welcome our newest members, **Kenneth and Rose Olson** of Fayetteville, GA, to our happy little club. Kenneth owns several high-quality telescopes, and he brings years of experience in astronomy to FRAC.

-Bill Warren

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Last Month's Meeting/Activities. Ten FRACsters and a guest went trick-or-treating at the Rock Ranch on Halloween night: **Jane & Roger Brackett; Anna & Felix Luciano; Steve Bentley** & his guest, **Patty Macmillan**; **the Milligans (Sarah, Jeremy, Emily & Delilah)**; and **yrs. truly**. We couldn't *treat* the children in attendance with views of the night sky in our telescopes because the skies played a *trick* on us: it was so cloudy that all we saw was skydivers gliding around below the clouds.

Our JRE observing and rainout date were fogged out, so **Dwight Harness** and **Louise & Bill Warren** went indoors for a solar system powerpoint presentation for about forty 2nd graders, their parents and teachers.

Sixteen members – **William Murray, Len & Mel Silver; Phil Sacco; Vicky Walters; Erik Erikson; Tom Moore; Felix Luciano; Steven "Smitty" Smith; Dawn Chappell; Alan Pryor; Jeremy, Sarah, Emily & Delilah Milligan**; and **yr. editor** – two new members (**Kenneth & Rose Olson**); and four visitors (**Matthew & Vincent Sensing; Courtney Seabolt**; and **Larry Herron**) attended our November meeting & observing. Alan and Dawn received their Basic Outreach certificates and pins (it was Alan's first A. L. pin, and Dawn's 6th). Phil received his Stellar Outreach certificate, Master Outreach pin and Constellation Hunter pin, bringing to 14 his total of A. L. observing pins.

Dwight Harness – FRAC's President, Grand Poobah, Imperial Potentate and Chief Bottle Washer – was out of town and unable to attend the meeting. So instead of our regularly scheduled program, all of us took turns telling what we don't like about him. The meeting was much longer than it normally is.

(That's not true, of course – except the part about Dwight not being there.)

Actually, Dwight, we sat around saying *nice* things about you. Bill started it off by saying, "Well…Uh…Umm…He's *short*." The discussion died after that, though, because no one could think of anything else to add. So for the next 30 min. we sat around wondering why our president had abandoned us.

Of course, that's not true, either. We had a very good meeting. We showed a Hubble dvd segment about **Crab Nebula** (thanks to Carlos, who brought his laptop when our regular laptop's keyboard went bonkers the day before the meeting).

We had 19 members and guests at our November JKWMA observings: **Aaron Calhoun** & **yr. editor** (both nights); **William Murray and Mel & Lenawee Silver,** and visitors **Matthew & Vincent Sensing** and six members of **Nikki Weaver's** family from Newnan (Fri. night); and **Erik Erikson, Brendon O'Keeffe, Truman Boyle & Jeremy Milligan** (Sat. night).

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This 'n That. The new ranger at JKWMA, **Corporal Keith Waddell**, came by after dark on Sat., Nov. 14th. He said that there had been a lot of poaching recently, and he asked us to contact him at his cell phone no. – **706-616-5238** – if we saw any vehicle headlights or heard gunshots during the night or at any time after dark in the future. We didn't see or hear anything that night, but if you're a frequent JKWMA attendee you might want to add Cpl. Waddell to your iPhone Contacts list for future reference.

*If you use a green laser pointer at night while observing, be *very* sure that you don't accidentally aim it at an airplane or a helicopter. There have been numerous incidents around the nation lately of pilots reporting being temporarily blinded by laser pointer beams. One of the quickest ways we know of earning a surprise visit from federal marshals is to aim your laser pointer at an aircraft.

Personally, **yr. editor** doesn't believe that backyard astronomers are the guilty parties. More likely it's due to children playing with a parent's laser pointer, teenagers playing a prank, or possibly even terrorist activity or the same kind of evil-minded individuals who want to invade your home computer and infect it with a virus. Once the feds decide to step in and regulate laser pointer use, however, the net effect will be the same regardless of whom the culprits are: we astronomers will be deprived of a very useful teaching and observing tool.

*****The A. L. has come a long way, baby, since the days when the Messier program was the only observing pin program. Now there are 52 of them: 15 programs for beginners, 16 for intermediate-level observers and 21 for advanced observers. FRAC members present and past have earned a total of 136 pins, including 38 basic outreach and 7 master outreach pins.

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Upcoming Meetings/Activities. Since December is a busy month, our only scheduled activity will be our annual Christmas dinner party at Ryan's Buffet Restaurant in Griffin at **6:00 p.m.** on **Sat., Dec. 5th.** We'll have a lot of door prizes to give out (thanks to **Truman Boyle**), and we hope you'll be able to attend.

(NOTE: We will NOT have our regularly scheduled meeting on the 2nd Thursday of the month [i.e., Dec. 10th]: our Christmas party on Dec. 5th will take the place of that meeting. The Garden will be locked on Dec. 10th.)

Directions to Ryan's: Coming south from, say, Hampton on U. S. Hwy. 19/41, stay on the 4-lane past the Hardee's/McDonald's stoplight in Griffin. Go two stoplights farther and turn right. After you turn, Ryan's parking lot is on the immediate left, just beyond the movie sign.

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The Sky in December. One of the best annual meteor showers, the **Geminids**, should be excellent this year, weather permitting. On **Dec. 14th** and **15th**, clear skies may show between 60-100 meteors an hour after 11 p.m. on both nights. And best of all, a waxing crescent **Moon** won't hinder observing on either night. So dress warmly, choose a spot where light pollution is blocked out by buildings or trees on the 14th or 15th, and let the show(er) begin!

For those who enjoy telescopic observing, here's a seasonal treat: *a trio of telescopic Christmas trees in the December sky*!

First, of course, there's **NGC 2264, the Christmas Tree Cluster** in *Monoceros, the Unicorn*. NGC 2264 is a large – about 1/2^{o} – bright open cluster with 20 bright stars forming the

Christmas tree's limbs and three times as many fainter stars forming the ornaments. It's easy to find: the brightest star in the cluster, 5^{th}-mag. **S Mon**, can be seen naked-eye from a dark site on a clear night. Any star chart of the winter sky will show you where to look.

Unfortunately, the Christmas tree is upside-down in our view. S Mon is the base of the tree, not the top. But it *does* look like its namesake, and once you get used to its orientation you'll be delighted at what you're seeing.

The second Christmas tree asterism is the little open cluster **M103** in *Cassiopeia*. Located 1^{o} SW of bright – 2^{nd}-mag. – **Delta Cas**, at high magnification the tree is slightly taller than a thumb-width, with its brightest star at the top of the tree and about 40 stars arrayed below it like rows of Christmas lights.

The third Christmas tree look-alike is **NGC 2362, the Tau Canis Major Cluster**. It's about the size of M103, but the triangle is equilateral rather than elongated like the other two. It consists of several dozen stars (at high power) surrounding the 4^{th}-mag. star **Tau CMa**.

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Above: M42/M43 in *Orion* (photo by **Alan Pryor).** M43 is the backward comma below M42 in Alan's photo. The **Trapezium** is the"star" just to the left of the dusty finger reaching into the nebulosity at the center of the photo.

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Calhoun's Corner: Orion Nebula

(Editor's Note: This is a new monthly column by ***Aaron Calhoun****. If you like it, let him know at* *aaroncalhoun7@gmail.com* *or 678-914-8897.)*

Orion, the Hunter, is the most familiar constellation in the winter sky. Three of its bright central stars form "Orion's Belt," and below them you'll find three fainter stars angling downward – "Orion's Sword." The middle star in the Sword is fuzzy, because it's not a star: it's **Orion Nebula**, the most famous nebula in the entire night sky.

Orion Nebula was thought to be a star by early astronomers. Its non-stellar nature was discovered in the early 1600s, but it didn't gain worldwide attention until 1769 when **Charles Messier** named it **M42** in his famous list of things that looked like comets but weren't.

The word nebula comes from a Greek word meaning "little cloud," and in binoculars M42 is indeed a little cloud of gases and dust – a beautiful emission nebula 30-40 light-years in dia. that glows from the energy of the young stars within it. From a distance of 1,350 light-years away, it covers one square degree in our telescopes, an area equal to four **Full Moons**. If the **Sun** were the size of a grain of sand, Orion Nebula would be 25 mi. wide!

In a telescope, M42 looks like an eagle in flight, with a slightly greenish tint due to the presence of ionized oxygen in the cloud.

Orion Nebula is a star factory in the process of creating hundreds of new stars. Four of them, lying close together like eggs in the eagle's nest, form the **Trapezium**, a little quartet of very young, white-hot stars ranging in age from 100,000 to 600,000 years old.

Just outside the eagle's backswept wings lies **M43**, a round (telescopic) or comma-shaped (photographic) nebula. (You could say that it's a bird the eagle is chasing.) M43 is actually part of the M42 cloud, but separated from it in our view by a dark dust lane.

(Next month: The Five Kinds of Nebulas.)

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Star Groups Large and Small

article by Bill Warren

Although the universe is infinitely large and still growing, stars do not exist in solitude. Every star in the universe is part of a larger group of stars, gravitationally bound to them and traveling through space with them like passengers on a crowded commuter train. There are young stars, and old stars, but no solitary stars.

Why not? Because stars do not magically appear out of nothing in empty space. They are born in dark, dense molecular clouds of interstellar gases and dust produced by supernova explosions and possibly other sources such as planetary nebulas. Without those gases and dust, there would be no material from which new stars would form.

How many new stars will develop depends on the size and density of the cloud, of course. But where there is enough material to produce one star, there is enough to spawn many others. The violent death of one ancient red giant star creates a stellar nursery in which a new generation of stars will arise. And since there are (and have been) countless billions of red giants and other dying stars in the universe, it follows that there are many star-forming regions in every galaxy, with new ones created whenever a star explodes or releases its gases into space.

Looking Outward. The **Milky Way** galaxy is 150,000 light-years in dia. and contains at least 100 billion stars. It is part of a larger *galaxy group* called the **Local Group**, which contains 85 galaxies including **Andromeda Galaxy, M33** (**Pinwheel Galaxy**) and many other smaller galaxies. Galaxy groups that are much larger than ours are known as *galaxy clusters;* typically, they contain hundreds or even thousands of galaxies, all of them bound together by gravity.

Galaxy groups and clusters are part of an even larger gravitational grouping known as *superclusters*. The Local Group is a very small part of the immense **Virgo Supercluster**, which spans about 100 million light-years and contains 1,700 galaxy groups and clusters. If the Virgo Supercluster were an elephant, our solar system would be a speck of dust on the elephant's back.

There are 130 superclusters within 1.3 billion light-years of us – which hints at how large the universe really is, and how small we are within it. Our Earth is, in **Carl Sagan's** words, a "pale blue dot" in a very large cosmos.

Looking Inward. Galaxies are the basic star grouping in the universe, but there are two other, smaller kinds of star groups within galaxies: *globular clusters* and *open clusters*. All three of them are endlessly fascinating, which explains why amateur astronomers spend so much time observing and photographing them.

Open clusters are fun to observe: no two are alike, and most of them can be resolved into individual stars even in small telescopes. My favorite open cluster is **M37** in *Auriga*: at high magnification, hundreds of stars crowd the field of view, glittering like diamonds on black velvet.

Globular clusters – at least, the largest and brightest ones in our view (**M13** in *Hercules,* **M22** in *Sagittarius* and the biggest globular of all, **Omega Centauri**) – are stunning in large telescopes because you can see thousands of individual stars in a single high-power eyepiece.

Galaxies, although impressive because they contain so many stars, tend to be somewhat disappointing visually because you won't see a single one of those stars, no matter how large your telescope is. They are too far away for that. (You could, however, see individual stars in nearby dwarf galaxies such as the **Large** and **Small Magellanic Clouds** if you were observing somewhere in the southern hemisphere.)

Telescopically, most galaxies appear as gray smudges, although some of them display bright round or oval cores. Andromeda Galaxy and **Whirlpool Galaxy (M51)** in *Canes Venatici* are the best.

Open Clusters. Unlike globular clusters and galaxies, open clusters can be any shape; in some cases their brightest stars form recognizable patterns called *asterisms*. Three examples: **NGC 457 (Owl Cluster)** in *Cassiopeia*, **Collinder 399 (the Coathanger)** in *Vulpecula*, and **NGC 2169 (the "37" cluster)** in *Orion*. Their shapes form the objects referred to in their nicknames.

With a few exceptions such as **M11, the Wild Duck Cluster** in *Vulpecula*, open clusters contain anywhere from a handful to several hundred stars – far less than the number of stars in any globular cluster or galaxy. (For many years M11 was thought to be a small, fully resolved globular cluster like **M4** in *Scorpius*, rather than a large open cluster. Look at M11 at high power and you'll see why the confusion existed.)

Open clusters contain relatively young stars. **NGC 6791** in *Lyra* is one of the oldest open clusters, yet it is no older than the youngest globular clusters.

Finally, open clusters are smaller than globular clusters (although in many cases they appear larger telescopically due to being closer to us). Whereas most globulars are 100+ light-years in dia., only the largest open clusters (e.g., **NGCs 869 & 884, the Double Cluster** in *Perseus*) are as large as 60-70 light-years in diameter.

The A. L. offers an Open Cluster observing pin program. Messier open clusters in that program include: M7, M11, M26, M38, M44, M47-48, M67 and M103.

Globular Clusters might be regarded as "open clusters on steroids." They are "globular" in the sense of being round or slightly oval. Most globular clusters contain hundreds of thousands of stars packed tightly together like sardines in a can.

There are slightly more than 150 globular clusters in the Milky Way, located above and below the plane of its spiral arms. (If they were within the plane, they would be torn apart by the gravitational tug of other stars in the plane.) Many of the oldest stars in the Milky Way are found in globular clusters.

While open clusters tend to be relatively nearby in space, the closest globulars – M4 and **NGC 6397** in *Ara* – are more than 6,500 light-years away. **NGC 2419 (the Intergalactic Wanderer)** in *Lynx* lies a whopping 300,000 light-years away. As a result of such distances, globular clusters tend to be unimpressive in small telescopes. In a 3-in. refractor, for example, M13 reveals no more individual stars than you'd see in a mediocre open cluster.

Globulars are arranged in classes according to how concentrated they are toward their centers. Those classes range from Class I (the most densely packed) through Class XII, the least dense.

All of the globulars in Classes I to III have large, extremely dense cores and few if any resolved stars at their edges. They look like fuzzy tennis balls. (Two examples: Class I **M75** in *Sagittarius* and Class II **M80** in *Scorpius*.)

At the other end of the scale, globulars in Classes IX to XII look more like open clusters than globulars, except in their round shapes and the number of stars they contain. Examples include M4 (Class IX), **M55** in *Sagittarius* and **M71** in *Sagitta* (both Class XI).

In between, Class IV through VIII globulars show bright cores, whether large or small, surrounded by thousands of stars at high power in a large telescope. These are the ones that, having observed them once, you'll go back to them time and again. Examples: M13 and **M5** in *Serpens* (both of them Class V), **M3** (Class VI) in *Canes Venatici* and M22 (Class VII).

The A. L. offers a Globular Cluster observing pin program. Messier globulars in that program include: M2-5, M9-10, M12-15, M19, M22, M28, M30, M53-56, M62, M68-72, M75, M79-80, M92 and M107.

Galaxies are gravity-bound groups of millions or billions of stars. Like globular clusters, galaxies are *old*. There are no "young" galaxies because it takes billions of years for galaxies to form. Among galaxies, however, dwarf galaxies are the youngest: they resemble globulars in concentration and size.

A 10-in. telescope will reveal several thousand galaxies. But because they are so far away, most of them are small, faint smudges in our telescopes, offering little detail. Bright galaxies display features such as: a bright nucleus (M31); a dust lane (**M104, Sombrero Galaxy** in *Virgo* and **M64, Black Eye Galaxy** in *Coma Berenices*); a mottled or grainy appearance (**M63, Sunflower Galaxy** in *Canes Venatici);* a central bar (**M83, the Southern Pinwheel Galaxy** in *Hydra*); and spiral arms (M51). Seasoned observers refer to galaxies as "faint fuzzies."

Edwin Hubble, an American, was the first astronomer to classify the galaxies. He divided them into four classes: *elliptical, spiral, barred spiral* and *irregular galaxies*.

Elliptical galaxies (e.g., **M49** and **M87,** both of them in *Virgo*, and **M105** in *Leo*) are round or oval in shape, with their brightness fading evenly from the central core, or nucleus, to the outer edges. They look very much like bright, unresolved globular clusters. **M32**, a companion galaxy of Andromeda Galaxy, is classified as a dwarf elliptical.

(Hubble later added another, related group, *lenticular galaxies*, but without much enthusiasm for it. Lenticulars are elliptical galaxies that display a well-defined disk shape. Perhaps the best known lenticular galaxy is **NGC 404,** located adjacent to the bright mag. 2 star **Beta Andromeda.)**

Spiral galaxies are what most of us think of when we hear the term galaxy: a flattened disk of billions of stars revolving around a central bulge or hub like a phonograph record on a turntable. Hubble subdivided the spirals into two groups:

regular *spirals*, and those with a thick central bar dissecting the galaxy from one side to the other (*barred spirals).* He further subdivided those groups in three ways, only one of which concerns us: the degree of openness of the spiral arms. But even that is of minor importance to us, since the only spiral arms we see are in face-on galaxies, most of which are generally difficult to observe except in ‘scopes that are 16 in. or larger.

Probably the best galaxy in which to see spiral arms is M51, Whirlpool Galaxy: on a clear spring night at JKWMA, you might see not just the core and spiral arms, but also (via averted vision) a faint bridge of unresolved stars connecting it to its smaller companion galaxy, **NGC 5195**.

Spiral galaxies presented astronomers with a perplexing problem. In the 1970s, American **Vera Rubin** and others found that all stars in spiral galaxies revolve at the same speed around their centers, regardless of how far away they are from the central hub. Stars along the outer edges of the spiral arms were traveling just as fast as stars near the center. But that wasn’t possible under the known laws of gravity and physics: velocity should decrease with stars’ distance from the galactic center, since gravity is weaker along the outer edges of spiral galaxies and the stars have farther to travel.

There was only one possible explanation for this phenomenon: some kind of unseen matter in and around galaxies must be exerting a gravitational influence on their stars without affecting them in any other way. Astronomers named this unseen substance *dark matter*.

Hubble’s final galaxy group was *irregular galaxies*, i.e., galaxies that, for any of a variety of reasons, do not fit into the other categories. The best-known example is **M82 (Cigar Galaxy)** in *Ursa Major*; two others are the Large and Small Magellanic Clouds.

In the 1960s the American astronomer **Halton C. Arp** categorized 338 irregular galaxies – he called them “peculiar galaxies” – grouping them according to the ways in which they were behaving strangely. M82 was unusual in so many ways that it defied Arp’s efforts to place it in any other group, so he listed it in a final category shared with only one other galaxy: *miscellaneous galaxies*.

The A. L,’s Arp Peculiar Galaxies observing pin program contains 11 Messier irregular galaxies: M32, M49, M51, M60, M65, M66, M77, M82, M87, M90 and M101.

In all, fourteen A. L. observing programs include star groups mentioned in this article. They are: Arp Peculiar Galaxies; Binocular Messier; Caldwell; Deep Sky Binocular; Galaxy Groups and Clusters; Globular Cluster; Herschel 400; Herschel II; Messier; Open Cluster; Southern Skies Binocular; Southern Skies Telescopic; Universe Sampler; and Urban. All of them except the two Southern Skies programs are within reach of our telescopes.

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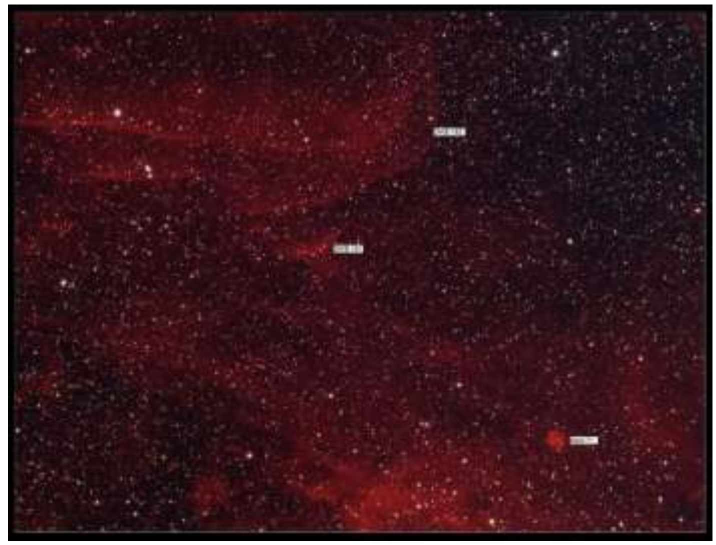

Above: DWBs 191 & 192, two molecuar clouds within the massive **Cygnus X** star-forming region. (Photo by **Felix Luciano.**)

DWB 191 is the triangular red cloud near the center and to the left of the white i.d. tag Felix added; **DWB 192** is the larger cloud above it and to the left of the tag.

The round red circle near the lower right corner is **Abell 71**, a planetary nebula. *This* is what will happen to our Sun about 4.5 billion years from now: it will cast off its outer shell of gases and become a white dwarf that will flare briefly into brilliance and fade rapidly. (Abell 71 is about 20,000 years old; its central star has flared and faded to about 18th magnitude.)

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