THE

FLINT RIVER OBSERVER

NEWSLETTER OF THE FLINT RIVER ASTRONOMY CLUB

An Affiliate of the Astronomical League

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Club Calendar. Tues., Sept. 2: Southern Crescent Technical College observing (8:30 p.m.); **Sat., Sept. 13:** Pool party/picnic dinner (**Bill Warren's** house, 5 p.m. for swimming/pool play, 6:30 for eating; **Fri.-Sat., Sept. 26-27:** Joe Kurz observings (at dark).

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President's Message. I spent this summer coaching my teenage daughter **Laura's** tennis team. We played matches in a summer league, and the kids played well enough to qualify for the state amateur tennis championships in Macon. Laura and her teammates learned a lot from the experience, if not from me. (Me coaching tennis is like **Gomer Pyle** running NASA.)

Between tennis, a brief vacation and my work, I've been busier this summer than ants in a sugar factory. I want to thank **Bill Warren** for minding the store when I wasn't available.

-Dwight Harness

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Last Month's Meeting/Activities. We had nine members at our July observings: **Aaron Calhoun & yrs. truly** (both nights); and **Alan Pryor, Carlos Flores, Brendan & David O'Keeffe** and **Felix Luciano** (Sat. night.) Fri. evening was clear but *very* hot and humid; Sat. was clear and cool, with only a hint of humidity and no mosquitos – the kind of conditions we dream of having (but seldom get) during the summer months. Alan later said that it's been at least a year since he's seen such beautiful skies. He, Felix and Carlos stayed until 3:45 a.m., and thus qualified to receive **Zombie Awards.**

It's rare for two members to be cured of night blindness on one observing evening. But that's what happened Sat. night.

First, there was Aaron saying, "Bill, something's happened! I can't see anything! Everything has gone black in my telescope!" Then, after a pause: "Oh. It's okay. I had it pointed at a tree."

Meanwhile, yr. editor was having problems of his own. He was wondering why, on an evening of such excellent seeing conditions and transparency, he was still having trouble locating simple targets like **Ring Nebula (M57)** and the **Wild Duck Cluster (M11).** They had always been easy to find until a couple of months ago when things started getting dark in his eyepiece. He attributed it to old age and deteriorating night vision. But then, in changing eyepieces at JKWMA, he realized that his **Moon** filter was still attached to his low-power eyepiece since our lunar observing in May.

We had 19 members and guests at our Aug. Perseids pizza meeting/observing party: **Dwight**

Harness, Tom Moore, Felix Luciano, Larry Higgins, Steve Bentley, Dawn Knight, Aaron Calhoun, Andy Hasluem, Erik & Mason Erikson, Joe Auriemma, David & Sarah O'keeffe, Steven "Smitty" Smith, Carlos & Olga Flores, yr. editor and visitors **Teresa Watson** and **Gail Hayes.**

Yr. editor wondered why he was the only one seeing Perseids meteors, until Dwight pointed out that they weren't meteors, but fireflies. The evening's highlights came when David found a weather balloon before sunset and followed it in his telescope for half an hour or more, and when Steve's reclining lawn chair collapsed with him in it.

Our Aug. JKWMA observing weekend brought out 16 members and guests: **Dwight Harness, Aaron Calhoun & yr. editor** (both nights); **Andy Hasluem, Erik Erikson** and Dwight's guest, **Chuck Trimble** (Fri. night); and **Alan Pryor, Felix Luciano, Truman Boyle** and four guests – **Edgar & Edelisa Rodriguez** and **Juan & Amarilis Bustamonte** -- (Sat. night). Among other observing delights, we saw an Iridium flare Fri.; the International Space Station and new **Comet C/2014 E2 (Jacques)** (both nights); and on Sat. night, a *very* bright (mag. -12?) orange-and-green fireball that lit up the night sky like a July 4th fireworks finale over at least 40^{o} of sky before breaking up.

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This 'n That. The Perils of Being Andy. A health update from beleaguered **Andy Hasluem:** "After my bout with Rocky Mountain Spotted Fever and problems associated with defibrillation, follow-up tests found that I had some arterial blockages. One of them was total. Only by the grace of God did I avoid a heart attack -- or worse. I've had three stent implants in the last month, all successful. One more procedure to go. Recovery is expected to be 100%.

"Prior to the tick bite, I was a on a collision course with a heart attack, it was just a matter of when it would happen. Getting bitten by that tick saved my life. A tick bite kept my ticker ticking."

*****If **Timothy Ferris** ever writes a sequel to his best-selling book on observing, he could follow the example of the tv movie *Sharknado* and title his second book *Seeing in the Dark 2: The Second One.* Or, he could just change the "S" in *Seeing in the Dark* to a "P".

***Questions.** *(In the June, 2014 issue of the* Observer *(pp. 3-4), we posed some questions about various astronomical topics we thought might be interesting or informative. Here are some more.)*

1. **What did Carl Sagan mean when he said, "We're made of star stuff"?**

Answer: Almost 99% of the human body is composed of atoms of oxygen, carbon, hydrogen, nitrogen, calcium and phosphorus, all of which are necessary for life as we know it. Sodium, magnesium, potassium, sulfur and chlorine add another 0.85%, and 27 other trace elements make up the rest.

All of those elements except hydrogen are created by nuclear fusion at the cores of aging stars and released into interstellar space via supernova explosions.

More than 4.5 billion years ago, some of the gas and dust in a molecular cloud congealed to become our **Sun** and its planets. Everything on Earth – including humans and animals – is the result of that process. An old star dies, releasing its contents into space to become a new star with planets circling it – and in our case, life forms composed of elements such as carbon that the old star manufactured.

As **Chris Impey,** an astronomy professor at the Univ. of Arizona, put it, "All organic matter containing carbon was produced originally in stars. The universe was originally hydrogen and helium. The carbon was made later, over billions of years…We know that stars make heavy elements, and late in their lives they eject gas into the medium between stars to become part of subsequent stars and planets and people. So we are literally 'star stuff.'"

2. **Where is Earth located in the universe?**

Answer: Earth is, in Sagan's words, a "pale blue dot" lying 93 million miles from the star we call the **Sun.** The Sun is the centerpiece and hub of a revolving eight-planet solar system that extends outward 1.87 light-years (l.y.) – nearly halfway to the next-nearest star.

Our solar system is located 27,200 l.y. from the center of the **Milky Way** galaxy, along a spiral arm called the **Orion Spur**. The Milky Way is about 120,000 l.y. in dia., so Earth is 9% closer to our galaxy's core than it is to the Milky Way's outermost edges.

The Milky Way is part of the **Local Galaxy Group,** which also includes **Andromeda Galaxy (M31)** and **Pinwheel Galaxy (M33).** The Local Group consists of 54 galaxies – most of them dwarf

galaxies – in an area measuring 10 million l.y. in diameter. Earth is located near the center of the Local Group.

The Local Galaxy Group is in turn a tiny outpost located along the outskirts of the massive **Virgo Supercluster,** which contains at least 100 galaxy groups and clusters and measures 150 million l.y. in dia. Earth lies about 60-70 million l.y. from the center of the Virgo Supercluster.

Taken in its entirety, the Virgo Supercluster is thought to be a flattened disk, which suggests that it is cartwheeling through space like a spiral galaxy.

The Virgo Supercluster is but one of millions of superclusters in the universe. Precisely where Earth lies in that profusion of 100 billion galaxies is anybody's guess.

3. **What does every object mentioned above – plants and animals, stars, planets, solar systems, galaxies, galaxy groups, galaxy clusters and superclusters – have in common?**

Answer: They are all gravitationally bound to something larger than themselves. Even superclusters are held in place by the gravitational influence of other superclusters.

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Upcoming Meeting/Activities. We'll start the month with a public observing at Southern Crescent Technical College in Griffin at 8:30 p.m. on **Tues., Sept. 2nd.**

To get to the site from N or S of Griffin, get on 4-lane US 19/41 and stay on it until you reach the Ga. 16 (Newnan-Griffin) exit. Turn east toward Griffin, go to the 2nd stoplight and turn left at Spalding Drive.

Go past the 4-way stop at Flynt St., and turn right at the next corner (Water Works St.) A large student parking lot will be on your left after you turn. Turn left into student parking, and make your way to the far right end of the parking lot beside a 3-story bldg. Unload your 'scope on the large sidewalk area at the NW end of the 3-story bldg, then go back and park in student parking.

The GPS coordinates for Southern Crescent are: 33° 15' 15.75" N, 84° 17' 23.9" W. (Thanks, **Tom Moore**.)

Instead of a formal club meeting this month, we'll have our annual pool party/potluck dinner meeting at **Bill Warren's** house on **Sat., Sept. 13th.** Bring along a swimsuit, an item of food and the entire family, and get ready for some good food, fun and frolicking fellowship! Pool play will begin at 5 p.m., and we'll eat at 6:30. Come early and stay as late as you want. You'll have a good time, whether you swim, dip your toes in the pool or just sit around talking.

As for what food to bring – FRAC will provide soft drinks, pizza, eating utensils, etc., but fried chicken is always welcome. Or potato salad, beans, chips, nachos, dip or some kind of dessert. Just bring whatever you'd bring for a church picnic.

Bill lives at 1212 Everee Inn Road, Griffin, GA 30224. His GPS coordinates are: 33° 13' 15.37" N, -84° 16' 54.77" W. Or if you prefer decimals, 33.220933, -84.281907. (Thanks again, **Tom**.)

To get to Bill's house from, say, Hampton, come S on US 19/41, and when you get to Griffin stay on the 4-lane past Ga. 92, the RR overpass, the Griffin exit, Ga. 16 (the Griffin-Newnan exit) and Ga. 362 (Williamson Rd.), and turn left at the stoplight at Airport Road. Go 0.3 mi., and turn right at the 4-way stop at Everee Inn Rd. Go one block and turn left at Roberts St. Bill's triple-wide paved driveway is the first one on the left; you can park there, or drive past it, turn around and park beside his yard.

We'll wind up the month with Joe Kurz observings on **Fri.-Sat., Sept. 26th-27th.**

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Catching Up With Prof. Stargazer

*(Editor's Note: As recently retired state highway patrolman **Truman Boyle** and crime analyst **Dawn Chappell** of the College Park Police Dept. probably can tell you from experience, **Prof. Theophilus Stargazer** can be difficult to track down. Five FRACsters literally ran into the professor recently as he was hurrying out of a local jewelry store. He was carrying a sack.*

"I really don't have time for this," he said, glancing around nervously. Then, seeing that he wasn't going to get rid of us easily he added, "Oh, all right. Get in my car. We can talk while I drive." We sped away and the interview began.)

David O'Keeffe: What was that loud ringing noise in the jewelry store, Professor? Was the store on fire? Maybe we should go back and help.

Prof. Stargazer: No, everything is fine. The clerk must have set the volume too high on his iPhone.

Dwight Harness: We haven't seen you in a while, Professor; what have you been up to?

Prof. Stargazer: I was visiting two old friends, Sol and Max.

Dwight: For *six months?* They must be very good friends to let you to stay that long!

Prof. Stargazer: It was the judge's idea. Sol's last name is Confinement. Max's is Security.

Does anybody have a question about astronomy?

Larry Higgins: You haven't been to Joe Kurz lately, Professor. Have you found another dark observing site?

Prof. Stargazer: About a year ago I found a site that was so dark I couldn't see my hand in front of my face.

Tom Moore: Where was it?

Prof. Stargazer: I just told you, in front of my face.

Tom: Not your hand, you idiot! Where was the observing site?

Prof. Stargazer: A bank vault in Griffin.

Steve Bentley: *A bank vault?* You can't see stars in there!

Prof. Stargazer: I did after the alarm went off and the cops showed up.

David O'Keeffe: *Wait a minute!* That's what I heard back there: a burglar alarm! *You robbed that jewelry store!*

Prof. Stargazer: Don't be silly; would I do something like that? Anyway, look around you: if I did it, guess who my accomplices are!

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Inflation: A New Name for God?

article/opinion by Bill Warren

*(Editor's Note: All of the quotes in this article except those in the Conclusion came from **Alan MacRobert** in his article in the July, 2014 issue of* Sky & Telescope *[pp. 19-24], "What's Next for Inflation Cosmology." Everything else is my research and comments.)*

Cosmologists – astronomers who study the universe, its origins, structure and time-space relationships – have long searched for scientific explanations of how our universe began. As a result, they routinely accept the Big Bang theory and the existence of theoretical particles such as *quarks* (subatomic particles that comprise protons and neutrons) *strings* (smaller particles that comprise quarks), and *gravitrons* (see below), none of which can be seen.

Or can they?

In March, a team of 47 scientists working with the BICEP2 project in Antarctica announced that, after eight years of data gathering and analysis, they have identified swirls of polarization in the sky's spiderweb-like cosmic microwave background (CMB). It was hailed by MacRobert as "the greatest discovery in cosmology this century." (p. 19) Why? Because their images "seem to be…gravitational waves… – the long-theoretical gravitron particles that convey gravity – seen…a trillionth of a trillionth of a trillionth of second (before the Big Bang occurred)." (p. 19)

So what does that mean?

It means that cosmologists believe they've found a new, non-religious explanation for how the universe came to be. "A new window has opened on what made the Big Bang. A new branch of astronomy is beginning to peer through it." (p. 18)

The new window is *inflation.* The new branch is *inflation cosmology.*

Inflation Theory. In 1980, American physicist **Alan Guth** proposed a theory – the inflation theory – "for producing an entire universe from practically nothing." (p. 20) Guth based his theory on an existing Grand Unified Field theory that, immediately prior to the Big Bang, whatever existed broke up into strong and weak nuclear forms and electromagnetism that combined into one field. "He (Guth) found that a tiny bit of space could self-expand (inflate) by at least a factor of 10^{24} in 10^{-32} second or less, while filling with ultradense (remnants of the pre-existing) material. The regular Big Bang takes over after that." (p. 22)

Put simply, inflation theory holds that, even before the Big Bang, space had already begun to expand at an unimaginable rate (see above), and "inflation created the universe." (p. 23) Inflation cosmologists are salivating at the notion that finally they may have answered the question, *What caused the Big Bang?*

Gravitrons from Before Time Began. The reported discovery of gravitational waves (which had never been directly observed before) supports

the long-held theory that gravitrons were part of the pre-Big Bang inflation process. "Previously, the earliest direct observation we had of events in the Big Bang was the nucleosynthesis of light elements dating from the first few minutes (after the Big Bang). BICEP's gravitational waves appear to come from the first 10^{-38} second (before the Big Bang)." (p. 19)

Still…

Like me, you may have problems with all this beyond wondering what the heck things like *nucleosynthesis* and *strong and weak nuclear forms* are. For example, the 10^{-38} part pretty much nails down the math to a very fine point, but phrases like "seem to be gravitational waves" and " (the) gravitational waves appear to come from…" suggest that they aren't sure about what they're seeing and when it occurred.

The math is impressive. It implies an accuracy of measurement beyond our comprehension. But if they can make such a precise measurement of when something happened more than 13-1/2 billion years ago, why stop there? Shouldn't they also be able to give us a closer estimate of the age of the universe than 13.82 billion years? If they can split the second before the Big Bang occurred into 38 places beyond the ten, why can't they say that the Big Bang occurred at 6:18 a.m. on Thursday, Sept. 7th in the year 13,824,046,975 b. c.? At least we'd know when to throw a birthday party. (**Dwight** will buy the candles.)

Beyond that, there's the fact that every answer generates new questions. For example, if inflation caused the Big Bang, *what caused the inflation?* To answer that question scientifically, you'd need to know what existed prior to the Big Bang. That's why the discovery of gravitation waves from before the Big Bang is important: besides supporting the inflation theory, it offers a window, however small, for cosmologists to examine "the inflating pre-existence that set the Big Bang going." (p. 18)

Anyway, while the reported discovery of gravitrons by one set of scientists supports inflation theory, it must be verified in other, similar studies (that are currently in progress, see the 3rd and 4th paragraphs below for two examples) to be accepted as more than just another theory.

Conclusion. Finding ultimate answers isn't easy if you're looking for something other than God as the force that created the universe. And while the quest for answers should always be ongoing – that's what science is all about – there's **Dirty Harry's** comment to consider: "A man's gotta know his limitations." Speaking of which…

Since you were courageous (or bored) enough to wade through all this, here's a p.s. for you. Consider it the prize in your Cracker Jack box.

A "News Note" by **Camille M. Carlisle** in the Sept. issue of *Sky & Telescope* reports that two other recently completed studies of the cosmic microwave background dispute BICEP2's findings. The BICEP2 observations, Carlisle reports, "don't show what researchers thought they did." (p. 12)

Using BICEP2's data combined with a new, more precise map of the polarized dust in the Milky Way, research teams from UC-Berkeley and Princeton/New York U. said they couldn't tell whether the swirls of gravitational waves come from the CMB or from dust in our galaxy. (If it was dust, the BICEP2 findings don't support inflation theory because the Milky Way formed at least 200 million years *after* the Big Bang.)

Those reports must have been devastating to the Bicep2 researchers.

Think about it: they announced their findings at Harvard to an excited crowd of hundreds of eminent cosmologists from all over the world, only to find a month or so later that they may have been studying the wrong thing for the past eight years.

Unless some of the other studies in progress verify their research, one can envision the following conversation between BICEP2 team members:

Researcher #1: Where did we go wrong?

Researcher #2: Shut up and deal.

At any rate, the game is still in progress. After one inning the score reads: God 1, Inflation Cosmologists 0.

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Next Page, Upper Left Corner: Elephant's Trunk Nebula (IC 1396A), a dark, sharply outlined concentration of interstellar gas and dust in *Cepheus.* (North is at the top of **Alan Pryor's** photo.)

The Trunk, seen diagonally at the center of the photo, lies just inside the W edge of **IC 1396,** a massive -- 3^o x 2^o -- cloud of nebulosity that is illuminated and ionized throughout by the bright star to the left of the Trunk.

The entire NGC 1396 complex is a region of intense star formation: some of the stars in Alan's photo are less than 100,000 years old. (By way of comparison, the newborn baby stars in the

Trapezium in *Orion* are old-timers, weighing in at about a million years old. Earth is 4.54 *billion* years old.

Elephant's Trunk Nebula lies about 2,400 light-years from Earth. Its nickname refers to – well, you figure it out.

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Above: M80, a globular cluster in *Scorpius.* Photo by **Alan Pryor.** Scorpius contains two Messier globulars, the other one being **M4.** They offer a stark contrast in appearance: whereas M4 is loosely concentrated, M80 is so tightly concentrated that even in a 4" to 6" telescope it appears as a fuzzy tennis ball, with no stars resolved. A 10" to 12" telescope shows M80's large, brightly concentrated core with stars dotting the outermost portion of its 6' diameter – somewhat like Alan's photo, only without the color and clarity that astrophotos provide.

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Above: NGC 6445, a planetary nebula in *Sagittarius.* Photo by **Alan Pryor**. Often referred to as **Box Nebula** for obvious reasons, **NGC 6445** owes its shape to its side-on orientation to us – an orientation similar to the more familiar planetary nebulas **M27 (Dumbbell Nebula)** in *Vulpecula* and **M76 (The Little Dumbbell)** in *Perseus.*

Telescopically, 6445 shares the same low-power field of view with **NGC 6440,** a lovely little compact globular cluster lying $1/3^{o}$ away to the S (and not shown in Alan's photo). Both of them are Herschel 400 targets.

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Computer Modeling

article by Bill Warren

Reality does not care what people think or expect. **–Stephen Hunter,** *The Third Bullet* (2013)

Much as we'd like to believe otherwise, we know very little about the universe we live in. Our most powerful telescopes cannot see to the edges of the expanding universe, so we don't even know how large it is. The elementary particles that comprise matter in the universe are far too small to be seen.

Between those extremes, there is literally a universe of unanswered questions about things that we cannot see. And because we can't see them, we develop theories regarding their existence and nature. With things like dark matter and dark energy, we are literally working in the dark in trying to study them. How do you prove or disprove the existence of things that can't be seen?

By devising methods of testing their existence. So astronomers acknowledge the presence of things unseen like black holes, having first theorized their existence and then studied them via their effects on the space around them.

Unfortunately, some things that cannot be seen also cannot be tested by direct observation – for example, questions about whether our universe is infinite or finite and whether there are other universes besides ours. To study such theories and others, cosmologists rely on a technique known as *computer modeling.* They create a computer-generated simulation of what they're studying, based on what is presently known. Then they add whatever variables they consider necessary and watch what the computer says will happen. By doing so, they can make predictions regarding what the subject of their research is, was or will be like in the future. It's the same thing that meteorologists do in predicting the weather.

It's also the reason why they are wrong so often. As **Michael Crichton** wrote in *State of Fear*, "Computer models can't prove anything…A prediction can't ever be proof." Why? Because a model is a simulation of reality, not reality itself. Reality isn't always predictable.

Still…with all its flaws and potential for misuse, computer modeling offers the best chance for scientists to understand the past, present and future universe when no other direct means of research is available at this stage of mankind's technological development. As long as scientists are searching for answers rather than amassing data to be manipulated toward their personal viewpoint, computer modeling can be a valid research tool.

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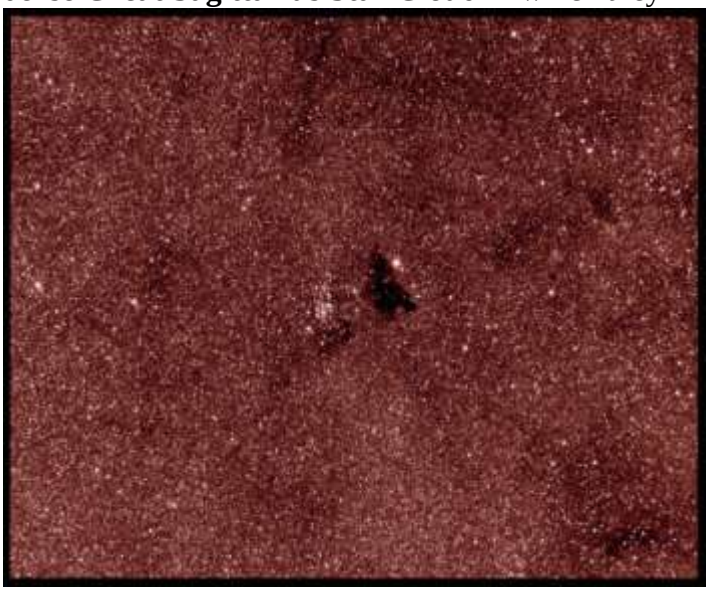
Upper Right Corner: Barnard 86 (Ink Spot Nebula) and **NGC 6520,** a dark nebula and open cluster in *Sagittarius.* North is at the top of **Felix Luciano's** photo.

Beyond its beauty, this stunning photo of **B86, NGC 6520** and a tiny portion of the incredibly dense **Great Sagittarius Star Cloud** in which they



reside perfectly illustrates and underscores **yr. editor's** comments on pp. 2-3 regarding the immensity of the universe.

Think you could count the stars in the photo? Well, this is just a microscopic portion of the Milky Way, which itself occupies a sub-microscopic portion of the observable universe.

Imagine a single atom on an elephant weighing ten tons – and then imagine how many atoms it takes to make an elephant of that size. In terms of the universe, the stellar background in Felix's photo is that teensy tiny atom on an elephant's back.

As for NGC 6520 and the Ink Spot…

6520 is a Herschel 400 Program target, and deservedly so. Yr. editor described it in 1997 in his 10" Dob as being "thumbnail-sized, with a lovely interplay of light, color and depth for such a small cluster. Very pretty, looks like a tarantula with about 20 bright stars forming an Omega shape and as many other fainter stars filling the body and rear legs. Located 1^{o} N of **M8 (Lagoon Nebula).**" He didn't see the dark nebula because (a) he wasn't looking for it, and (b) he probably didn't know it was there.

Barnard 86 has a 7^{th}-mag. star at its NW edge. The dark nebula offers a perfect starting point for observers who want to pursue the Barnards: it's small, and unless you're using a 12" 'scope or larger, you probably won't see any stars at all within the 5' x 3' Ink Spot.

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