

<http://www.raclub.org/>

# The StarGazer

Newsletter of the Rappahannock Astronomy Club

No. 4, Vol. 2 February 2014–April 2014

## Why I Love Astronomy and How I Became an Astroimager

by Ben Ashley

My astronomy journey began in the winter of 1997—10 years old, with my father in a field outside our home, looking west after sunset at a fuzzy white streak about the size of your thumb when held out at arm's length. It was the Hale-Bopp comet. At that time, it was still quite dim, and we might not have seen it at all if not for living in what was a very dark site back then. Over the next 2 months, Hale-Bopp became bright enough to be seen as a point of light high in the western sky above the red setting Sun. And in the dark night, it formed a tail that grew longer and longer, eventually splitting into two—a large white dusty coma that faded into yellow and orange, and sharply cut blue fins like the crest of a tropical bird. I remember seeing the comet from the backseat of a car riding home one night and telling my parents I wanted to go look at it, but was told no because it was too late. I dutifully went to bed but waited until everyone else had gone to sleep before getting up again, putting on a coat, and slipping outside unheard, up the lane to a high hill. I was mesmerized by Hale-Bopp. I had learned about comets in school and looked at pictures of them in books, but here this one was before me and it was real!

Ever since then, I have been in awe of space. The scale and magnitude of the measures of stars, planets, and distant galaxies are so great, they are beyond human comprehension. And every day, there is news about something new that has been learned about our universe. Although it isn't yet, it is certain that space will be our last frontier, and the possibilities seem infinite and mysterious. What most excites me is being able to experience for myself these things that I hear and read about.

When I learned about a quasar in Virgo with detectable emissions that have travelled for billions of years to reach us, I wanted to see them for myself—and with my first telescope I was able to. When I learned about the dwarf planet Sedna with a visual magnitude approaching 22, I wondered again whether I could find it with my modest equipment. In my first attempt, I was unsuccessful, but after 2 nights and 7 hours of combined data, I found a strong and certain signal of Sedna. How many people have really seen such a thing with their own eyes? (continued [here](#))



Hale-Bopp ©Jerry Lodriguss

Source: <http://apod.nasa.gov/apod/ap131013.html>



## How to Join RAClub

RAClub is a non-profit organization located in the Fredericksburg, Virginia, area. The club is dedicated to the advancement of public interest in, and knowledge of, the science of astronomy. Members share a common interest in astronomy and related fields as well as a love of observing the night sky.

Membership is open to anyone interested in astronomy, regardless of his/her level of knowledge. Owning a telescope is not a requirement. All you need is a desire to expand your knowledge of astronomy. RAClub members are primarily from the Fredericksburg area, including, but not limited to, the City of Fredericksburg and the counties of Stafford, Spotsylvania, King George, and Orange.

**RAClub annual membership is \$15 per family. Student membership is \$7.50.** Click [here](#) for a printable PDF application form.

The RAClub offers you a great opportunity to learn more about the stars, get advice on equipment purchases, and participate in community events. We meet once a month and hold regular star parties each month on the Saturday closest to the dark of the Moon. Our website, [www.raclub.org](http://www.raclub.org) is the best source of information on our events.

We also have an active [Yahoo group](#) that you can join to communicate with the group as a whole. Just click the link, then the blue Join this Group! button, and follow the instructions to sign up.

### The StarGazer

February 2014–April 2014

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Editor: [Linda Billard](#)

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[Reference: <http://www.copyright.gov/fls/fl102.html>, June 2012]

Website: [www.raclub.org](http://www.raclub.org)

Yahoo Group:

[http://tech.groups.yahoo.com/group/rac\\_group/](http://tech.groups.yahoo.com/group/rac_group/)

#### RAClub Officers

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[Jerry Hubbell](#) Astrophotography

### Calendar of Upcoming Events

Club Meeting, Maury School	April 16
Star Party, Caledon	May 3
Virginia Renaissance Faire*	TBD
Club Meeting, Maury School	May 21
Star Party, Caledon	May 31
Astronomy Night on the Mall†	June 6
Club Meeting, Maury School	June 18
Star Party, Caledon	June 28

\*weekends May 10–June 8, specific dates TBD

†backup date June 7

### Recent Outreach Events Completed

2014 Science Fair, Stafford Elem. School	February 20
STEM Night, Anne Moncure Elem. School, Stafford	February 26
Star Party, Caledon	March 1
Star Party, Caledon	April 5

## President's Corner

Well, the weather has finally started to warm up, and everyone is busy with their spring activities. Don't forget to take advantage of the warmer night temperatures to spend some time gazing at the Moon or Mars, which reached opposition in April. Saturn will soon be in view, and if you hurry, you can catch the last of Jupiter this season. Our cover story is by Ben Ashley, our club VP, who recounts his adventures when he first caught the astronomy bug and his subsequent growth over the past few years pursuing astrophotography. If you are not aware, Ben has resigned his VP duties because he has taken a position in Utah with his employer. We wish Ben all the best, and he has assured us that he will continue to keep in touch. Ben has been a great asset to our club and has promised to be a resource for us into the future.

I know you will enjoy this issue of the *StarGazer*; it has become the annual NEAIC/NEAF issue where our members report on the big show in Suffern, NY. This year, Bart and Linda Billard report on their activities at the show, and I throw in a few tidbits about my activities. In addition, Glenn Holliday, our resident history buff, tells us little bit about Shakespeare's knowledge of astronomy, and Terry Barker begins an occasional series on astronomy Internet resources by introducing us to the RSS Reader.

Personally, I feel especially blessed this year because I am pursuing my favorite hobby as a vocation and have the opportunity to speak with astronomers all over the country by attending star parties and events during the year. In this issue is a short report on my most recent adventure at the Winter Star Party (WSP) in Key West. Hopefully, at some point in your astronomy pursuits, you can attend this enduring event.

All the usual coverage of our meeting presentations is included in this issue, and make sure you check out the Image of the Quarter by David Abbou.

Well, that's it for now...until next time, Clear Skies!—*Jerry Hubbell*

### Welcome to New RAClub Members (February–April)

- ❖ Ron Henke
- ❖ Brian Sirnack
- ❖ Benjamin Burke

## Astronomy Math by Scott Busby

How far does light travel in 1 year (1 light year), if 1 Earth year = 31,000,000 seconds?

Use this method:      Distance = speed x time  
                                  Distance = 300,000 km/s x 31,000,000 sec

Distance = 9.3 trillion kilometers or 5,778,752,066,999 miles or 5.7788e+12 miles

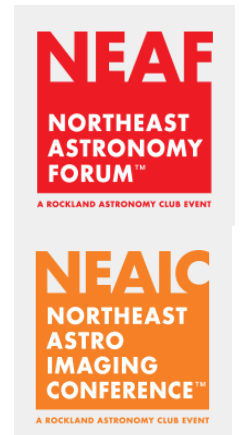
## NEAIC & NEAF—America’s Premier Astronomy Expo

By Linda Billard with Bart Billard and Jerry Hubbell



This year was the 23rd anniversary of the NorthEast Astronomy Forum ([NEAF](#)) and the 10th anniversary of its partner event, the NorthEast Astro-Imaging Conference ([NEAIC](#)). Rockland County Astronomy Club hosts the two events, which are held in Suffern, New York, at Rockland Community College and the Crowne Plaza Hotel, respectively. They run consecutively—this year, NEAIC was April 10–11 and NEAF followed April 12–13. They featured a full roster of speakers, including our own Jerry Hubbell (at NEAIC again this year).

Bart and I also made the trip to attend both events. On Jerry’s advice, we took the scenic route up I81 and across Pennsylvania—much nicer, less traffic, no tolls (except \$1 for one bridge on the way home), and only about 40 minutes longer than taking ugly I95. For convenience, we stayed at the Crowne Plaza the entire time...not cheap, but it’s a nice hotel, and it means no driving on the first 2 days except to go out to dinner if you want to. We went to several good restaurants either alone or with the Hubbell family—excellent food and staff that were happy to cater to the preferences of young children (Marcello’s (Italian), Bagel Boys, Bada Sushi, Airmont Diner, and Jumbo Chinese & Japanese).



(Courtesy of Rockland Astronomy Club)

**Day 1, NEAIC.** On Thursday, NEAIC began at the Crowne Plaza Hotel in Suffern. Because of his changed role (no longer an attendee but an employee), Jerry spent much of his time staffing the Explore Scientific (ES) display in the exhibitors room. Bart and I attended as many seminars as we could (a few time conflicts forced us to choose). In the first session, Bart was intrigued by a presentation by Dr. Benjamin Mazin on *Superconducting Detectors for UV, Optical, and Near-IR Astronomy*. The new devices, referred to as “microwave kinetic inductance detectors,” are being developed in [Dr. Mazin’s lab](#) at UC Santa Barbara. They allow users to determine the pixel location, energy, and arrival time of individual photons. The applications of this technology range from detecting Earth-like planets around nearby stars to untangling the emission mechanisms of pulsars. Given Bart’s interest in exo-planets, he found this presentation especially interesting although the need for super-cooling the detector probably makes its use by amateurs difficult. The more controlled environment of an observatory is needed. (*In the next StarGazer, Bart will talk more about this technical breakthrough.*)

In the second session, Jerry presented on *How to Obtain Your IAU Minor Planet Center Observatory Code*. Attendees learned about the capabilities you must have to collect data for the MPC and the requirements for submission. Once you have satisfied the MPC that your capabilities meet its standards, you receive a unique location code. (Jerry’s is I24 Lake of the Woods Observatory, Locust Grove, VA.) Data you collect become part of a database used to track the changing location of the many thousands of asteroids around us. Jerry was pleased with the turnout. Some were so engaged, they stayed into the lunch hour to get more details. For [more info on the talk](#), see the description later in this issue of the *StarGazer*.

In the afternoon, Bart and I attended a seminar on *High Resolution Planetary Imaging* given by Dan Llewellyn of the Atlanta Astronomy Club. An experienced imager, Llewellyn described his entire technique—from type of telescope

to use, thermal equilibrium, collimation, and weather—to correct image capture with different software and RGB balance. He demonstrated a complete processing run using Registax and Autostackert2 and final tweaking. The image of Jupiter he produced was quite remarkable (see below).



Jupiter by Dan Llewellyn

Source: <http://www.atlantaastronomy.org/PSSG/Program.htm>

Jerry did not have an opportunity to attend any of the sessions because, unlike last year, he was there representing Explore Scientific (ES). His time was primarily spent in the vendor display room showcasing the Telescope Drive Master (TDM), while other ES employees covered the company's telescopes and eyepieces. Jerry spoke with a few people he had talked with last year as well as some new folks who seemed ready to purchase the TDM and were pleased to be speaking with someone who had tested the device and thus was thoroughly familiar with its capabilities.

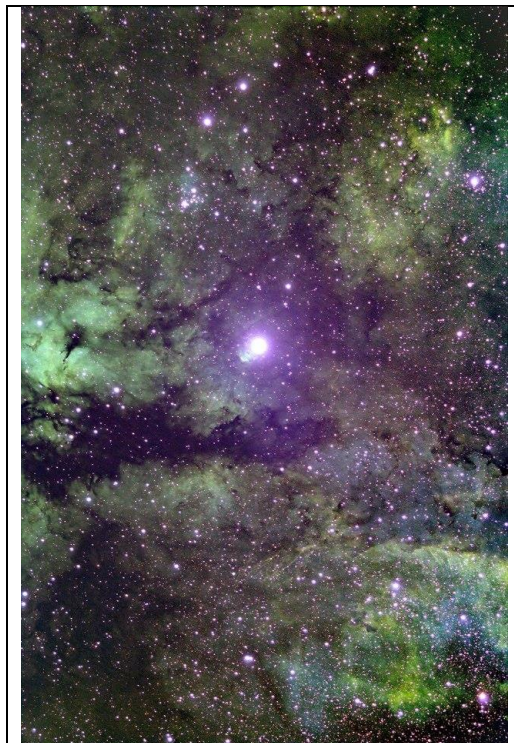
### Day 2, NEAIC.

On day 2 of NEAIC, Bart and

I attended a presentation by Gordon Haynes, who came all the way from England to give a talk entitled *Escape from the Emerald City, Hubble Palette the Way It Should Be*. The talk focused on common problems encountered in [narrowband imaging](#), particularly the predominance of green when using the Hubble palette. Haynes said he chose narrowband imaging as his focus because he lives in a city with lots of light pollution. He described the seven stages and some of the tools he uses to obtain his beautiful images. We later learned during a chat with Al Nagler (of TeleVue fame) that his son “discovered” Haynes on a business trip to England a few years ago. Haynes now serves as a consultant to TeleVue and provides many of the images used in the company's marketing materials. The TeleVue booth was adorned with an array of Haynes's work.

That same day, we attended a fascinating seminar presented by Rich Jakiel on *Lunar Geology Via Imaging*. I was especially interested because it's another way to use imaging to investigate lunar features. Jakiel covered the basics of lunar geology using only images from his planetary cameras and a DSLR. He described the equipment he uses and recommended resources for [geological maps](#) of the Moon. He then covered current amateur research opportunities, including hunting for “new” lunar domes and monitoring for new impacts. One of the most interesting topics was a brief tutorial on how to determine the order in which features developed in the same area because multiple features often impinge on each other.

Jerry and his ES colleagues broke down their display early to move it over to the college for the next day's start of NEAF. That evening, he attended Celestron's New Product Announcement presentation for the company's new NexStar Evolution Schmidt-Cassegrain telescope. Unfortunately, the Celestron people had an accident in the process of packing to move the telescope for the announcement session. The telescope tilted, and the primary mirror smashed into the corrector plate. This catastrophe forced them to use the other prototype model for the demo and at NEAF for the next 2 days—not the most auspicious way to begin showcasing a new product. Jerry



Gamma cygni Nebula by Gordon Haynes

Source: <http://www.fromquarkstoquasars.com/apod-ic-1318/>

also spoke with David Eicher of *Astronomy Magazine* and Kelly Beatty of *Sky and Telescope*, both of whom expressed interest in having him write some articles.



The Bino Stand (Source: Terry Barker)

**Day 3, NEAF.** Saturday, the NEAF show began at the college. Bart and I arrived about an hour after it opened. The pictures and the hype don't begin to prepare you for the myriad vendors and displays! We visited almost every booth at least once, trying (mostly unsuccessfully) to systematically assess what was available. I concluded that it would be a mistake to purchase a telescope on the fly. However, by the end of the day, I was pretty sure that lunar imaging and observing should be my focus and can now work out what I want to buy. We did buy a few accessories and the same binocular stand that Terry Barker purchased last year.

We spent quite a bit of time at the International Occultation Timing Association (IOTA) booth talking with Ted Blank, whose presentation the day before intrigued us even though we only saw the last few minutes. We then attended a tutorial session Ted held that afternoon to learn more about measuring asteroids and mapping lunar limb features using timing of the disappearance and reappearance of stars occulted by them. IOTA supports citizen science contributors in obtaining and publishing data on occultation timing. These data can lead to discoveries of new double stars, companion asteroids, and more. (*I plan to write more about IOTA in the next newsletter.*)

Jerry spent his entire day at the ES booth talking to people about the TDM. He was pleased to have several people drop by who'd attended his talk at NEAIC. A number of them purchased signed copies of his book. Others who already had it, commented on its usefulness. I was pleased to meet Maury Solomon and Nora Rawn of Springer Books, who are our contacts for the current book and the new one we're working on.

Before leaving the show, Bart and I went to the courtyard behind the show venue to visit the Solar Party that had been going on all day. It was a great day for solar observing...essentially no clouds and 70 degrees. We saw spots and prominences through a variety of telescopes, including John Raymond's (Richmond Astronomical Society). In addition to the conventional telescopes, one woman had a "Sun Spotter," a clever device that projects an image of the Sun via a lens and mirrors. We were attracted to it because it's kinda funky looking.



Sun Spotter (Source: <http://www.scientificsonline.com/sunspotter.html>)

**Day 4, NEAF.** Bart and I did not stay for the second day...had to get home. Jerry remained most of day at his post at the ES booth but it was a slow day—typical of the second day at NEAF—with about half the number of visitors. Consequently, Jerry finally had time to walk around to talk with some of the other vendors, spending time at the MoonLite Focuser booth and chatting with Austin Grant of *Astronomy Technology Today*, who was very interested in the TDM and how it works. He thought he might buy one for himself.

I highly recommend that everyone make a trip to this event at least once in your life. We enjoyed it so much and learned so many new things that we're already planning to go again next year!

## Shakespeare—Amateur Astronomy Enthusiast?

By Glenn Holliday

At the February RAC meeting, I presented an invitation from the Virginia Renaissance Faire to do something about Elizabethan astronomy at the Faire. During the discussion, Linda Billard forwarded the link to an [article](#) about astronomical references in Shakespeare's works published in the *Irish Astronomical Journal*. The article made me wonder whether everyday Elizabethans knew more about astronomy than everyday 16th century Americans. The results of my initial research and musings follow.

The Bard of Avon, William Shakespeare, shows a surprisingly deep knowledge of astronomy in his works. For example, the play *Julius Caesar* explains the movement of the sunrise from season to season. In other works, Shakespeare also teaches us that the Moon's orbit is an ellipse, not a circle.

Today, not many people know those things. Shakespeare also knew some things that are very familiar to us today, but that were new knowledge in his society. Some Shakespearean scholars have found hints of that in Shakespeare's dialog on heliocentrism and magnified views of the Moon and planets. Copernicus published at the beginning of the Elizabethan era. The telescope was invented at the end of Shakespeare's life, but astronomers were trying to invent it during his writing career. (Bacon and da Vinci wrote about using lenses to magnify the Moon and Milky Way long before the first real telescope.)



William Shakespeare  
Source: <http://en.wikipedia.org/wiki/Shakespeare>

Was Shakespeare as extraordinary in his astronomical knowledge as he was in his writing genius? Or was that knowledge more common in Shakespeare's day than in ours? Did everyday 17th century Londoners understand astronomy better than 21st century Americans? Are you smarter than an Elizabethan?

Shakespeare had only a grammar school education. His schooling ended at age 14, when his family ran out of money for school. I don't find any evidence that astronomy was commonly taught in the grammar schools. However, it was certainly a subject found in all the colleges.

A common romantic description suggests that people of pre-industrial societies knew more about the natural world than we do today because they lived more time with it: people saw more of the sky and relied on their knowledge of the natural world in their everyday lives. It may well be that most Elizabethans knew better than most 21st century Americans which nights the Moon would give the most light for work and travel, or when the position of the Sun on the horizon indicates the time to plant.

Most Elizabethans were familiar with *astrology*. But though it was popular, it doesn't seem that everyday citizens learned the intricacies of that art—any more than they do today. They sought out professionals for astrological expertise. Professional astronomers of the day were expected to provide astrological advice as well as scientific discourse.

I do not find evidence in history that most Elizabethans knew all the astronomy we find in Shakespeare. I suspect Shakespeare's knowledge was unusual for his time. Where did he learn it?

Shakespeare read everything that he could find. He also took advantage of his connections at court to meet every notable name he could. The field of knowledge didn't matter to Shakespeare, he consumed it all. After all, he was a true Renaissance man.

One notable person whom Shakespeare likely met in London was Thomas Digges, a well-known astronomer and supporter of Copernicus' heliocentrism. His father invented the perspective trunk, a precursor of the telescope, and Digges himself proposed a design for a reflecting telescope well before Galileo's refractor. Digges wrote an important paper on the New Star of 1572. Because Copernicus was not yet well accepted, Digges wrote of the "New Astronomy" only indirectly.

One of Digges' daughters married the executor of Shakespeare's will, and one of his sons wrote poetry for the prefaces to two collections of Shakespeare's works, so there is strong evidence that Shakespeare knew Digges. I think this acquaintance with Digges is a leading contender for the source of Shakespeare's advanced knowledge. Digges probably fed Shakespeare's curiosity with more astronomy than the average poet encountered.

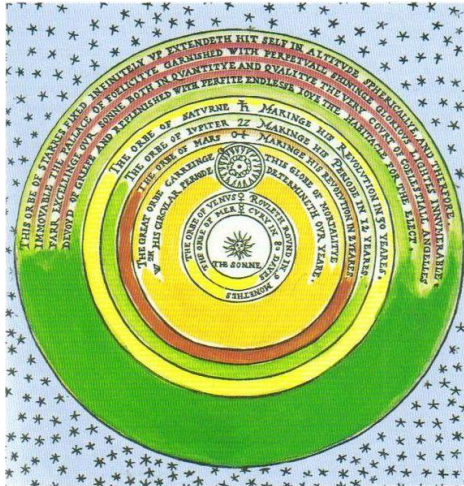


Illustration of Copernicus's Universe in Digges's Book  
Source: [http://en.wikipedia.org/wiki/Thomas\\_Digges](http://en.wikipedia.org/wiki/Thomas_Digges)

Anybody with good historical references on the question, I'd love to see what you've found. For a survey of astronomical references in Shakespeare's works, see this [Irish Astronomical Journal article](#). For an argument that Shakespeare wrote about Digges' interpretation of Copernicus, see [this article](#) by a Penn State Physics and Astronomy professor. Thanks to Linda for inspiring me to wonder about this.

## How to Spice Up Your Astronomy Life—Try an RSS Reader

By Terry Barker

Do you sometimes get the feeling that you're missing out on something when you hear that a tweet has gone viral? That someone famous has 10 million followers? Do you just scratch your head when a friend tells you that you need to add space.com to your RSS reader? Ever heard

about an interesting tweetup and thought you might want to go? Even when you have no idea what it is?

Maybe I can help. I'm not going to try to convince you to join FaceBook or Twitter—you have to decide that yourself. It's kind of like trying to convince a friend to quit smoking. You're not going to do it for him—he has to make the commitment on his own.

What I will do though, is show you some of the advantages as they apply to astronomy. I'm sure you've also heard that FaceBook can be a huge time waster. True, if you let it. It can be just as addictive as video gaming. Still, I'll try to give you a nudge, and maybe you'll feel the urge to try something new and see for yourself.

Let's start with RSS (Really Simple Syndication) readers because they were around long before FaceBook and Twitter, and they still have impressive uses. If you pick up only one tool from this article, I'm betting this is the one you're going to find most useful.

You can think of an RSS reader as a way to "collect" articles from various websites so that they appear as links on the reader page. The advantage is that you can see articles from various sites on a single page, as opposed to visiting each site individually. Also, if you click one of those links in Feedly, you get a synopsis of the article. Then,

### All

6,403 unread articles // keyboard shortcuts

#### FEATURED

SPACE.com	5K	Asteroid Found with Rings! First-of-Its-Kind Discovery Stuns A
io9	500+	How We Won the War on Dungeons & Dragons Thirty years ag
ScienceDaily: S...	400+	Solar system has a new most-distant member The Solar System

#### LATEST

Neatorama		Hilarious Product Reviews for a Ridiculously Overpriced Watt
Mashable!	75	College Football Players Can Unionize, Landmark Labor Ruli
io9	1	Meet our newest neighbour, VP113 The outer solar system has z
Mashable!	74	No, Microsoft and Sony Don't Need to Worry About the Faceb
Amazon.com G...	89	Deal of the Day: Bushnell 8 MP Trophy Cam HD Trail Camera

Sample from Feedly, the RSS Reader



you can decide whether to click another link in the synopsis to go to the website to read the full article. So, you have two shortcuts to guide you—the title of the article (in the main list) and a teaser containing a new link to the full article and a paragraph or two describing the full article.

The previous king of RSS readers was Google Reader. It had all the features you want in a reader, and it was so good, people (including me) couldn't believe that Google would pull the plug, but it did. There was much cursing, but it happened. There are many replacements, but the one that seems to have won out, and is my personal RSS reader, is Feedly. Its capabilities are very close to those of the dead Google Reader.

I could go on, but hopefully, you get the picture, and I'll just include the astronomy related links that I have in Feedly. I have: space.com, Sky & Tel, sciencedaily.com, richastro.org, and lo9 (for my sy-fy fix). You can arrange the links by category, which helps organize the feeds.

Let's use Sky & Tel as an example of how to add a feed to Feedly. Go to skyandtel.com. In the left hand column, you'll see a button labeled RSS. Click the button. You'll see the window below pop up.



You have your choice of the kinds of feeds you want. For example, for the top item, "Most recent," you can click on the My Yahoo button to add the feed to Yahoo's reader. Or for Feedly, right-click on the XML button and select "Copy the link address" from the popup window.



Close

### RSS Feeds from SkyandTelescope.com

RSS (Really Simple Syndication) is a format that allows websites to easily expose linked headlines to their readers. To get RSS feeds, you'll first need an RSS reader, which allows you to automatically pull in fresh content from multiple RSS feeds across the Web into a single application. One such popular reader is My Yahoo! To instantly add SkyandTelescope.com's feeds to your My Yahoo! personalized site, simply click the "+ My Yahoo!" button(s) below! Or, to add SkyandTelescope.com's feeds using a different news reader, click on the feed's XML button, and follow your reader's instructions.

#### [SkyandTelescope.com](http://SkyandTelescope.com)

Most recent SkyandTelescope.com stories:

News stories:

Observing stories:

Blogs:

Podcasts:

Most popular stories:

Most emailed stories:



Now go to Feedly, and you'll see an add box in the upper right-hand corner. It has a magnifying glass icon in the box. Insert the link address there. While your cursor is still in the box, press Enter. Articles from Sky and Tel will appear, and you'll see a green icon at the top marked FOLLOW. Click it and a sidebar will appear with your categories showing as a list. After making your selection, hit the green icon at the bottom of the sidebar, also marked FOLLOW. You're done.

Usually, you can also add a feed by browsing for the name of the website by clicking Add Content in the left sidebar of the home page. For some reason, it couldn't find Sky and Tel, so I had to use the XML method.

You'll find new articles every day. Not necessarily from every feed, because you'll get only articles that are new on the particular web page.

Now, for the magic. Once you click on an article, you'll see a mess of icons show up in gray just below the title of the article. Float your cursor over them to see a description. You can send the current article to Evernote, Instapaper, One Note, Google+, FaceBook, Twitter, LinkedIn, Hootsuite, or even Gmail. The Favorites icon lets you mark articles for reading later. You can retrieve your favorites by clicking on Saved for Later in the left sidebar.

And another big feature of Feedly--it's available for mobile devices, and it will sync with anything you do on your desktop.

If you're an Evernote user, like me, this is a wonderful way to clip articles to keep in one place for further use or research.

That's all for now. Next time, I'll show you how to use FaceBook, Twitter, etc."

### **Why I Love Astronomy and How I Became an Astroimager (continued from page 1)**

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To do all of this, I had to get into astroimaging. I didn't begin there though. I began with the most stripped-down manual telescope, a book, and a red light. Of all the things I have done during my astronomy journey, this has done more for me than anything else. I could not be where I am today without forcing myself to learn the whole sky to the point that I could read it like an address book. Night after night, if I did nothing else, I went outside and tried to pick out every constellation in the sky.

For my first telescope, I chose a 120 mm Orion f/8.3 refractor on a SkyView Pro GEM. The scope and mount had a rather steep learning curve that I wouldn't recommend for other beginners without an experienced coach. However, as time went by, my appreciation for the scope grew, especially when I compared the contrast and clarity of the optics with other scopes I had the chance to look through.

I first used the scope to look at the Moon and then Jupiter. After that, I tried to find the Great Nebula in Orion because I had a poster of it in my room. It was harder than I expected. Even though I could see the spot with my eyes, it took forever for me to get the scope pointed there. The first several times I went looking for the Andromeda Galaxy, I couldn't even find it. It's easy to get disoriented when locating things by star hopping. Without the scope, you see only a handful of stars in the sky, but then you look through the eyepiece and there are 100.

Before long, I decided to attempt a Messier Challenge of finding all 110 objects, with certainty, in a single year and on my own. This forced me to go out to Caledon more often and to plan observing sessions because my skies at home were surrounded by tall trees that blocked my view of constellations low to the horizon. It was at Caledon that I met Bart and Linda Billard, and Glenn Holliday, all of whom helped me with concepts that I was learning and whose passion and knowledge for astronomy was inspiring. I had started the challenge in the spring and skipped most of the Coma/Virgo objects because I was inexperienced. This meant I had to stay up until after 2 a.m. on the next February's cold nights to finish.

In the next year, I became less satisfied with visual astronomy. The things I saw in the sky just didn't look like the pictures. Also, I had become fond of galaxies, but even in scopes up to 20" I couldn't see any details. So, I started reading blogs by people who had pictures that I liked and started asking questions about how they did their work. The idea of astroimaging began to form in my mind, but I was hesitant because the sheer volume of information and variables and choices was massive.

Coincidentally, Jerry Hubbell was releasing his first book on astrophotography at the time, and I decided I would get a copy. Astroimaging started to make sense, and it encouraged my thoughts on entering the water. The final push

came at Belmont Observatory one night with Scott Busby when he showed me his process of imaging M33. He was taking a 5-minute exposure, and I watched a blank screen with a counter ticking down to zero. There is a wait while the image downloaded, and then “poof,” there appeared the galaxy with incredible detail and surrounded by thousands of stars. It was like seeing Hale-Bopp all over again, and I knew I had to pursue this.

The first step according to Jerry is designing an astronomical imaging system rather than purchasing and snapping together a bunch of random pieces. My greatest concern when designing my own setup was reaching at least the minimum performance level for long exposure/deep space imaging within a budget of several thousand dollars. Just like choosing a beginner telescope, you have to spend enough and get out of the department store price range to actually have something that works. After this, I had other considerations in the type of scope and focal length, the field size, the chip size and matching it to the resolution of the scope, and portability. (It’s no fun dragging out, setting up, and later breaking down hundreds of pounds of equipment every time you want to image.) Finally, I wanted versatility that would not confine me to a few possible projects, and I wanted equipment that I could grow into and not have to upgrade within 6 months.

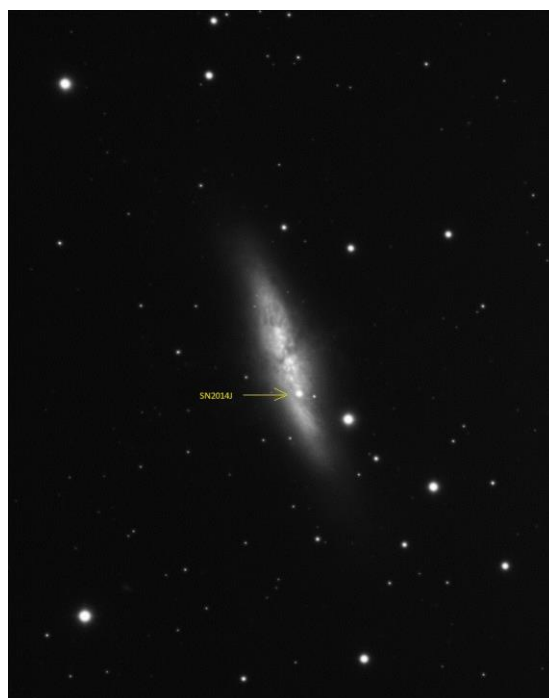
I ended up choosing an Explore Scientific 127 CF Triplet Apo Refractor, an Orion Atlas mount, and an Atik 383L+ CCD camera. I purchased most of my equipment used, but in very good condition. I decided what I wanted and then waited around for those things to show up on the “used” market.

More than a month later, I had everything and was ready to start imaging. Time for another hard moment! In the beginning, it would take me 2 hours just to set up my equipment. My polar alignment was poor, and I generally made a tiny mistake somewhere that would have a huge impact on my project. One example was balancing the scope with a diagonal and an eyepiece rather than with the imaging train (camera stuff) I was going to need later. This meant my images had a lateral blur because the mount slipped under the uneven weight.

Learning to focus your telescope for imaging is the next big challenge. In fact, let me assure you, if you can learn to focus a medium or fast focal speed telescope for a CCD camera manually, you can do any of the rest of this. There are tools that can help, and techniques that make it easier. The best secret is to leave your mount on a first magnitude star after the alignment procedure and focus on it until other fainter stars show up in your image.

My first image was of the M13 globular cluster in Hercules. It wasn’t very good. About the longest exposure I could take at the time without seeing movement in the image was 15 seconds. I set my camera to take a bunch of 30-second shots, and then I stacked them together with image processing software to get a really shaky and blurry picture. Still, it showed me more of M13 than I had ever seen visually, and I was on my way.

Most of my progress since my first image has come from practice. The rest came from rebuilding and tuning my mount to improve its tracking accuracy from +/- 20 arc second periodic error (PE) to +/- 5 arc second PE. I have been able to take exposures as long as 30 minutes with no discernable movement and average FWHM measures within 10 percent of those in a 5-minute shot of the same target. Now I am to the point where I can really duplicate results of professionals and see for myself the wonderful things that they have studied.



Supernova SN 2014J in M82 (January 2014)  
Source: Ben Ashley

I have to thank many of the members of our astronomy club for helping me get this far. Your interest in my progress and constructive criticism has meant a lot to me. If you are new to astronomy and need help learning how to explore in a budget-friendly way, contact me, Benjamin Ashley, at [bashleyr@gmail.com](mailto:bashleyr@gmail.com).

## Adventures at the Winter Star Party

by Jerry Hubbell

I struggled to get up at 3:30 a.m. on Tuesday, February 28, to make my flight from Richmond to Miami. Despite the extremely early wake-up call, I was excitedly anticipating the flight, and then the connecting one to Key West for the 2014 Winter Star Party (WSP) on Scout Key. This 30th annual WSP was expected to be one of the most well-attended in recent years, although there is a 600-person limit on the island for safety reasons. This year's WSP was scheduled from February 23 to March 2.

My flight from Richmond at around 7 a.m. was uneventful (I managed to get a little sleep), and my arrival in Miami was memorable, flying over the ocean on our final approach into MIA. I had a couple of hours to wait around, so I grabbed an early lunch and finally boarded my flight from Miami to Key West. I looked forward to this flight and looking at all the keys on the way.



A View of the Keys From My Flight From Miami to Key West



Welcome Sign for the 30th Annual Winter Star Party on Scout Key

When we landed in Key West, it was crowded in the terminal but I quickly made contact with fellow Explore Scientific (ES) employee Greg Bragg. He was there to pick me up and bring me to the WSP. We had a good conversation on the way to the WSP and arrived around 2:30 p.m. Sheldon Faworski was already there, and the ES tent and tables had been set up. I set about working on the Losmandy Titan mount (installing the motor drives) so that we could use the ES 6" APO refractor on that mount later that evening. It was very comfortable that afternoon—around 70 degrees and not too humid.

I was fortunate to meet a couple of well-known astrophotographers that day, including Don "Mongo" Parker, longtime lunar and planetary imager. We spent the day talking with various customers and then, after going to dinner at 5 p.m., returned to spend the evening hours showing our customers the different telescopes and observing a wide variety of objects. The long days went by very quickly. On Tuesday and Wednesday evening, the skies were great, although there were very noticeable light domes from Marathon to the northeast and Key West to the southwest. On Thursday, a storm was expected, and it was overcast all day. Consequently, we weren't all that busy, so Scott Roberts took Greg and me to Key West for lunch. We spent the afternoon strolling around the downtown area. I found Key West a very exciting and diverse place with all kinds of people but also very crowded

this time of year. Overall, I had a great time at the WSP and enjoyed meeting everyone there. I look forward to attending again in the future.



A view to the Northeast of Scout Key (7 miles south of Marathon)



Sheldon Faworski, Scott Roberts, me, and Greg Bragg at the WSP

## Highlights of Recent RAClub Presentations

Abstracted from Bart Billard's Meeting Minutes

### February 2014—Photometry and Astrometry for the Amateur Astronomer

*Jerry Hubbell* began his presentation by saying he'd presented this talk 2 years ago but decided to update it a bit and present it again. Both photometry and astrometry can be traced to work of the ancient Greek astronomer Hipparchus. He catalogued stars and assigned them rankings of apparent brightness from 1st to 6th magnitude. This system was later standardized with a logarithmic scale and extended to cover fainter stars only visible in telescopes. The development of filters with standardized pass bands in the 20th century improved the consistency of measurements and led to publication of a catalogue of stars by Arlo Landolt with measured brightness in each of the filter pass bands. With the development and increasing availability of charge-coupled device (CCD) cameras, more and more amateurs have been able to learn the process of photometric measurement. Jerry described the process of using astronomical software to measure the relative brightness of a target star compared with a catalog star in the image. After calibration by subtracting an average of dark frames (taken with all light blocked from the CCD) and using an average of flat frames (taken with light from a uniform background such as the sky shortly after sunset) to normalize the detector responses, the relative flux of the target and comparison star(s) are measured. The explanation of how the measurements account for the light from the sky that is picked up along with the light from the stars was interesting. The flux from the sky alone is estimated in an annular area centered on the star, with the inside of the annulus large enough to avoid including flux from the star. Jerry showed an example where a background star was within that annulus and could corrupt the sky flux estimate and explained that the software uses the *median value* of the pixels in the annulus instead of the *average* to get a better estimate.

About 190 BC, Hipparchus used catalogs created by his predecessors Timocharis and Aristillus, along with his own observations, to discover the precession of the Earth's axis. This precession is one reason catalogs of star positions are defined for a specific time period, or "Epoch," of some 30 to 50 years. Before the era of astronomical photography, positions could be measured with telescopes fixed to move along the meridian—the imaginary line in the sky that an object crosses when it is due south of the observer and reaches its highest elevation in the sky. The moment an object crosses the center of the telescope's field of view, marked by a reticle, it is measured with a precise clock. The object's coordinates are found based on that time and the elevation angle of the telescope. With the advent of astrophotography, measurements of relative positions of objects could be made by careful x-y measurements on photographic plates. These relative position measurements can now be made with CCD images. To calibrate positions, Jerry said amateurs now use professional-level catalogs, for example, the US Naval

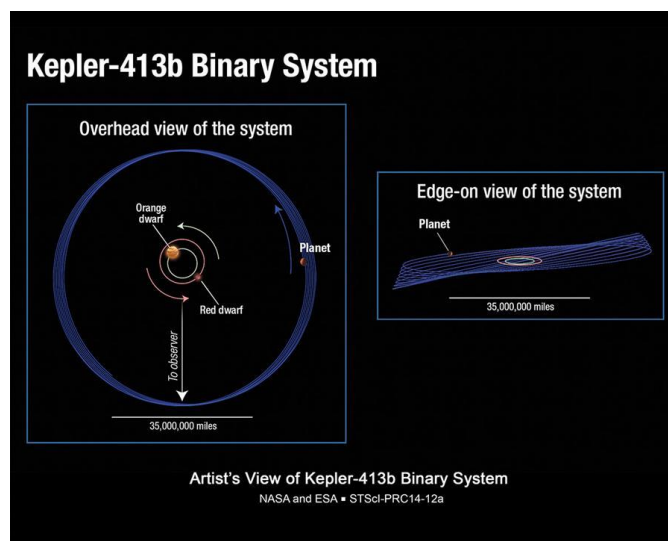
Observatory CCD Astrograph Catalog (UCAC) series. With the help of software, an amateur can digitally adjust the center position, scale, and orientation of a CCD image to match catalog stars seen in the image. You can do it manually by clicking controls for each adjustment and watching the matching of the indicated positions of catalog stars with the stars in the image or with the help of automated solving algorithms in some software versions that can do most, if not all of the work. Jerry showed the result of the last method, a “blind solve,” obtained using the website, [Astrometry.net](http://Astrometry.net). A copy of his presentation is available on the Club website on the [programs page](#).

### March 2014—Yet Another Kepler Update

*Bart Billard* began his presentation by saying that his topic had been about the Kepler space telescope mission each December for the last 3 years, noting that the disadvantage of talking in December was that new announcements of Kepler results usually occurred shortly after his presentations. (Early January is the date for the annual American Astronomical Association meeting.) This time, an unexpected announcement from the Kepler team on February 26 revealed 715 newly confirmed planets, and the total for Kepler reached 961, compared with 167 confirmed planets announced prior to December’s presentation—certainly worthy of an update.

After reviewing the nature of the Kepler mission, Bart presented results that became public in the last 3 months. A bar chart showed exoplanet discoveries by year since the first nearly 20 years ago, and colored portions indicated those made by Kepler in two groups: the 5 years starting in 2009 up to the February announcement, and the day of the announcement. This year’s bar, with 794 discoveries (including ones announced in January), accounts for more than half of all exoplanets discoveries. Another chart of the size distribution of the known exoplanets before and after the Kepler mission began, including the newly announced group, showed that Kepler results are increasing the apparent relative abundance of smaller planets compared with the Jupiter-like planets. One explanation is the dependence of other exoplanet detection methods on mass and size of the planets.

Another discovery features a planet with an odd wobbly orbit around a binary star system that is tilted with respect to its host stars. Because the stars’ varying attraction distorts the orbital plane, the planet transits, as seen from Earth, were affected. Three transits 66 days apart were followed by 500 days with no transits before another five transits occurred. The researchers expected the next transit visible from Earth would not be until 2020. They also concluded the binary stars’ changing gravitational influence on the planet affected its rotation axis, causing it to wobble and precess. Its tilt could vary by as much as 30 degrees over 11 years—much more rapidly than Earth’s—leading to rapid and erratic changes in seasons.



Bart also had an update on the concept for a new mission for Kepler. It had ceased data collection on its original mission last year as a result of a second reaction wheel failure. The new concept would keep Kepler pointed in the plane of the ecliptic, allowing an orientation with balanced light pressure for observing campaigns of up to 83 days. NASA’s Astrophysics Division director invited Kepler to the Senior Review for astrophysics operating missions, and the team submitted its proposal on January 30. A test of the concept with a known transiting exoplanet showed Kepler could still detect transits in the new mode.

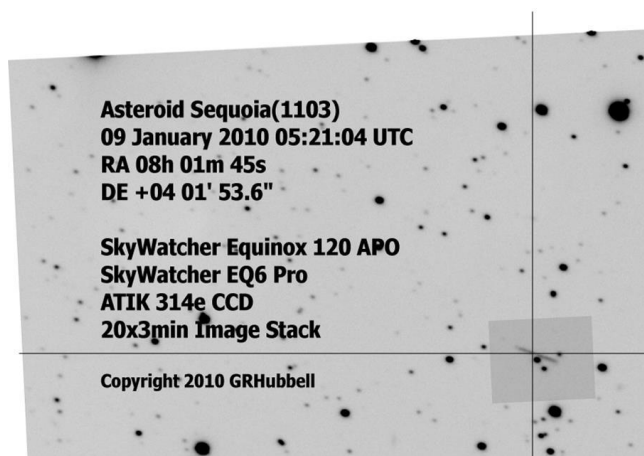
Bart ended the presentation with a look at what determines whether a Kepler target becomes a candidate or confirmed planet, and some of the new techniques that led to confirming 715 candidates all together. If a light curve

of a star shows regularly repeated dips in brightness of several hours duration, a planet with a certain size and orbit period could be the cause, and with enough repetitions of dips, the signal can then become a candidate. It means the signal is consistent with a planet transiting the star, but it could also be the result of something else. Bart then discussed other causes of similar signals, meaning that some candidates could be “false positives.” Eclipsing binary systems are an important source of false positives. Their light curves could be distinctive, but a fainter binary system in the background of the Kepler target, for example, would have its light blended with the target star’s light, which could result in a signal more like a planet’s. To confirm a candidate as a planet, researchers would have to find evidence that such “sources of confusion” are extremely unlikely. They would then be able to say the candidate was confirmed with high confidence. Evidence for confirming candidates could come from ground-based observations that independently detect the planet. Systems with multiple transit signals provide additional possibilities for discounting false positives. One is that so few candidates are seen among the many Kepler target stars, yet so many are in systems with more than one candidate (“multis”). Statistical arguments show false positives could account for only a few of the hundreds of candidates in multis. These arguments were first used in 2012 as part of the validation of the Kepler-33 system with five transiting planets. This year’s work refined the arguments and validation methods to confirm hundreds of candidates in multis.

Some of the audience questions addressed the future of Kepler and the possibilities of a successor mission. Another such mission is not planned, but the proposed K2 mission could help dispel any doubts that the sample of stars Kepler monitored is special by sampling new areas of the galaxy along the ecliptic. A copy of his presentation is available on the Club website on the [programs page](#).

#### April 2014—How to Obtain Your IAU Minor Planet Center (MPC) Observatory Code

*Jerry Hubbell* presented a version of the talk he recently gave at NEAIC. The [MPC](#) is the clearinghouse for observations of asteroids, comets, and outer irregular satellites of the major planets. He explained assignment of observing codes allows the MPC to establish a certain level of ability for a new observer and also document the location from which amateur and professional astronomers make astrometric observations. The observer location is necessary for performing computations of parallax to refer observations to a common Earth-centered coordinate system. The adjustment is necessary before the observations can be used to update orbit calculations. Jerry said about 1,800 observatory locations around the world are providing observations to the MPC. Most amateur observations of asteroids help refine orbits. (The current magnitude range for discovering new asteroids is 20–21.)



The observer wishing to obtain an observatory code needs to demonstrate his/her capability by making a set of repeated measurements of 3–5 asteroids over a 2–4 week period. The observer submits these in the required format using the code “XXX”. The measurements are images with an exposure long enough to record the asteroid, but kept short to minimize trailing. The images need to be calibrated and “plate solved” against a reference star catalogue such as the US Naval Observatory’s (USNO) UCAC4. In response to a question, Jerry said users can find out how to request a free DVD copy of the catalog at the [USNO website](#). He explained calibration entails subtracting a dark frame and then using a flat frame to

adjust for variations in detector response. Jerry listed three programs that can be used for the analysis. AIP4WIN is a reasonably low-priced choice available from Willmann Bell and MaxIm DL is a high-end choice. The third program is Astrometrica, which, along with MaxIm DL, will create a report in the right format. These programs help find the

adjustments in scale, position, and orientation to fit the stars in the image with the positions of corresponding catalog stars, which then allows the position of the asteroid to be converted into coordinates in the sky.

Jerry had a number of tips from his experience when he obtained his observatory code in 2010 by submitting his 13 observations of 3 minor planets made in 4 sessions during the winter of 2010. He chose asteroids near opposition, when they were brightest. Google Earth is the preferred source for your observatory latitude, longitude, and altitude coordinates. Seeing of 2–4 arc sec is not a bad thing because having more pixels on each star image gives better centroid determinations. To get proper accuracy for the time of observation (less than 1 second uncertainty), Jerry uses a GPS receiver to update his computer clock once a minute. A copy of his presentation is available on the Club website on the [programs page](#).

## Image of the Quarter

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I took this photo of Jupiter on March 15, 2014, using my 33-year-old Celestron-8 telescope and NexImage5 camera. I was very happy to capture some decent detail on the planet, including the Great Red Spot directly below center on the planet. This was the first time I clearly and definitely captured the GRS! I also was able to capture the moon to the right of the planet.—*David Abbou*