

Rappahannock Astronomy Club

Minutes, December 15, 2021, Online Meeting

In attendance:

David Abbou
Terry Barker
Jim Blowers
Scott Busby
Bart & Linda Billard
Glenn Faini
David Eicher
Claire Gardiner
Glenn Holliday

Bruce Jenkins
Hank Nebel
Mark McDonagh
Troy Major
John Maynard and William
Rolando Pancotti
Matt Scott
Steve
Vienna Falls Chorus?

The meeting began at about 7:15 p.m. Twelve members and eight visitors were present including David Eicher, for his presentation on galaxies.

Presentation

David Eicher, editor of *Astronomy Magazine*, joined our meeting on Zoom to talk about galaxies. He said Timothy Ferris's 1980 book on the subject was his current favorite. He said he was amazed at how nearly everything we knew about galaxies has changed in the last 40 years, and especially the last 10 years. He began with Edwin Hubble in October 1923 observing what was called the Andromeda Nebula, M31, and discovering a cepheid variable star so faint that it indicated the Andromeda Nebula was three times farther away than the largest estimate anyone else had made for the size of the entire universe at the time. What astronomers called "spiral nebulae" were then shown to be separate galaxies like the Milky Way. Soon red shifts studied by V.M. Slipher (starting before Hubble's discovery) were tied to a new distance scale that revealed the expansion of the universe.

For studying galaxies (or any new phenomenon), the first step was classification, which Hubble pursued in the 1930s. He developed the "tuning fork" diagram, which Gerard de Valcouleurs expanded in the 1950s and 1960s to the system still in use today. David explained estimates of the number of galaxies in the universe were complicated by the relationship between the distance of observed objects and the amount of time that passed before the light observed arrived here. Galaxies grow by mergers of smaller galaxies, and he suggested galaxies of the early universe, represented by the most distant galaxies we see, numbered in the trillions, whereas the number of galaxies of the current universe, like those seen nearby, was probably 100 billion. He deferred talking about the way that estimate was made to later in the presentation.

David said a good way to start to understand galaxies is to begin at home with the Milky Way. It has some 400 billion stars, a number he said was rather uncertain because the most abundant stars are hard-to-see red dwarfs. David described the location of the solar system at the edge of a spiral arm known as the Orion arm about 26,000 light years from the center of the galaxy. He indicated it was a good thing it was far out because in the centers of galaxies is a lot of danger. He showed a Spitzer image in the direction of the center of our galaxy, which he said was in Sagittarius just about at the midpoint of a line between the cluster M6 and the Lagoon Nebula. He noted we only see a quarter of the way to the actual center mostly because of dust between the us and the center. There is a relatively modest black hole there of about 4.3 million times the mass of the Sun.

A next step beyond our Milky Way, David said, were galaxies of our Local Group (named in the 1930s by Hubble). It included at least 55 galaxies. Again, the number was uncertain because, as with stars, dwarf galaxies are the most common, and the number of dwarf galaxies was uncertain. He said the three largest galaxies were the Andromeda galaxy (M31), the Milky Way, and the Triangulum galaxy (M33). The rest of the local group were dwarf galaxies. He showed images of M31, with its two dwarf galaxy satellites (M32 and NGC205) and M33 with faint surface brightness. He noted M33 had one of the largest known star-forming regions (NGC604) and lacked a central black hole (although most galaxies have been found to have them).

David showed the Antennae galaxies and NGC 2623, examples of merging galaxies. Although there tends to be a lot of room between galaxies, there are plenty of examples of merging galaxies for us to observe. He said the Milky Way disk was an estimated 8 billion years old, and that it had probably started with the merger of about 100 small galaxies. He also noted the predicted merger of the Milky Way and Andromeda in about 5 billion years, and said Avi Loeb, an astronomer at Harvard who had studied and written about the motion of Andromeda, proposed Milkmeda as the name for it.

Continuing beyond the Local Group, David discussed the Virgo Cluster, which contains M87, its most massive giant elliptical galaxy. The image he showed had a hint of the jet in M87. The M87 black hole, or to be more exact its shadow, was the first Event Horizon image. Its mass was 3.5 billion solar masses. He said M87 had about 12,000 globular clusters, compared with a couple of hundred for the Milky Way. The M87 image that he used was one by the amateur astronomer Adam Block.

David continued with examples of more exotic galaxies. He showed an example of “Einstein’s cross” in which four images of a distant quasar exactly behind the center of a faint galaxy were formed by its gravitational lensing effect. He also showed a recent Hubble image, the Hubble Ultra Deep Field, explaining that based on the size of the tiny patch of sky it imaged and the number of galaxies it showed, there are probably 100 billion galaxies in the visible universe.

Quasars and various active galaxies were puzzles for a long time but were more recently seen as active centers of distant galaxies with central black holes consuming matter and radiating toward us. David said by the 1980s, astronomers began to find most galaxies had central black holes. When galaxies merged, the disturbances caused matter to fall into their black holes with some heated and ejected in jets of matter and energy, so the appearance depended on the viewing angle. Some time after mergers, conditions would quiet again. Thus, nearby galaxies were mostly quiet while distant galaxies seen as they were billions of years ago were more often active.

Continuing with the subject of mergers, David showed an image of Perseus A (NGC1275), a monstrous centrally dominant galaxy. It had evidence of chaotic disturbances and widespread star forming activity, all attributed to an active central black hole. He described the puzzle of how elliptical galaxies formed. Effects of angular momentum suggested that like planetary systems, galaxies should have spiral or disk shapes. Astronomers eventually realized mergers could explain the elliptical shapes. He showed an image of Centaurus A (NGC5728) and suggested maybe after their merger, the Milky Way and Andromeda might resemble it.

David told us that cosmic inflation implied the universe could be much larger than what was visible, perhaps infinite. Considering only the visible universe, which includes some 10,000 billion billion stars and is 93 billion light years in diameter, he discussed the possibility of life elsewhere. He said exoplanet searches recently showed planetary systems to be common, and spectroscopy showed chemistry is consistent throughout the cosmos. Materials that made life possible here were abundant. The amino acid glycine was found in the first comet sample returned to Earth in 2016. He pointed out the possibility life started somewhere else was not unreasonable, but that the cosmic distance scale that Hubble found made it unlikely we would see aliens land and greet us. If the astronomical unit measuring the distance from the Sun to Earth were one centimeter, the inside edge of the Oort Cloud would be ten football fields, and Proxima Centauri, the nearest star, would be four times that. He also noted the energy requirements to move material objects (as opposed to light with no rest mass) over interstellar distances made it likely SETI was the only method that might answer the question about life elsewhere.

David concluded with discussion of a very new area of research on galaxies, suggesting the possibility of zones where life is more likely to exist in them. Rocky worlds require “metal-rich” stars. If that is the case a galaxy like the Milky Way may have a “habitable zone” in the spiral arms, about 10,000 to 30,000 light years from the center. Farther out may mean fewer “metals” and farther in may mean much greater danger. David concluded that 100 years after Hubble and with all we have learned, especially in the last 15 years, we still have a lot to learn about galaxies.

After thanking David Eicher, Glenn Faini mentioned the Rappahannock Astronomy Club was originally named for M33, the Triangulum Astronomy Club. David thought he might actually remember that name from club newsletters they used to get. He later mentioned an interest in visiting this area for its Civil War History. They also discussed the comparison between Hubble’s M31 image and modern images. Amateur astronomers’ images today made the 1950s television show Lost in Space look like it used Hubble’s image. Bart Billard asked David to comment on the red shift of the distant blue galaxies he had pointed out in the Hubble Ultra Deep Field image. He confirmed they were greatly red shifted, but we did not yet

know much about them or how they formed so long ago. It was one of the goals of the James Webb Space Telescope due to be launched soon.

Old Business

- President's Report—Glenn F. said he did not yet have any presentations lined up for future meetings. He said he was going to have John Maynard report on cloud storage options but saw John had stepped away and said he would get back to that topic later in the meeting.
- Treasurer's Report—Matt Scott reported five new members joined or renewed in November, accounting for the \$100 incoming funds. He said another member joined but he did not get the check cashed before the first of this month and would include it in the next report. Glenn said the sixth member whose check was cashed late was member number 64, and that a past member he was speaking with who might rejoin could get us up to 65. There were no expenditures.
- Vice President's Report—Glenn F. said the December 11 star party was cancelled owing to the weather, giving him nothing to report.
- Secretary's Report—Bart Billard said he was behind on the November minutes but hoped to get them done and out for comments by the weekend.
- *StarGazer* Report—Linda Billard said she would not be starting up on the next newsletter until after the holidays, but she had several ideas for articles. She emphasized that she was still interested in anything members might suggest. She especially mentioned interest in stories about gadgets, or instruments, or books someone liked, or really liked, or really disliked. Glenn F. mentioned a laptop he got for his wife that he planned to return, He did not know until he got it that it came with Windows 11 S version. He said it's apparently S is for security, and they couldn't install anything unless it comes from the Microsoft store, like an "Apple wannabe."
- Cloud Storage—John was back to report on what he had found about options to store video from meeting presentations and make it available for viewing later. He said he had looked at some possibilities and found that YouTube and Vimeo were the cheapest. However, if you choose the cheap options, you have no control over what other videos get mixed with yours. YouTube and Vimeo decide what video follows yours if the user continues streaming after it ends. He and Glenn Holliday also noted you become part of their advertising unless you pay for storage and streaming of your videos. John said the cloud storage offered by Amazon, Microsoft Azure, and Google Cloud also allow a way of streaming video to online users, but that comes with a metered charge for the amount downloaded. There would be a risk of huge expenses if the content became very popular, or we would have to enforce restricted access. We discussed the restricted access possibility but were not sure whether it was the right way to go. John wanted to do further research and get back to us when he had more information.
- Communications—Glenn F. said there was nothing to report other than our Groups.io list running smoothly because Don Clark and Myron Wasiuta were not present to talk about the website or Facebook page.
- Equipment Inventory—Scott Busby said the inventory status was unchanged but he wanted to talk about the Celestron 8SE telescope he had mentioned in a recent email as a possible addition to the inventory. He said he had found it was well cared for and he was able to run it through all its capabilities without problems. He found its collimation good, and said he thought the astrophotography accessories it came with might be for Nikon cameras. (They did not fit his Canon cameras.) It was on an AVX mount without a polar alignment scope, and he had one on backorder for it. He said it would also need a protective case. He liked its simple setup and its astrophotography capability. Scott said he wanted to offer it to the club for purchase for the equipment inventory, indicating he would ask \$1,300 to include the polar alignment scope when it came in. When Glenn F. asked whether it might replace something else, Scott suggested the Brandon Vernon Scope was not so suitable as a loaner, and it might bring about \$2,000 on the market. He mentioned a couple of other telescopes that lacked mounts and a SkyQuest Dobsonian that had a helical focuser that might be difficult to upgrade.

Glenn F. said he would like to make a motion that we purchase the telescope that Scott was offering for use in the club inventory and to make another motion that we ask Scott to make a list of equipment that we don't need in the inventory and could liquidate, either offering some to club members or donating some to MSRO to use to raise some funds. Scott said he was an advocate of limiting the inventory to what was most useful. Glenn F. asked for a second on his motion for the club to purchase the 8SE and Troy Major seconded it. There was discussion of

whether it was something that might be a good donation to MSRO. Scott said it was not suitable for the level of capabilities of the MSRO equipment and more appropriate for club members wanting to get more experience or learn astrophotography. In response to a question about the AVX mount, Troy said he had one and found it easy to use and suitable for astrophotography. About the other equipment subject to the second motion, Glenn F. pointed out he was suggesting it could provide MSRO with material to sell for fundraising, not equipment to use. Scott said he was in favor of the club liquidating the other equipment for its benefit, and he thought it was not really needed by MSRO for fundraising. After some discussion about the requirement to have a membership vote for purchases over \$100 and a check of the Bylaws to confirm that we did not need to wait a month before holding the vote, Glenn confirmed there was no more discussion and called for a voice vote. It was all “ayes” and no “nays.” Glenn F. concluded that the club could purchase the 8SE telescope package from Scott, and Matt could write the check for it.

Glenn F. turned to determining other inventory equipment to liquidate. Scott proposed that his experience with maintaining and lending the inventory equipment gave him a good idea of what excess equipment might interest members, and that when he decided on liquidating such an item, he could simply offer it first to club members, then sell it afterward if there is no interest. Glenn F. agreed and felt proceeding that way would not require a vote. Scott said he would seek Glenn’s input if questions arose, about a particular price point, for example. Glenn replied that after the first of the year when Myron Wasiuta was Vice President, he should be the one to consult. When asked, none of the other members had any problems with the arrangement.

- Cloud Storage (Continued)—At this point John had determined that Amazon cloud storage charges were 2.3 cents per gigabyte for the first 50 terabytes of storage plus 0.04 cents per 1,000 requests per month for downloads, and Azure and Google were nearly the same, up to 0.2 cents difference depending on the storage region. He recommended we choose the U.S. East region, for the best performance implications for our membership. Glenn recommended John choose whichever storage service was easiest to use and simplest to link to, and John indicated more familiarity with Amazon. After we concluded the expense was not likely to be \$100, Glenn proposed a motion to approve John Maynard obtaining a cloud storage from Amazon for storing club meeting presentations and allowing people to stream them. Troy seconded the motion. Mark McDonagh asked whether the payment method could be tied to some sort of generic account or method that would make it easier to transition to a different person if some time in the future John was unable to continue the administration. Glenn F. asked Matt to explain how charges for the website were handled, and Matt explained that Don paid the bill and submitted a claim to him for reimbursement. That way the person who understands the service being paid for is able to check the bill before it is paid. He did not know whether Don had the account set up in RAC’s name or his own. Glenn F. noted that Don was stepping down as webmaster and the position was being transferred from Don to John, with Glenn Holliday as backup and Alex Filothodoros available to help with debugging and troubleshooting. Matt asked him to make sure Don transfers the invoice information also, because we paid for 5 more years of service about a year ago. In discussion with Mark, Glenn determined he was advocating using a generic account like the ones the club officers are using (president@raclub.org, vicepresident@raclub.org, etc.). John said he expected Amazon would require a credit card for automatic monthly payments. Scott proposed using a credit card style gift card for a certain amount and replenish it from time to time. Mark suggested the club bank account might allow us to get a debit card to use as a payment method not tied to a specific member. Matt said he would have to find out about that. Glenn concluded we were not ready to vote on what to approve, and we should table the motion and move on to other business.

New Business

- Members at Large Nominations —Glenn F. made the following motion for approval of his choices for members at large:
 - I move that the Rappahannock Astronomy Club approve my nominations of [the following] as Members at Large for CY 2022.
 - Linda Billard - *StarGazer* Editor
 - John Maynard - Webmaster
 - Scott Busby - Equipment Manager
 - Jerry Hubbell - MSRO Science, Inc. Assistant Director
- Scott Busby seconded it. The voice vote passed with no “nays.”

- Bylaws Review—Glenn said he looked over the Bylaws and had a few changes/edits to propose. He recommended changing “shall be the Rappahannock Astronomy Club” to “is the Rappahannock Astronomy Club” under “Name of the Organization.” He proposed changing the reference to light pollution “effects on our environment” to “effects on the environment.” He also said he wanted to have Linda fix the page numbering. After starting to consider a motion to submit the proposed changes to the members we concluded we should hold off to let the incoming Executive Council do that.
- Star Parties for 2022—Glenn F. brought up the proposed star party dates for 2022 that he sent out to his Caledon contacts and the Executive Council members. He wanted to go ahead and at least get the January date out to members while waiting to hear whether there were any conflicts because club members would need some time to make their plans.

Next Meeting

The next meeting is on Wednesday, January 19, 2022. It is planned as an online meeting. Officer elections are on the agenda.