# Rappahannock Astronomy Club

**Minutes, July 20, 2016, Meeting**

In attendance:

Bart & Linda Billard
Mark Burns*
Jerry Hubbell
Paul Jacobs
Scott Lansdale
Payal Patel
John Putnam
Tim Plunkett
Ryan Rapoza
Tom Watson
Myron Wasiuta

*Visitor who joined at the meeting

The meeting began a little after 7 p.m. Nine members and three visitors, one of whom joined at the meeting, were present.

# Program

The program for the evening was a discussion of astronomy in the news by members present. Scott Lansdale led off with four items. First was about a minor G1-class geomagnetic storm the day of the meeting, which he said was interesting for him because of his radio astronomy interests. Spaceweather.com recommended watching out for auroras, especially in the southern hemisphere winter skies. Myron Wasiuta suspected the active region he had been watching during the last week could be the source. Another topic was the increasing frequency of noctilucent clouds seen at lower latitudes. Scott said the earliest sightings date back to about 1885. He said they now are being studied by the NASA Aeronomy of Ice in the Mesosphere (AIM). Measurements by AIM indicate that at noctilucent cloud altitudes, the temperature is decreasing about 0.5K per decade, and water vapor is increasing about 1 percent per decade. Myron wondered why the temperature decreased when increasing carbon dioxide in the atmosphere tends to cause warming. Bart Billard and some others suggested the warming is caused lower down in the atmosphere, and the carbon dioxide below the noctilucent clouds absorbing the heat radiated acts like insulation and allows the air at those levels to cool.

Scott's next topic was evidence of water clouds found outside our solar system. The brown dwarf, or failed star, WISE 0855, has a similar water absorption spectrum to Jupiter. It is about five times the mass of Jupiter and has a temperature of about -10° Fahrenheit compared with -224° Fahrenheit for Jupiter. The final topic was NASA's Juno mission, which entered an eccentric orbit of Jupiter earlier this month. Goals include trying to confirm ideas about Jupiter's structure. Does it rotate as a solid body? Is there a solid core, and if so, how large? Myron noted that if we could see Jupiter's magnetosphere, it would stretch 5 degrees on the sky. Tom asked about observing Jupiter's radio emissions, and Scott confirmed amateur radio astronomy equipment can. One of its instruments is the Jupiter Energetic Particle Detector Instrument (JEDI). Scott mentioned that the JunoCam is not one of the science instruments. It will produce close-up images of Jupiter's poles, and the public will be able to select other points of interest for images. Scott showed two short Bill Nye videos about Juno topics, including how Juno is powered and what questions the mission is designed to try to answer. One technique for investigating Jupiter's structure involves precise measurements of Juno's orbit using the Doppler effect.

Bart followed Scott with a discussion of the Laser Interferometer Gravitational Wave Observatory (LIGO) accomplishments during the 4-month operation in the Advanced LIGO configuration at low power. Two confirmed detections were announced in February and June, and one reasonably likely one was also observed. All represented binary black holes in their "death spiral," in which orbital energy lost to emission of gravitational waves results in their distance decaying and their orbital periods decreasing until they merge. The LIGO signals show increasing frequency and amplitude until a peak in frequency and amplitude is reached, followed by decreasing amplitude at a constant frequency as the black holes merge and "ring down." The Astronomy Picture of the Day (APOD) website featured a simulation of a binary black hole merger following the February announcement on the 12th. For the June announcement APOD featured an animated graph of the LIGO detector frequency content versus time during the event. For sound, the video included what the waveform of the merger sounds like when played as an audio recording.

Bart said the information is found by matching the waveforms of the signals with computer simulations of merging binary black holes with various masses and spins. The details of the waveforms measured by LIGO provide information on their total mass and individual masses, and even some information about their spin. This information also indicates how strong the wave emission is, telling us how far away they are. A network of gravitational wave detectors has the ability to monitor all of the sky (up or down) both day and night. Three or more detections (for this run, LIGO had two, one in Washington State and one in Louisiana) provide the possibility of localizing the source enough for follow-up observations in visible light or other wavelengths.

Jerry Hubbell showed us YouTube videos available on the SpaceX Falcon 9 reusable booster. He said they are launching about once a month, so you should be able to see a new video every month. We saw one video of a successful vertical landing on a barge. Myron wondered how to tell it is not a takeoff video run backward. Another showed an unsuccessful landing in which the booster fell over after setting down (not a video run backward).

Myron talked about "Tabitha's Star," a star with an unusual dimming pattern found in Kepler data via a citizen science project run by Yale astronomers that allows people to analyze Kepler light curves via the Internet. Tabitha Boyajian is one of the astronomers investigating this find. This is the star that was in the news recently with the media speculating about alien civilizations and Dyson spheres. Other proposed explanations are a huge swarm of comets or debris from a planet broken up by a collision. A Kickstart program was established to fund controlled observations of the star with a network of amateur telescopes. It is now getting about 15–20 observations a day from around the world. AAVSO is also involved. Bart mentioned the PANOPTES project that is attempting to design a small robotic telescope that could be built by amateurs and schools to create an observatory network for transit searches and other applications. They could be used to observe this star, although they have a wide field of view for covering many stars at once. Myron said Tabby's star is an easy star to observe. He showed a Ted Talk she gave about the star.

# Old Business

- Stargazer and Communications Committee Update—Articles from Jerry and Tom Watson were the only outstanding items for the next newsletter, apart from the President's Corner.
- MSRO update—Myron said MSRO is operational with a smaller camera substituted for Jerry's, which needs repair. He said 2-minute subframes are possible without tracking errors, and it can often go up to 5 minutes.
- Treasurer's Report—Tim Plunkett said he needs to have his contact information on the club website updated because of his recent move. This month's report includes a check from Dave Benz that Tim got in January. He was asked about David Abbou's check and said it would be in the July report. The number of paid memberships for this year is now 19. Ryan Rapoza suggested that he could use a member email list to send out invites to members to join the club Facebook page. Facebook provides a way of advertising events locally. Tom said he could try something similar on Twitter by using hashtags for our area and for astronomy with an image of a brochure announcing an event.

# New Business and Astronomy News

- Caledon Star Party July 9 and Embrey Mill July 8—Scott said it was another great star party with about 20 people attending in all. Tom said he found out he had not learned his new lens well enough (should have remembered his own advice from his June program). Scott and Mark Burns joined David Abbou for the Embrey Mill outreach the evening before. They had some clouds but were able to get good views of Jupiter and Saturn later on. Jerry suggested we need to have brochures ready to hand out at events. Linda said she has some but has had difficulty getting people to pick them up. Someone asked about having a club T-shirt to wear at outreach events and star parties. Tim said he has some Galileoscopes available for anyone interested. He ordered extras some time ago and there were not enough takers. The Shiloh Park event was cancelled because of lack of publicity. It might be rescheduled for December.
- Meeting Programs—Scott Still needed a program for September. Tom indicated he thought he could do something.
- Club Picnic—Scott said the club picnic will be at Belmont on August 6 starting at 2:00 p.m. Scott Busby will provide food, but attendees are encouraged to bring a side dish or dessert.

- Other Upcoming Events—Shenandoah Park is looking for help on July 30. Scott asked members to let him know if they want to participate so he can provide names (participants will be admitted free at the Park gate). Stratford Hall is October 8. Scott said he needs to contact them. He also said he needs to check with Ferry Farm for the November event. We discussed possible times for Northumberland next year. “Facilities” are not available in the summer, so fall is better.

# Next Meeting

The next meeting is the club picnic on Saturday, August 6, 2016, at Belmont.