

# Rappahannock Astronomy Club

## Minutes, February 13, 2013, Meeting

In attendance:

- Benjamin Ashley
- Terry Barker\*
- Bart & Linda Billard
- David Buckwalter
- Scott Busby
- Don Clark
- Jerry Hubbell
- Amber Hubbell
- Melvin McDaniel\*
- Tim Plunkett

\*New member joined this evening

President Jerry Hubbell began the meeting at 7:00 p.m. Ten members and a visitor who joined the Club during the meeting were present.

## Program

Jerry Hubbell presented "Engineering a Fiber-Fed Spectrometer for Astronomical Use." He recently purchased a fiber-optic spectrometer and has integrated it with his telescope. Jerry's talk was mainly on the how-to of designing and putting together the spectrometer, telescope, and other parts and software to get it all to work, but he included some spectra that he had time to take before starting to work on the presentation. Some of the questions he addressed included how to match the telescope with a fiber and get the light focused on the fiber tip, how sensitive is the CCD in the spectrometer and what does that mean for the limiting the magnitude of objects you can measure, how to guide the telescope to keep the light on the fiber tip, and how to calibrate the wavelength and intensity response of the spectrometer system.

Jerry found a Science-Surplus Spectrometer with do-it-yourself alignment for just \$200, less than 1/10 the cost of new fiber-optic spectrometers, and not a lot more than the transmission diffraction gratings mounted in a filter holder that amateurs normally use. The spectrometers are very compact, roughly a 4x6-inch box holding the circuitry and the spectrometer optical bench. He showed the layout of the optical bench and how it folds the light into a compact path, from the fiber interface with the slit, to the collimating mirror, to the grating, to the focusing mirror, and then to the linear CCD. The spectrometer includes a fiber, the other end of which Jerry connected to the telescope. For this interface he designed a fiber optic head.

The fiber optic head allows him to bring the light in the desired wavelength band into the fiber connection to the spectrometer, to pass the light in another band to the guide camera so he can guide on the same object he is measuring, and to adjust the focus of the light so that both guide camera and fiber are at their proper focus position simultaneously. The fiber optic head was based on a flip mirror that Jerry modified. He removed the mirror provided to make a hole to pass light through to the guide camera without flipping the mirror up and then replaced the mirror with a one that passes infrared wavelengths while reflecting visible wavelengths. This type of mirror is often called a "cold mirror" because of the association of heat with infrared light. A fiber-optic cable adapter mounted in a nosepiece that fits the eyepiece holder in the right-angle leg of the flip mirror provides the connection for the fiber. Jerry also added a focal reducer to get a better match of the cone of light from the telescope with the range of angles accepted by the fiber. He worked out that the fiber angular acceptance, given as a numerical aperture of 0.22, corresponded to a matching focal ratio of f/2.27. The focal reducer produces focal ratios of f/4 and f/3.75 for his two telescopes, which is a reasonably good start but could be improved.

Jerry also talked about making adjustments to locate the position of the object on his CCD that would correspond to correct positioning of the light on the fiber, the benefits of auto guiding, and writing software to acquire the data and format it so he could store a series of spectra in FITS image format representing

wavelength dependence along one axis and time dependence along the other. He said the spectrometer controller limits the exposure to 64 seconds, and because the light is spread out over many pixels to record the wavelength dependence, it produces a limiting magnitude of about 6 for detecting the spectrum peak, or 4 to 5 for getting a good signal-to-noise ratio over a range of wavelengths. Jerry was able to use the spectral lines in fluorescent light (from his iPad display) to provide known wavelengths for calibration of the scale of the spectrometer. He used Tom Field's RSpec software for normalization of the response, which takes care of effects such as the wavelength variation in sensitivity of the CCD in the spectrometer, and the reflection efficiency of the cold mirror as a function of the wavelength. He finished his presentation by illustrating results he has obtained so far. Jerry has measured the light from the Sun, Moon, Jupiter, and various stars such as Alpha Tau, Eta Tau, Alpha Ari, Alpha Gem, and Alpha And.

Ben Ashley asked about effects turbulence had on guiding in the infrared. Jerry said the guiding takes place on a long time scale compared with the turbulence effects. The turbulence just spreads the image of the star, but the size of the fiber is large compared with this spread. Auto guiding has proved unnecessary for the 60-second exposure times the spectrometer allows, but it can be helpful for taking a series of many spectra on the same object. Don Clark asked whether Jerry could measure the spectrum of the comet coming later this year, and Jerry said he would be able to. Bart Billard asked about trying the 200-micron fiber. Jerry said he had not tried it yet, but that he thought he would probably have to auto guide with it. Glenn Holliday asked about using the spectrometer on the Moon, and Jerry said he had and found the spectrum looks similar to the Sun's. Don asked about asteroids, and Jerry said it would be harder because he normally identified the position of asteroids after taking the image.

## Old Business

- Treasurer's Report—Tim reported seven dues payments for next year along with one payment of Astronomical League dues. Seventeen members have paid dues for the new year, (One has also paid dues for next year.) Tim noted that dues are supposed to be paid by the end of March.
- Star Parties, Events, and Meetings—The star party scheduled for Belmont on February 8 was successful. Scott reported the skies were beautiful and the temperature fell to 15° by the time he quit. Jerry, Linda and Bart, Melvin, and Ben were among the attendees with Scott. Scott spent a lot of time showing views with his observatory telescope. They witnessed an awesome pass of the International Space Station.
- Status of Club Loaner Equipment—Ben Ashley said the only changes were that he had the 8-inch Dob and George Clarke had the Club Personal Solar Telescope.
- Scheduled Star Parties and Outreach Events—Ben said he planned to get to the Post Oak Middle School outreach to set up at 5:30. The primary date was Friday, February 15, with a backup the next day. His Post Oak contact was suggesting the tennis courts, but he was trying to persuade him that the football field would work better. Ben noted that the attendance might be large because he had seen some additional schools included in cc's in the email traffic. Linda talked about the England Run Library outreach star party planned for March 23 to coincide with the Discovery Exhibit that will be at the library February 26 to April 24. The viewing would be limited by buildings and light sources in the area. Ben observed that we need to consider limiting our commitments keeping in mind distance involved, and that groups should be encouraged to attend our Caledon events. However, those who attended Northumberland last fall appeared willing to make that trip again. Jerry indicated November 9 appeared to be the best date for it. Our next Caledon date is March 9.
- Communications Committee and Website Maintenance—Glenn said he spent some time doing maintenance such as setting up Ben's contact information as the new Club Vice President. Jerry noted it took a lot of time to change things with the current configuration, especially the picture of the month. Adding comments to help people find things has helped. There has been much discussion on needs and approaches. Among the suggestions: we need to get an estimate of hours/month needed to be webmaster; we need to make it so different people can focus on updating different parts; and we need to have someone check updates before they go live. Glenn noted the committee needs to come up with some recommendations in March, particularly whether the Club should use a free or paid hosting option. Jerry said he would like the committee to provide a position before the meeting. On the Rac\_group status, Scott said he was running a trial of a Today in History feature for each day in February.

- RACLUB *StarGazer* Newsletter—Linda reported that the January quarterly issue was sent out and the next issue had been started.
- Potential New RAClub Meeting Location—We confirmed the plan to hold a trial meeting March 20 in the room available at the Heritage Center in the lower level of Maury School. Linda said directions and a reminder would be sent out on the Yahoo group prior to the normal meeting date.

## **News/New Business/Announcements**

- Jerry reported Astronomy Days this year are April 20 and October 13. The fall date might be opportune for viewing Comet ISON.
- Jerry was invited to speak at the 2013 Northeast Astro-Imaging Conference in New York on April 19. The topic chosen was “How Amateurs Can Generate and Use Professional Imaging Data.”

## **Next Meeting**

The next meeting is on Wednesday, March 20, 2013, at the Heritage Center in Fredericksburg. The change in day and location was made in January and affirmed at this meeting for a trial of the venue as a new meeting location. Members are encouraged to attend to see if the new location and day are desirable.