

Rappahannock Astronomy Club

Minutes, December 12, 2012, Meeting

In attendance:

- Terry Barker
- Bart & Linda Billard
- Don Clark
- George Clarke
- Leigh Gettier
- John Gray
- Glenn Holliday
- Jerry Hubbell
- Melvin McDaniel
- David Marlow
- Tim Plunkett
- Matt Roles

President Jerry Hubbell began the meeting at 7:00 p.m. Ten members and three visitors were present.

Presentation

Bart Billard presented an update on the NASA Kepler space telescope mission. The telescope was launched 3-1/2 years ago with a goal of collecting at least 14 quarters of stellar light-curve data on more than 100,000 stars to search for extra-solar planets (exoplanets). The minimum mission goal was recently achieved, and the mission received approval for an extension of 4 years. The telescope is in an Earth-following orbit around the Sun and was 42 million miles from Earth as of November. It monitors an area of 105 square degrees between Deneb and Vega a little above the plane of the Milky Way.

The Kepler telescope uses transit measurements, as opposed to radial velocity measurements, to discover exoplanets. In the radial velocity method, the unseen planet's gravitational effect on the host star causes the star to wobble in a small orbit of its own. With a favorable orientation of the planet's orbit, this wobble includes periods of motion toward and then away from Earth, and it can be detected by spectroscopic measurements of the Doppler shift. Because larger shifts result from more massive planets orbiting close to host stars, the radial velocity searches completed before Kepler's launch almost exclusively detected planets like Neptune and Jupiter in mass and in orbits mostly relatively close to their parent stars in the searches.

The Kepler telescope design allows it to search for transits—slight dimming of stars for periods of a few hours that result from planets in orbits that happen to pass in front of the host stars from Earth's point of view. To push the capability of finding extra solar planets beyond what was achieved by radial searches, Kepler is sensitive enough to detect these even for a planet of Earth size orbiting a star like the Sun. If these changes reoccur regularly, consistent with a potential planetary orbital period, candidate planets are identified.

Follow-up observations with ground-based telescopes can then be made to confirm whether an apparent transit signal is actually caused by an exoplanet. In some cases, a host star has more than one candidate, and these systems can be confirmed by careful observation of the timing of the transits for evidence of the gravitational influence of the planets on each other. One type of "false alarm" source that needs to be ruled out by follow-up observations on Kepler candidates is variations caused by background eclipsing binary star systems. These can mimic planet transits if they happen to lie behind a star monitored by Kepler. As of early December, Kepler has found 2,321 candidate planets and 2,165 eclipsing binary stars among the 150,000+ stars it is monitoring. While follow-up work has confirmed 105 planets, estimates suggest that as much as 90 percent of the candidates will eventually be confirmed.

The mission's discoveries to date include the first unquestionably rocky planet (beyond our solar system), the first multiple-transiting planet system, the first small planet in the habitable zone of a star, the first Earth-size planets, Mars-size planets, and the confirmation of a new class of double-star planetary systems. The results reported in two recently submitted papers have the potential of increasing the number of confirmed Kepler planetary systems to 67, with more than half of these systems containing

more than 1 planet. Nearly half of the candidate planets are Neptune size (2–6 times Earth's size), and nearly 700 are super-Earth size (1.25–2 times Earth's size). There are 246 in the Earth size range, 210 in the Jupiter size range (6–15 times Earth's size), and 71 larger planet candidates. Of 46 candidate planets found in the habitable zone, where liquid water could exist, 10 are Earth sized.

Among systems with unexpectedly small orbits, the first included six candidate planets, all with orbits that would fit inside Venus's. In a recently discovered system with three planets smaller than Earth orbiting a red dwarf 1/6 the size of the Sun, all the orbits take less than 2 days. Kepler-16b is the first planet known to definitively orbit two stars—what's called a circumbinary planet. Kepler has also found circumbinary systems, more than one planet orbiting a double star. The Planet Hunters project has citizen scientists examining Kepler data to see what human pattern recognition capabilities might find that automated data analysis used by the Kepler team might miss. Planet Hunters have found some candidates, and they recently had their first confirmation: a planet orbiting a binary star system that is in turn orbited by another distant binary.

Old Business

- Treasurer's Report—Tim reported two dues payments for next year and the donation from Northumberland Preservation, Inc. balanced by slightly more in expenditures for picnic supplies and expenses for pizza and drinks at the election meeting. The number of members for 2012 remains at 38, and 8 members have paid dues for next year (1 has paid dues for the next 2 years).
- Star Parties, Events, and Meetings—The star party scheduled for Caledon on December 8 was cancelled because of the poor conditions forecast for the event.
- Hobby Town USA—Glenn stopped at the hobby shop to leave the Club flyers and said they seemed excited to have them. He reported they have three different low-end Celestron telescopes on display, but he has not asked about whether they can order other models.
- Status of Club Loaner Equipment—Matt returned the Sky View telescope, and Glenn got a measurement on the shaft. He asked about suggestions for a source for replacement knobs. Jerry and Bart suggested McMaster-Carr. Glenn reported that the Meade Infinity telescope that was offered previously as a possible donation to the Club was sold by the time he asked about it again.
- Scheduled Star Parties and Outreach Events—The outreach for Post Oak Middle School was scheduled for 4:00 to 6:30 p.m. on December 15, with the Belmont star party scheduled for the same evening not very far away. A number of volunteers were interested in offering to take equipment to show and talk about astronomy in the event the weather forecast was marginal (clouds, but not rain or snow). The Library requested a presentation for a children's outreach program in January. Linda and Jerry were working on a presentation about constellations, and said the Library would organize an activity. Most of the children would probably be in the kindergarten to third grade range.
- Recently Completed Astronomy Presentation—David Abbou provided several presentations on constellations, observational astronomy, and the space program for the Park Ridge Elementary School "All-Star Literacy Night" on November 29. He mentioned the Club during the presentations, which had an audience of about 50 students and teachers.
- Web Site Maintenance—Jerry repeated the need for someone to take on maintenance of the Club website. Glenn said he would have more time to devote to maintenance once his term as Vice President ends. Terry Barker said he has some experience using WordPress. Jerry asked Linda Billard, Don Clark, and Glenn Holliday (along with Scott Busby who was not present) to form a committee and assess the RAClub.org website in relation to the Yahoo RAC_GROUP and the *StarGazer* newsletter and report back with recommendations for updating the design.
- RACLUB *StarGazer* Newsletter—Linda said she had enough material for this quarter, but is still looking for more material to add or use later. She said she would interview Leigh for an article and would give Jerry material for another topic they were planning to cover. Linda said Scott wrote an article on his observatory adventure that would be the lead article for the third edition. Don asked whether the *StarGazer* could be sent to organizations such as schools where it could be distributed if useful for some astronomy program or activity.

News/New Business

- Star Party Requests and 2013 Schedule—Jerry said there were several star party requests for the coming year. Glenn and Leigh said they were getting the information transferred. They were working on another format for two files that would not open for Leigh. Jerry asked about whether it would be less confusing to omit the Belmont members-only events from the public announcements on raclub.org. There did not seem to be any objection to limiting the announcements to the group list instead of putting them on the public website.
- Astronomy Presentation Status—Jerry said there were a couple of requests pending that could be discussed as their respective dates get closer.
- Discussion on Possible New RAClub Meeting Location—Linda reported on a possible meeting location she found out about as a result of her volunteer work for the Rappahannock Heritage Center, which maintains a historical document repository. She showed photos of the meeting space they have in the lower level of Maury School. Based on her relationship with them, they are willing to let the Club use the space for no charge. It would involve a change in meeting night because the room is already in use on the second Wednesday of each month. Other Wednesdays are available as are other nights. Parking would be available, and the Club would not have to cut meetings short to be out by 9:00 p.m. Linda said she mentioned the possibility of the Club making a one-time donation, but that it was not a requirement on the part of the Heritage Center. Jerry asked members to start thinking about whether it would be a good idea to move the meeting date in order to use this location.

Next Meeting

The next meeting is on Wednesday, January 9, 2013, at the Central Rappahannock Regional Library Headquarters, 1201 Caroline St., in Fredericksburg.