

Rappahannock Astronomy Club

Minutes, June 19, 2013, Meeting

In attendance:

- Benjamin Ashley
- Terry Barker
- Bart & Linda Billard
- Don Clark
- Joe Fordham
- Joe Francis
- Glenn Holliday
- Jerry Hubbell
- Melvin McDaniel
- Javier & Ruby Valverde

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President Jerry Hubbell began the meeting shortly after 7:00 p.m. Twelve members were present.

Program

Joe Francis presented “Neutron Stars” this evening. He noted he had presented some other stellar evolution topics (black holes and supernovae) in part to have motivation for learning about the subject in more depth. Joe said that in the short time since those earlier presentations his research for this one uncovered new information calling for revisions of some things he said earlier.

Neutron stars are one type of supernova remnant. Their composition is about 90 percent neutrons at extremely high temperature, up to a trillion degrees. Basically the pressure supporting them against gravitational collapse is the result of a quantum mechanical effect of the allowable states of the neutrons called “quantum degeneracy pressure.” Neutron stars are about 1.4 to 3.2 solar masses and are only about 12 kilometers in radius. The density is equivalent to about a billion tons in a teaspoon. Because neutron stars are so small compared with the cores of the stars they come from, rotation speeds as high as 716 revolutions per second have been detected.

Joe said for a star in a range of 4–8 times the mass of the Sun, the fusion process in the core reaches the stage of forming iron 56, which cannot fuse with any other element or split without absorbing energy. It is bad news for the star when fuel to maintain the pressure that balances gravity thus starts running out. When the iron in the core builds up to about 1.8 solar masses, the star’s core suddenly collapses, with the outer parts first falling in then bouncing back to form a supernova explosion. Joe said these explosions are so energetic that heavier elements than iron are formed from some of the gravitational energy released in the collapse. In the collapsing core, protons combine with electrons to form neutrons.

Joe told us a second mechanism for forming neutron stars. He said white dwarfs that accrete matter from a companion star and reach 1.38 solar mass form type Ia supernovae and leave behind a neutron star. Joe also mentioned he found a new type of supernova is now being recognized involving stars of more than 130 solar masses. The collapse starts when oxygen fuses, and it is so energetic that nothing is left behind in the core.

Because higher mass stars are rarer, Joe told us estimates indicate only 1 in a 1,000 stars in our galaxy is a neutron star, however, only 2,000 of the estimated 100,000,000 are known. Most are radio pulsars. From their starting temperatures around a trillion degrees, they are still many thousands of degrees after several billion years. Joe was asked what they emit and said he thought they emit energetic x-rays (Glenn did a search that confirmed this recollection). Some neutron stars move at high speeds, up to 1,500 kilometers per second, which has scientists puzzled about what mechanism can accelerate so much mass.

Joe discussed exotic phenomena associated with neutron stars. Pulsars result when their high magnetic fields are not aligned with their rotation axis and the rotation moved the field rapidly enough to produce a

beam of radio emission that sweeps across us. The brightest produce radiation at all wavelengths. The energy radiated eventually slows down the rotation rate. Bart asked if we mostly see only neutron stars that are pulsars for us. Joe said that most of the known neutron stars are pulsars. Some neutron stars have extremely strong magnetic fields and are called magnetars. A typical pulsar's field strength is of order 1 trillion Gauss. Atoms in such fields are cylindrical in shape. Magnetars have fields 1,000 times stronger and produce weird effects, including splitting photons apart. Scientists are uncertain about the mechanism of formation of the high magnetic fields.

Joe concluded with guesses about what eventually happens to neutron stars. Possibilities include pairs of them merging into a black hole or one with a stellar companion accreting enough matter to collapse to a black hole. Some may cool off until they are no longer visible, and some may fly off at high velocity. There are some ideas that two neutron stars colliding could form gold or other heavy elements.

Old Business

- **Treasurer's Report**—Tim Plunkett said he had only the purchase of the projector to report for last month. There were no dues payments he was aware of—he asked anyone who might have paid dues to let him know. Jerry commented that the balance was still enough for an equipment purchase and asked members to consider possibilities to suggest. One suggestion was handouts. Linda already had printed copies of the club brochure for the Friday outreach. Terry suggested making copies of one of the sky maps one can download as a handout: The white space could be used to provide contact information for the club. Another suggestion was T-shirts to wear at outreach events (Comet ISON or the National Mall event were examples), hand out to new members, or sell at events. Joe suggested the club could get a go-to Dobsonian of around 14 inches aperture (someone said not so big you need a ladder) as an attraction for star parties and outreach events. Ben said some large Obsession Dobs are sold online for ridiculously low prices. Terry suggested a video eyepiece camera to put views on screen for visitors.
- **Status of Club Loaner Equipment**—Ben had no changes to report for the status of loaner equipment.
- **Star Parties, Events, and Meetings**—Bart and Linda were the only ones to go to Caledon for the May star party attempt. The forecast changed for the worse about the time they were leaving the house, and a call from Melvin let them know after they were on the way. Bart and Linda went early to try to use the club webcam with the NexStar, which has a solar filter, on the Sun. They wound up getting some experience setting up for imaging the Sun before clouds obscured it, and they also enjoyed the picnic supper they took with them. Sammy and his wife stopped to talk on their way into town and were thus aware Linda and Bart were likely to give up after eating.

Jerry gave a talk about his book to the Richmond Astronomical Society in April and sold four books. The next outreach date was May 17 at Post Oak Middle School. The next Caledon dates were June 1 and June 29. The June club meeting at Maury School is June 19. The Northumberland Preservation, Inc. outreach is tentatively set for November 19. Ben said he would like to encourage more groups asking for outreach events to come to Caledon as various Scout groups have done. Jerry told us of an invitation to the club to participate in the Astronomy Festival on the National Mall on June 14 (June 15 backup). The event has had 4,000 to 5,000 people come in past years. Jerry said he and Linda and Bart planned to go and other members were welcome. Interested members are asked to email him. He mentioned the need to get the Personal Solar Telescope from Glenn to use at the event.
- **Communications Committee Report**—Terry said that the template had been selected and he had started work on the implementation in WordPress. The prototype can be viewed at teebark.com/rac. He showed the image of the template to members. One thing to think about was the wide format of the image of the month example. It was not clear cropping would be possible for all images to match the format. Scott suggested a rotating set of images with one highlighted and one on each side as thumbnails. Jerry and Terry talked about the timeline for getting a basic structure going toward fall, with some decisions pending for how much content to include, and having it ready to go up by the end of the year. Linda concurred with that goal. The template chosen is supposed to be “responsive” (makes it look good on other platforms such as smart phones), and Terry has confirmed it seems to be working. Scott was not present to report on the Yahoo Group status. Jerry said he is doing minimal maintenance on the RAClub.org site. Linda would be the editor for the new site. Linda reported on the StarGazer newsletter status. The recent issue was the fourth newsletter released. Linda still wants

people to suggest ideas—suggestions are sufficient (interest in writing the article is welcome but not required). She suggested Joe should think about an article about binoculars. Similarly, members should think about things they are doing that we could let others know about. Linda said Bart is going to do a couple of short book reviews—other members could do book reviews, too. Jerry also asked members to keep in mind getting some group photos at events. They could accompany articles about the events.

News/New Business/Announcements

- Upcoming Star Parties and Outreach Requests—Jerry mentioned the Astronomy Festival on the National Mall on June 14, which he discussed earlier in the evening. Scott said he remembered seeing something about the Washington Monument being scheduled to be lit up soon. Ben said Astronomy Day in the fall coincides with Observe the Moon Day; an old request from Wilderness Elementary asks us to do something for them on that date. We discussed the need to work out some details for a Comet ISON event: what direction we would be looking and an appropriate date and location. Should we try Pratt Park?
- Jerry announced that Astronomy FM would interview him on a May 22 show at 9:00 p.m. He said he would talk about his book and our club.

Next Meeting

The next meeting is on Wednesday, July 17, 2013, at the Heritage Center in Fredericksburg.