

ORION Trapezium

March 2017 Volume 44, Issue 3



Who are we?

ORION was founded in April 1974, by a group of scientists at the United States Department of Energy facilities in Oak Ridge, Tennessee. Our original goal was to perform correlated, instrumented observations of atmospheric and astrophysical phenomena. Since then, we have expanded in many directions, including optical and radio astronomy and instrument design.

What's Inside

March 2017 Meeting and Program	2
February 2017 Speaker	3
President's Perspective	4
TAO Events	9
Outreach and Education	10
Parting Shots	13
About ORION	14

Future Events

ORION Meeting

Wednesday, March 15, 2017
1900 hours (7 pm)
The Historic Grove Theater
Randolph Road
Grove Center, Oak Ridge

TAO Public Stargazes

Saturday, March 18, 2017
Saturday, April 1, 2017
Roane State Community College
Tamke-Allan Observatory (TAO)
7:30 pm to 12:00 am
8:00 pm program

TAO Notes

ORION people are invited to arrive early (when announced on email) to prepare for evening viewing. Bring a telescope, red flashlight and munchies.

First time visitors – drive out before dark. Map available at www.roanestate.edu/obs.visit.htm

March 2017 Meeting and Program

Speaker



Roy Morrow, Ph.D

Presentation Title

The Trappist Exoplanets- An Interactive Presentation

Abstract

On February 22, NASA announced their telescope revealed the largest number of Earth-size habitable zone planets around a single star. This announcement created a flurry of national newscasts and newspaper headlines. Astrophysicists speculate that all seven planets are rocky and could contain water in some form. The star is a low surface temperature red dwarf and the orbits of the seven rocky planets would all fit inside Mercury's orbit. The first two planets were discovered by a modest 24 inch Belgian robotic telescope called Trappist-1 located in the Atacama Desert. NASA then pointed the Spitzer Space telescope at the red dwarf and found 5 more planets. The Kepler telescope will be repositioned to study these planets in detail.

For this presentation I will take an approach different from past talks. This presentation will be interactive with the audience taking an active part. The slides will be structured to encourage questions. So please do not sit in the back row! Go and read the NASA data and image releases about the Trappist system so you can add to the discussion. This will be a learning experience for all of us!

Speaker Bio

Roy Morrow is a retired Ph.D. analytical chemist and has been active in astronomy since the 10th grade! He initially wanted to pursue a career in astronomy, but then learned the job market was much better in chemistry! Roy has observatories at his home in Tellico Village and at the Arizona Sky Village.

February 2017 Speaker

Dr. Ted Stryk of Roane State College presented an incredibly interesting talk titled “Searching for a Gem: Exploring Planetary Images Old and New.” Dr. Stryk was asked by NASA to join the New Horizons Missions Encounter Team at the Johns Hopkins Applied Physics Lab. He had previously demonstrated the image processing skills to extract data from old NASA missions’ analog images that revealed previously unnoticed but useful information. These skills were greatly needed to improve the quality of the Pluto and Charon images. Since New Horizons was a fly-by mission there was no opportunity to image the areas again under the same conditions.

Dr. Stryk has been an amateur astronomer for many years and served as an intern at Bays Mountain Planetarium. He is now an Associate Professor in the Philosophy and English Department



Dr. Stryk describes some enhanced Venus images from the Russian Venera spacecraft. The Venera landers obtained the only images of the Venuvian surface.



Ted got mugged by Pres. Fields. The ORION coffee mug is owned by few but coveted by many!

ORION President's Perspective: March 2017 David Fields The usefulness of small satellites for performing research

Earth's moon is rather distant – about 2 light second away -- but it provides a possible platform for space-related research (Figure 1). Closer moons would be very useful – and now we have them! It is now possible for small groups of people to design and have launched their own satellites. Small Satellites called Cubesats can be as small as 4"x4"x4" cube and even smaller. They can potentially be deployed in the Low Earth Orbit (LEO) zone or far above, and provide platforms for economically testing concepts and performing research tasks. Microelectronic and highly redundant radiation-hardened circuitry, advanced communication protocols, and the possibility for maneuvering via interactions with gravitational, as well as static and dynamic electromagnetic fields/fluxes provide a wide trade space of possibilities.

Figure 2 shows one small satellite, the size of (2) Cubesats. The cost per launch is nominally about \$, 00, 000 but launched with larger satellites, \$0, 000, 000 or more... much less.



Figure 1 Earth's moon is rather distant for a research platform – about 1 light second distant.

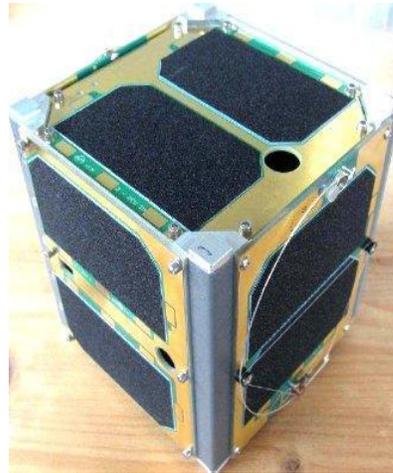


Figure 2 Small satellites can be much closer to Earth than the moon. This satellite is 4"x4"x8" and can be only 0.5 light milliseconds distant.

Small satellites can perform research that supports knowledge of distant planets. Two areas are (1) discovery and examination of planets with magnetic fields and (2) investigation of the potential for light-powered spacecraft.

Studying Planets with Magnetic Fields

Planets with Magnetic Fields generate radio waves while interacting with nearby moons or the solar wind. This interesting branch of radio astronomy has areas of study that cannot be pursued from the earth's surface. Not only does earth generate significant electromagnetic noise, but many of the frequencies of interest do not penetrate our ionosphere.

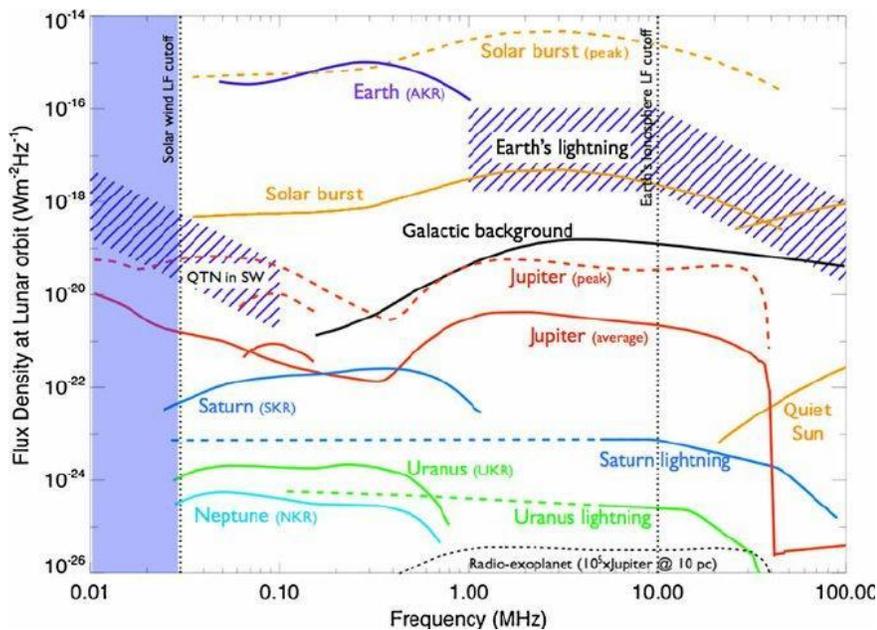


Figure 3 Radio flux in space (lunar orbit) from various sources.

The above Figure 3 shows the energy from other planets, that we could detect from an orbiting satellite. If we place our antennas outside Earth's ionosphere, then we more readily can detect and can study these signals. I choose this plot because it shows, at the bottom, what might be the signals from giant Jupiter-like planets at about 31 Light years distant.

Light-Powered Spacecraft -- Application for Interstellar Research

Light-Propelled Spacecraft are likely to be the first interstellar craft developed by our civilization. Launched and propelled (for part of the journey) by powerful lasers, they will require much research to attain the necessary capabilities. Project Starshot (Figure 4) was funded 2y ago to work toward this capability – anyone interested might want to attend the Tennessee Valley Interstellar Workshop in October, in Huntsville, AL. See www.tviw.us or ask me for information.



Figure 4 Project Starshot is studying LASER control of light-sails.

Our planet has built and tested no LASER-propelled spacecraft. There is a significant amount of work that needs to be done, and some of this can be done using small satellites.

Thus this research frontier shares with radio astronomy, the possibility of using small satellites as a tool.

Light-Propelled Spacecraft: Application for Research and Threat-Prediction in our Solar System

Solar-propelled light sails will be used to study the space environment and protect the earth from threats. Among these threats are solar Coronal Mass Ejections (CMEs) and climate change. This figure shows a typical path of a CME. The important thing to note is that the path is twisted by the sun's rotating magnetic field, and prediction of the arrival of a CME on Earth is difficult. Small solar sails in space can provide early warning of these solar plasmas.

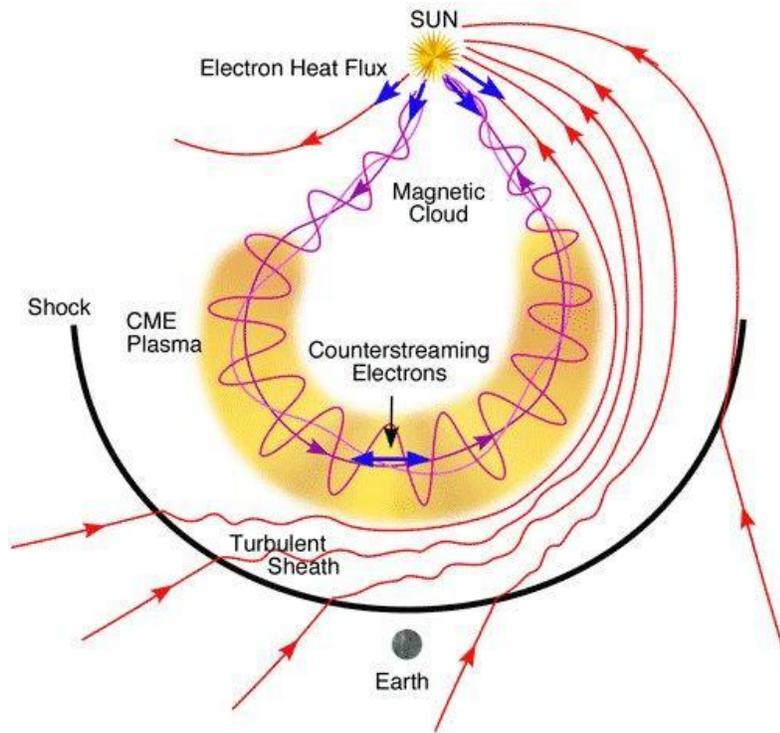


Figure 5 Coronal Mass Ejections are difficult to Predict.

However, our civilization has launched no LASER-powered sail, and only one successful solar sail. There is a lot of work to be done with small satellites to develop launch, sail deployment, navigation, and multi-satellite coordination. Again – we need to learn to use these tools.

Summary

Look back to Figure 2. Satellites such as this are being launched at a rate of over 100 per year -- the following plot (Figure 7) omits several of the recent small research satellites.

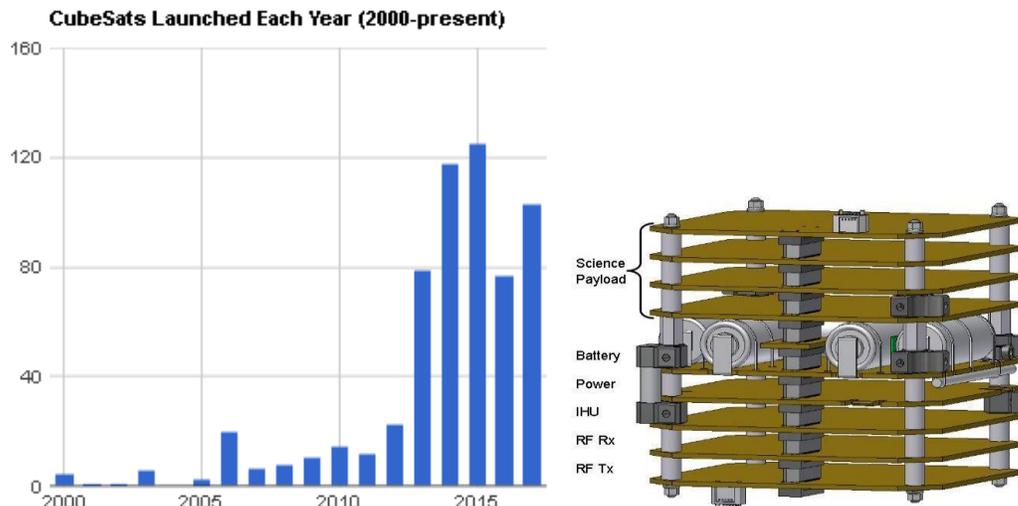


Figure 6 Modular construction of Fox-1 CubeSat, of size 4"x4"x4" and mass under 1Kg.

Figure 7 Yearly launch of CubeSats (omitting some recent research satellites)

Figure 6 shows the internal construction of a typical CubeSat. This relatively simple approach makes CubeSats available for many research efforts, and the opportunities to contribute to space-based research are considerable. This particular CubeSat is of the FOX-1 design, which serves several different users. The top three panels are reserved for scientific experiments.

Who in ORION can think of a research challenge that might be worth pursuing? Who is interesting in participating in monitoring or building satellites? Lightsails and VLF radio research are two possibilities.

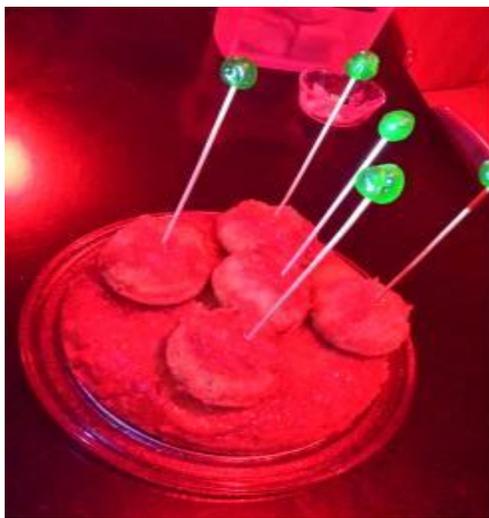
TAO Events

TAO Public Stargaze February 4



Djerdj Sardanov
provided this picture
of the February 4
Family night
attendees

Well, once again the clouds won on February 18 family night. A few braved the cold (including rain and clouds) to meet at TAO. The attendees were sparse, but the interest was high. Jim Long again provided an alien cake that generated some spectroscopy interest



The alien cake is natural color when illuminated with white light but red under the red light—EXCEPT for the green cherries on the stalks!. Note the red cherries on the cake have disappeared in red light. So this is how bored astronomers can find scientific things to do on a cloudy night.



Dave Rauen and Billie Elaine Grove drove from Spencer, TN to visit TAO on February 18. Dave is an engineer who worked in Detroit and now is pursuing a long-held interest in astronomy. Billie is a Van Buren county native. They were invited to return on a clear night (there must be one sometime in the future)

Outreach and Education

Many area astronomers are members more than one of the local clubs. On Saturday, February 25, some 20 astronomers and telescopes showed up on Roger Lane's driveway. Suzanne Lane and visitors provided munchies, inebriants and lots of astronomy talk. Astronomers from Knoxville Observers, Orion, SMAS and The Tellico Astronomers all enjoyed the event and the dark skies over Roger's house. As a good outreach measure, Roger invited all of his neighbors.

Roger wrote in an email to attendees and neighbors:

I want to thank all of you for coming out last night and making the first Knoxville Observers "driveway astronomy" event a success. It looks like we had around 12 scopes set up with 2-3 taking photos. I am anxious to see the finished products...and so are some of my neighbors. I am still in shock that a Saturday night event was planned and the weather and seeing conditions improved as we approached time to set up, albeit cold. I hope everyone had a good time! I would love to do this again in the fall....or sooner! With a little neighborly cooperation we pulled off a reasonably dark sky in the middle of the subdivision. I'm also copying you on the email I sent to the neighbors. It's a plus to keep them on my good side.

Pamela Whitfield and Djerdj Sardanov set up astroimaging gear in Roger's driveway and demonstrated that quality images can be captured without traveling to remote dark sky sites. Their equipment is high quality, but quite portable, and can be powered from a rechargeable power pack (although Pam did use an extension cord).

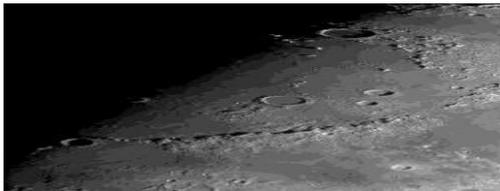


Pam Whitfield's image shows the beautiful Flame Nebula, NGC 2024 and the Horsehead B33. While the Flame is an emission nebula with dust lanes, the Horsehead appears only as a silhouette blocking the light from behind. It appears as a dark area looking like a horse's head in the upper right. The bright star adjacent to the flame is Alnitak, the last star in Orion's sword. Pam uses an Explore Scientific APO refractor and a CCD camera.



Djerdj Sardanov captured this detailed image from Roger Lane's driveway on February 25. George uses an Explore Scientific Maksutov-Newtonian telescope and a very high quality Sony DSLR camera.

M81 and M82 are two interacting galaxies in Ursa Major. M82 on the left, aka the Cigar, is a starburst galaxy with massive star formation occurring. M82 has collided with M81 resulting in the star-forming activity and its strange shape. M82 retained most of its spiral structure but as the two move toward a second collision, who knows what things may look like. The two will likely merge sometime in the future.



This lunar image from George Sardanov is very high quality and I could not resist including it in this month's Trapzeium (not from Roger's driveway)

This image of the flooded Mare Imbrium impact basin is from Djerdj Sardanov. This high resolution image shows many flooded craters internal to the Imbrium structure and indicates the flooding occurred after the massive basin had formed and after the other large internal craters. There is a nicely formed crater with a central rebound peak about half way on the right side. This must be a crater that formed after the Imbrium structure flooded.

George Writes: Mare Imbrium or "Sea of Rains" - The Apollo 15 landed near the gap in the mountains that were formed as a result of an asteroid impact on the Moon. The big crater in the middle is Archimedes and the one to the right is Plato. The picture is a stack of the best 250 from a 30sec video

Parting Shots

OK HERE IS ONE MORE.

We have all been watching Venus and Mars in the Western horizon. This image is from Vicente Diaz a SMAS member. He uses a Meade SCT and a DSLR camera. Everyone possessing a telescope should gather friends and neighbors to see this planet in the crescent phase.



Vicente Writes: Let me join on the Venus craze and like Duane and Lee I find it absolutely beautiful! At the beginning of the month, the pairing of our two closest planets was a pretty sight and still is. I also took a photo of the crescent Venus (attached) and **had two of my grand-kids look thru the scope**; they were fascinated by "the little Moon". I will try to get another photo of Venus at the beginning of March as it shrinks into a thin crescent but I may have to take the photo in daylight as the roof of the observatory blocks my western view.

About ORION

ORION is an amateur science and astronomy club centered in Oak Ridge, TN that was founded in April 1974 by a group of scientists at the United States Department of Energy facility in Oak Ridge, Tennessee. We serve Oak Ridge, Knoxville, and the counties of Anderson, Knox, and Roane.

ORION's mission is to support science research, teaching, and amateur astronomy in East Tennessee, and therefore we are closely associated with and support TAO by volunteering to host their public events, share our knowledge of the skies with a variety of telescopes, and help provide intellectually stimulating programs at the observatory. ORION works to share the wonders of the cosmos and the culture of science to people from all walks of life.

Members are scientists, engineers, technicians, and others with varied talents and expertise. Over half have telescopes, many are amateur radio operators, and some have a technical interest in astrophotography.

ORION has working relationships with several organizations, including museums and amateur astronomy groups.

Membership is open to individuals who will actively contribute their time and ideas. Our annual membership dues are \$20.00 and student discounts are available.

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