



SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

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Planning the Planets

by Dr. John Boardman

From the April 2017 issue of DAGON, used by permission

Are there other habitable planets out there? And, if there are, can we get to any of them, and how long is it likely to take? The answers to those questions have changed as our knowledge develops about how planets are formed, how they develop, and how fast we'll be able to travel through space.

When I first began to read popularized books about astronomy, many of their authors seemed to think that planets were formed when two stars approached each other very closely, exerting such a strong gravitational attraction on each other that they pulled material out of each other, and that this hot, gaseous material then solidified and formed solid particles that orbited them. Since stars only rarely approach each other that closely, such events would be very rare, and therefore planetary systems should be very rare. This concept foundered when a Russian astronomer proved that the very hot, gaseous material, that would be pulled out of stars in such a manner, would not solidify, but would just dissipate in space.

It is now considered by astronomers that, as stars are formed by condensation out of interstellar matter by its mutual gravitational attraction, some particles rotate so fast around this proto-star that they do not become part of the star, but condense into much smaller, solid bodies. So much matter becomes part of the star (or, in many cases, stars) that pressures and temperatures at its core increase to the point where light atoms fuse into heavier atoms, thus making the star shine. But the smaller bodies in orbit around the proto-star do not get that hot, and instead solidify into planets.

Astronomers were then of the opinion that many planetary systems could exist, but that they could not be seen from Earth because the stars they orbited were so bright that planets could not be seen in their glare. Then evidence of planets by other means were sought. Gravitational evidence of planets could be determined by their minute influences on the motions of the much larger stars which they orbit. A slight but regular-dimming of a star indicated that it was caused by a planet orbiting around that star and slightly dimming its light each time it passed in front of the star. By such means, estimations could be made of the planet's period, its size, and its distance from its star. This has led to the compilation of the Exoplanet Catalog, which now lists over 3,400 planets orbiting stars other than our Sun.

The star nearest to our Sun is actually a triple star system, Alpha Centauri, at a distance of 4.24 light years. (This is the distance light would travel in 4.24 years. One light year is about ten trillion kilometers, or six trillion miles.) The brightest of these three stars, Alpha Centauri A, is like our Sun a yellow star, somewhat larger and brighter than the Sun. Alpha Centauri B is a little smaller and fainter than the Sun. Alpha Centauri C is a much smaller and fainter red dwarf star, usually called "Proxima Centauri" or just "Proxima", Latin for "nearest", since it is by a small amount slightly nearer to the Sun than the other two Alpha Centauri stars. The Alpha Centauri system, which appears to the unaided eye as a single star, is the third brightest star in Earth's night sky. It is too far south to be seen from north of about 30° N latitude. Medieval Arabian astronomers named it Rigel Kentaurus, "Foot of the Centaur", for its position in that constellation.

Proxima is known to have at least one planet, about the size of our Earth. It would have to be quite near to Proxima, a cool red dwarf star, in order to have a climate warm enough to support life, since liquid water would be necessary for life to appear there.

There has recently been discovered another star, which has at least seven planets. It is also a red dwarf, the most common sort of star in the universe. That type of star is also the easiest to search for planets, since it is small and thus more likely to be affected by their much smaller gravitational fields. This star had been given the cumbersome and uninformative name "Trappist-1", for the Chilean telescope used in its discovery.

The fact that a Chilean telescope was used indicates that Trappist-1, like Alpha Centauri, is too far south in the sky for an American telescope to be useful. And Trappist-1 is about 40 light years away, which means that even if one of its planets is home to a technological civilization, messages to it would require 40 years to get there, and another 40 years for a reply. And we have no reason at all to believe that the velocity of light can be exceeded by any means whatsoever.



Guest Editorial

Kepler Data on TRAPPIST-1 Coming Online

by Paul Gilster, *Centauri Dreams*

K2 Campaign 12 is an observational window that comes at the right time. Operating as the K2 mission, the Kepler spacecraft collected data from December 15, 2016 to March 4 of this year on the TRAPPIST-1 system. With seven planets, at least six of them likely to be rocky worlds, TRAPPIST-1 is suddenly high on everyone's target list for future observation. The new Kepler data are a key part of this, as Geert Barentsen, K2 research scientist at NASA's Ames Research Center at Moffett Field, California, explains:

Scientists and enthusiasts around the world are invested in learning everything they can about these Earth-size worlds. Providing the K2 raw data as quickly as possible was a priority to give investigators an early look so they could best define their follow-up research plans. We're thrilled that this will also allow the public to witness the process of discovery.

The raw cadence data — 'cadence' refers to the time between observations of the same target — are available from the archive at MAST. Note that these are raw data files, absent any vetting or processing. Data that have been put through this process will be available some time in June. On the NASA Kepler & K2 site, Barentsen described the use of the data this way:

While we recommend that scientists only use the pipeline-processed data products in journal papers, we do encourage our community to share their understanding of the raw data with the public by blogging or tweeting tutorials and analyses. This public TRAPPIST-1 data set offers a unique opportunity to let a wider audience witness the process [of] scientific discovery.

Meanwhile, the raw, uncalibrated data are intended as an aid to astronomers as they prepare proposals due this month for further investigations of TRAPPIST-1 by telescopes on Earth. Needless to say, the data gathered here, once refined and fully examined, will also factor into observations of the TRAPPIST-1 planets by the James Webb Space Telescope.

K2 Campaign 12 offers 74 days of monitoring, the longest, nearly continuous set of observations of the star yet, and as this NASA news release explains, the data give us the chance to refine earlier measurements of the TRAPPIST-1 planets, refine the orbit and mass of the

seventh planet (TRAPPIST-1h), and delve into the magnetic activity of the host star.

The preparation for this observing run began in May of 2016, when the discovery of the first three planets in the system was announced. The Kepler spacecraft's operating system was then tweaked to make needed pointing adjustments for Campaign 12. A good bit of serendipity went into the observations, for the original coordinates for Campaign 12 were set in October of 2015 before the TRAPPIST-1 planets were known. Had the exoplanet discovery not occurred when it did, Campaign 12 might have missed the system entirely.

"We were lucky that the K2 mission was able to observe TRAPPIST-1. The observing field for Campaign 12 was set when the discovery of the first planets orbiting TRAPPIST-1 was announced, and the science community had already submitted proposals for specific targets of interest in that field," said Michael Haas, science office director for the Kepler and K2 missions at Ames. "The unexpected opportunity to further study the TRAPPIST-1 system was quickly recognized and the agility of the K2 team and science community prevailed once again." Another indication of the importance of the TRAPPIST-1 planets, and the likelihood that atmospheres here will be among the first investigated as we begin the search for biomarkers.

Disclaimer: *The opinions expressed in editorials are those of the individual authors, and do not necessarily reflect the position of The SETI League, Inc., its Trustees, officers, Advisory Board, members, donors, or commercial sponsors.* ❖



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Minutes of the Twenty-Third Annual Membership Meeting

22 April 2017, Eventide Inc., Little Ferry, NJ
(adjacent to SETI League Headquarters)

- **Call to Order**

The meeting was convened at 13:03 hours EDT at Eventide Inc. (adjacent to SETI League Headquarters) in Little Ferry NJ, by Executive Director Emeritus Dr. H. Paul Shuch. Five SETI League members in good standing are present. The SETI League currently has 121 members in good standing. Our Bylaws requiring one percent of the current membership to be in attendance for the conduct of SETI League business, the attendees represent a quorum.

- **Minutes of 2016 Membership Meeting**

The Minutes of the 2016 Membership Meeting having been previously posted to The SETI League's World Wide Web site, a motion was passed to accept the minutes as posted.

- **Treasurer's Report**

Developed jointly by Dr. Shuch and Secretary/Treasurer Heather Wood, covering the calendar year 2016 (as e-filed).

1. Revenues: Dues and Contributions \$19,728; Interest Income \$0; Total \$19,728.
2. Expenses: Educational/Scientific Programs \$10,579; Management/General \$2,431; Fundraising \$960; Total \$13,970.
3. Revenues minus Expenses: \$5,758.
4. End of 2016, SETI League account balances equalled \$9,503. 2016 beginning net assets \$3,845.
5. 2016 Budget: Projected Revenues \$15,000; Program Expenses \$12,000; Management/General Expenses \$2,000; Fundraising Expenses \$1,000; Total Expenses \$15,000; Projected excess \$0; Projected Ending Balance \$9,603.
6. This report was accepted by those present.

- **Executive Director's Report**

During 2016, the Executive Director:

1. published four issues of *SearchLites*, the quarterly newsletter of The SETI League, Inc.
2. gave SETI public lectures and/or concerts in Sebring FL, Baltimore MD, and Cherry Hill NJ.
3. performed 52 weekly updates of The SETI League website

4. posted roughly 100 photos, plus numerous links and comments, to The SETI League Facebook page
5. issued one press release and conducted several press interviews
6. served as co-chair and webmaster for the IAA SETI Permanent Committee
7. responded to several dozen email and telephone inquiries from members and prospective members.
8. collected modest SETI book royalties, which he contributed to The SETI League.

- **Committee Reports**

Membership

Elisabeth Pioletat, volunteer Regional Coordinator for France, emailed her annual report, which was read into the record by executive director H. Paul Shuch.

EME Committee

Report by SETI League president and station trustee Richard Factor. The EME beacon remains off the air following Mr. Factor's relocation to Arizona. He states that relocation of the beacon station to his new residence is impractical. Thus, future EME activities are suspended indefinitely. However, his new location is an ideal site for Optical SETI observations, he has nearby neighbors with optical observatories, and he contemplates OSETI activities from his residence in the future.

OSETI Committee

Member Bill Kitchen reports on his new Celestron 13" optical telescope, which he believes will be useful for Optical SETI activities, and opines that Sedona AZ will be an ideal location from which to observe.

Awards Committee

Awards Committee chairman David Ocame being absent, report provided by Dr. Shuch. There were no Giordano Bruno Awards or Orville N. Greene Awards presented for contributions during 2016, due to a lack of nominations. Nominations during 2017 will be solicited. Twelve websites have been given the

SETI SuperStar award this year. More nominations are requested from the members. Paul will note this in the next issue of *SearchLites*.

- **Old Business**

1. **Very Small Array**

Dr. Shuch reports that the project remains on hold, due to lack of funding, with no progress to report since last year. However, a photojournalist from the UK has chosen the VSA as the backdrop for a photo essay about citizen science, to be shot early next month.

2. **Mid-Year Renewal Letter**

Last May, Ms. Wood emailed a mid-year appeal to lapsed members, which generated three responses. The November renewal letter generated a few more renewals of lapsed members. These mailings will continue for 2017.

3. **Annual Report**

No report was published either this year or last. Mr. Factor recommends that, instead of a full report, annual status updates be posted to the Website, and published in *SearchLites*.

4. **Web Server**

Mr. Factor reports that the website is functioning well, and now supports File Transfer Protocol. We continue to use a commercial email service for official SETI League communications.

- **New Business**

- **Interstellar Beacon**

Mr. Kitchen reports in some detail about a new 501(c)(3) nonprofit organization he has established for the express purpose of optical transmissions into space, as a virtual (digital) backup of Planet Earth. He urges SETI League involvement.

- **Next Meeting**

The next Annual Meeting will be held on Sunday 22 April 2018. The date has been verified as not in conflict with Easter, Passover, or US tax season. The meeting will be at Eventide, Inc. at 1300 hours EDT, to be followed immediately by the Board of Trustees meeting. The date and time will be announced to the membership via the website and newsletter.

- **Good and Welfare**

- The SETI League's Facebook page www.facebook.com/setileague has (as of this morning) generated 1,1,198 "likes", numerous

member posts, and considerable discussion among members.

- Mr. Factor suggests we develop an Optical SETI Eyepiece kit, for use with members' small optical telescope, and has volunteered his company, Eventide Inc., to mass produce it.

- **Adjournment**

The Annual Membership Meeting was adjourned by the Executive Director Emeritus at 14:24 hours EDT on 23 April 2017. A Regular Board of Trustees meeting followed a brief recess.

Business Transacted by Board of Trustees:

0. **Quorum Call**

Trustees and Officers present: A. Heather Wood, Richard Factor, H. Paul Shuch
Trustees and Officers absent: Martin Schreiber
A quorum is present.

1. **Election of Officers**

The following slate of officers was retained for an additional one-year term:
President - Richard Factor, serving without compensation
Secretary/Treasurer - A. Heather Wood
Executive Director Emeritus - H. Paul Shuch, serving on a volunteer basis
Registered Agent - Anthony Agnello

2. **Personnel matters**

- No executive session was convened nor Personnel reviews conducted, as all persons involved expressed satisfaction with present performance and arrangements.
- The Executive Director Emeritus reviewed with the Board of Trustees the previously adopted terms for cost-sharing of his health insurance premiums, as a program expense, which will continue at last year's percentage, pending availability of funds and subject to periodic review.

3. **Annual Budget**

The draft 2017 Budget presented during the Membership Meeting was adopted.

4. **Advisory Board**

The Executive Director Emeritus will draft an annual letter to our Advisory Board members, thanking them for their continued service to The

SETI League. The Secretary/Treasurer will provide a list of email and/or postal addresses for distribution of said letter.

5. **Bank Fees**

The Secretary/Treasurer reports that during 2016 we were charged \$18/month for credit card processing, plus a small per-transaction fee and modest percentage, plus an additional \$3 monthly imaging fee. She will be questioning the latter, since we do not receive images of statements. She was asked to continue to query banks as to the availability of a free non-profit checking account.

6. **Tax Return Filing**

The Secretary/Treasurer reports that she was successful (for the first time in seven years) in eFiling our organizational tax return using the electronic Form 990N postcard, and having it timely accepted by the IRS.

7. **Press List**

Ms. Wood suggests migrating our email Press List to Mail Chimp. The Board authorizes her to do so.

8. **Telecommunications**

- Ms. Wood demonstrates retrieval of voicemail messages from our telecomm provider, which appears an awkward process at best. Mr. Kitchen recommends that we migrate our incoming telephone lines to Google Voice, which will provide voice to text conversion. Ms. Wood to investigate and implement.
- Mr. Factor reports that our Google Groups are dormant, and is authorized to discontinue them. He is tasked with investigating implementation of PHP-BB on our server.

9. **New Business**

- Dr Shuch reports on two organizations offering to provide fundraising assistance to The SETI League, on a fee basis. The Board determines that such support is not financially viable.
- Dr Shuch proposes that, in order to further the development of Optical SETI and Optical METI technologies, The SETI League Inc. and Interstellar Beacon Inc. become mutually affiliated nonprofit organizations, with no financial obligations to be assumed by

either organization. The motion is seconded and adopted unanimously.

10. **Scheduling of Next Meeting**

The SETI League Board of Trustees will next meet on Sunday, 22 April 2018, immediately following the 24th Annual Membership Meeting, in Little Ferry NJ.

11. **Adjournment**

The Board of Trustees meeting was adjourned at 14:56 EDT. ❖

Event Horizon

SearchLites readers are apprised of the following conferences and meetings at which SETI-related information will be presented. League members are invited to check our World Wide Web site (www.setileague.org) under *Event Horizon*, or email to us at info@setileague.org, to obtain further details. Members are also encouraged to send in information about upcoming events of which we may be unaware.

May 26 - 28, 2017: Balticon 51 Baltimore Science Fiction Society Annual Convention, Baltimore MD.

July 23 - 26, 2017: Society of Amateur Radio Astronomers Conference, NRAO Green Bank, WV.

July 27 - 30, 2017: Central States VHF Conference, Albuquerque, NM.

August 9 - 13, 2017: 75th World Science Fiction Convention, Helsinki, Finland.

September 25 - 29, 2017: 68th International Astronautical Congress, Adelaide, Australia

November 17 - 19, 2017: Philcon, Cherry Hill, NJ.

April 22, 2018, 1300 EDT: Twenty-Fourth SETI League Annual Membership Meeting, Little Ferry, NJ.

August 16 - 20, 2018: 76th World Science Fiction Convention, San Jose CA.

October 1 - 5, 2018: 69th International Astronautical Congress, Bremen, Germany

October 21 - 25, 2019: 70th International Astronautical Congress, Washington DC ❖



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Please renew my membership in this category:

Full Member	\$50 / yr
Supporting Member (elderly, retired, or disabled)	\$35 / yr
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Patron (priority use of The SETI League's radio telescope)	\$10,000
Director (Patron membership plus seat on advisory board)	\$100,000
Benefactor (a major radio telescope named for you)	\$1,000,000

Annual memberships are issued for the calendar year. Those processed in January through April expire on 31 December of that year. Those processed in September through December expire on 31 December of the *following* year. Those members joining in May through August should remit half the annual dues indicated, and will expire on 31 December of the same year.

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The SETI League invites you to pay your membership dues and additional contributions via credit card, using the PayPal online payment system. Simply log on to www.paypal.com and specify that your payment be directed to paypal@setileague.org.

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<i>Proceedings of SETICon04(CD)</i>	\$15	\$18
<i>SARA Conference Proceedings:</i>		
2006, 2007, 2008, 2009 (specify)	\$20	\$27
<i>SETI League Technical Manual (CD)</i>	\$10	\$13
<i>Project Cyclops 2nd Edition</i>	\$20	\$30
<i>The Listeners</i> by James Gunn	\$15	\$21
<i>Sing a Song of SETI (Songbook)</i>	\$10	\$13
<i>Sing More Songs of SETI (Songbook)</i>	\$10	\$13
<i>Sing a Song of SETI (music CD)</i>	\$15	\$18
<i>Sing More Songs of SETI (music CD)</i>	\$15	\$18
<i>Demented!</i> (music CD)	\$15	\$18
T-shirts, specify M, L, or XL	\$15	\$22
SETI Nerd Gift Set (one each Mouse Pad, Pocket Protector, <i>Project Cyclops</i> and <i>Tech Manual</i>) at 20% Savings to <u>Members Only</u> :	\$30	\$45

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