SearchLites

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The Quarterly Newsletter of The SETI League, Inc.

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Why Humanity Should Be Messaging Extraterrestrial Intelligence
by Bill Kitchen

Everyone understands why SETI is amazing. The raw ingredients for life are everywhere in the Universe, and with hundreds of billions of stars in our galaxy alone — one of trillions in the visible Universe — the first discovery of life, of complex life, and of intelligent life beyond our world will change everything. But it won't usher in a future where humans and aliens meet, exchange technology and build a galactic future together. It won't even result in a meaningful two-way conversation. Even optimistic estimates for the number of intelligent species put the average round-trip communication time at greater than a human lifetime. The speed of light just isn't fast enough.

Instead, imagine everything you'd hope to find out from contact with an extraterrestrial intelligence. What are they like? What's their culture like? Their music; their art; their religions; their languages; their home world; their technology; their conception of the Universe? How does their biology work? How does the biochemistry of everything on their world function? You'd want to know who they are, how they came to be, how they work, what their civilization was like, where they're from and whether they're still around or not. If they still exist, you'd want to be able to contact them; if they no longer exist, you'd want to know everything about the moments when they did. There's a full suite of knowledge about their civilization that must exist, and you'd want to know it all.

Such a message would be the ultimate time capsule from an alien intelligence. From our perspective, after 4.5 billion years of life on Earth, we recognize how fragile it all is. How quickly humanity could come to an end, whether from a global or cosmic disaster or by our own hands. If all we did was search, there might never be a record of the greatest legacy of humanity to spread among the stars: the full suite of human knowledge would be lost to the Universe forever. If we want to leave a true cosmic legacy that will outlive ourselves — that can serve as an eternal presence to announce "we were here" with the full power of our presence — we must craft and broadcast that message ourselves!

All of art, science, philosophy, religion, psychology, history and more could be our gift to the Universe. We could create a blueprint for Earth: a time capsule for humanity. We could send a digital Noah's Ark to the stars, complete with the DNA of every known species Earth has ever housed. It could even contain a blueprint for you. A message like that, broadcast with enough power, will arrive at any potential listener, whether they're hundreds, thousands or even millions of light years away. Even if we're already gone when it arrives, that message will be humanity's ultimate legacy to the cosmos.

We may not be around forever; there's a good chance humanity will perish by some cosmic disaster, or by our own doing. By broadcasting humanity's ultimate message to the stars, a new form of immortality awaits us all.

Guest Editorial:

Is Amateur Optical SETI Feasible?

by Marlin (Ben) Schuetz
Boquete Optical Observatory, Panama

Is amateur optical SETI a viable option? After a few years of research, developing hardware and considering this issue, a fair case can be made in the affirmative. But before getting into the basis for the "yes" answer, let's consider some of the rudiments of Optical SETI. It has been shown by many that an appropriately scaled pulsed laser system can outshine a parent star by several orders of magnitude out to more than 1000 light years. That statement seems straight forward, but requires some explanation. During the brief period of a laser pulse (~10^-8 to 10^-9 seconds), many more laser photons can pass through a distant unit of area than photons from a parent star. For example, if the rate of detected stellar photons is 10^6 per second and a laser pulse length is 5 nanoseconds, then on average during that very brief pulse interval one could expect only about 0.005 stellar photons, but there could be tens or even thousands of photons from a laser pulse and these would be sufficient for detection. On this brief time scale, a specialized detector can ignore nearly all of the stellar background flux.

The amateur may well hold the best cards for detecting ETI laser signals. Large institutional telescopes are few in number and fewer still have allocated significant blocks of time to Optical SETI searches. Moreover, for signals originating from up to ~400 light years, small telescopes have many advantages over their larger cousins.

Recently, for another paper, I was tasked with comparing the sensitivity of the Boquete Observatory's system to laser signals with that of other Optical SETI projects. Prior to this, I was aware of most of those comparisons, but when the whole picture was laid out a new appreciation was formed for the potential contributions amateurs can make. The Boquete telescope has only a 0.5 meter (20") aperture compared with institutional optical SETI instruments ranging at present from 0.9 meters to 1.8 meters. How can the Boquete system compare favorably with these? Other SETI laser signal detection schemes typically employ two or more photo-detectors (photomultipliers or avalanche photodiodes) whose outputs are compared to reveal photoelectron pulses that are coincident in time (piled up). This method requires fussy design and precise construction using beam splitters to divert portions of the incoming starlight to the photo-detectors. It is expensive, somewhat complicated and not so simple to calibrate and maintain. Also, to minimize false positives, the detectors' sensitivities are usually further attenuated.

The Boquete photometer uses only a single photomultiplier in combination with a number of unique steps that result in a simplified detection method having improved sensitivity and without concerns for false positive detections. The later is exemplified with the observation of nearly 4000 stars during which only a single (presumed) false positive event was experienced. In addition to coincident pulse detection, the photometer is also sensitivity to non-coincident pulsed signals, (i.e. photoelectron pulses spread out in time to 25 nanoseconds or more). The single detector photometer is described in some detail at the Boquete Observatory's website.

The range of stellar magnitudes is yet another aspect that favors small telescopes for optical SETI. For example, candidate stars most often include magnitude extremes of ~2 to 14. The 0.5 meter telescope/detector is limited to stars no brighter than about magnitude 6 without a method of light attenuation; larger telescopes are even more constrained. Thus, considering stellar flux limitations a small telescope with a single detector can have a sensitivity advantage over a larger one with multiple detectors. Furthermore, telescopes with apertures as small as 10"- 14" can be applied to SETI searches of the several thousand stars within ~100 light years.

We now know that exoplanetary systems are ubiquitous in our galaxy and beyond, but there is still the very great uncertainty regarding the proclivity for intelligent life beyond earth. Some have guessed one planet in a million – give or take a bunch. Needed now are many small optical SETI observatories to survey the hundreds of thousands of nearby stars. Hopefully it won't be necessary to expand the search beyond that.

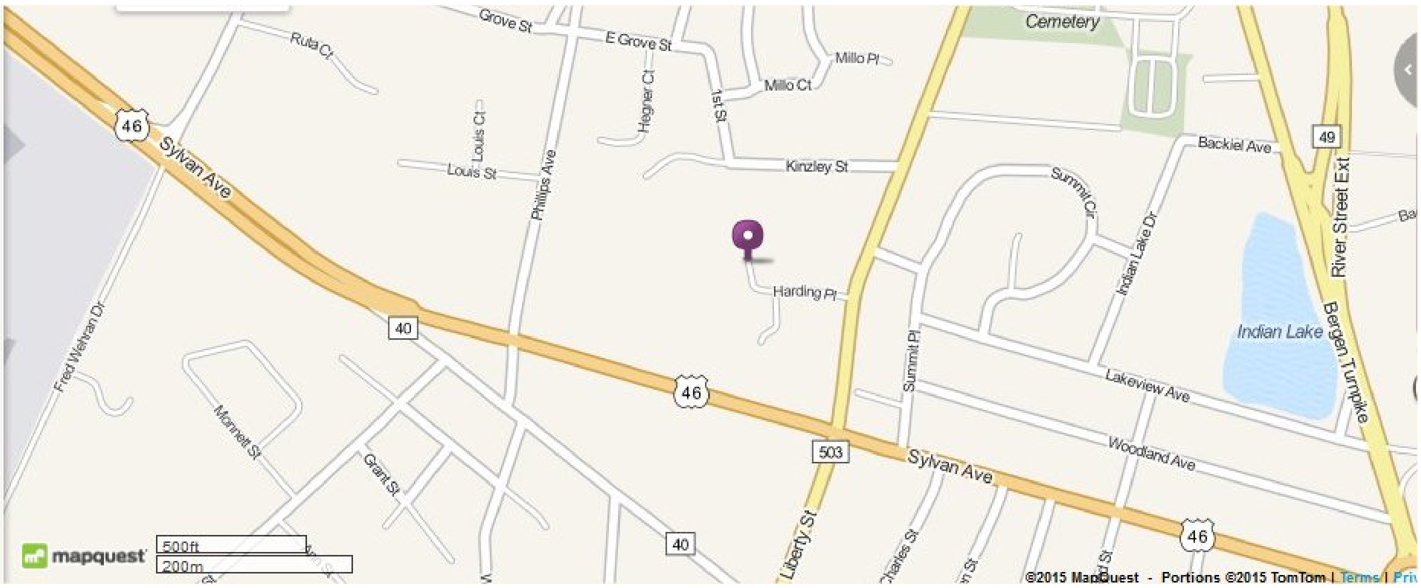
This all too brief discussion may be a useful starting point for others to dig deeper and perhaps become involved in the very challenging effort to detect signals from other worlds. At present, and to my knowledge, The Boquete Optical SETI Observatory is the only facility that is full time functional and dedicated to this project. Bruce Howard's Owl Observatory in Michigan is also functional and dedicated to OSETI, but it awaits his imminent retirement to begin full time operation. With the exception of the Harvard All-Sky Survey (2006), institutional OSETI programs general function only intermittently. It is not clear if the Harvard program is still active. However, if there are others, we'll be glad to know about them and endeavor to foster good working relationships. METI International is spearheading a campaign to develop a Global Network of Optical SETI Observatories.

There is much to do. Please join us.

Announcement of the Twenty-Third Annual Membership Meeting

Sunday, 23 April 2017, Little Ferry NJ

In accordance with Article IV, Section 1 of our duly approved Bylaws, the Trustees of The SETI League, Inc. hereby schedule our Twenty-first Annual Membership Meeting for 1 PM Eastern time on Sunday, April 23, 2017, at the conference room of Eventide, Inc., One Alsan Way, Little Ferry NJ 07643. This office is located adjacent to The SETI League office, one block north of Route 46 and one mile east of the Teterboro Airport, accessed off of Route 46 via Liberty Street to Harding Avenue to Alsan Way.
Here is a map, courtesy of MapQuest.



We recommend that out-of-town members and guests flying in commercially use the Newark International Airport (EWR), which is about twenty minutes South of our office. There is a wide variety of hotels available at the Newark Airport. A rental car is recommended. From Newark, drive North on the New Jersey Turnpike to US Route 46 Westbound, cross over the Hackensack River, and two long blocks after the traffic circle, turn right onto Liberty Street.

Our members and guests using General Aviation are invited to use the Teterboro Airport (there *are* landing fees and a security fee). Of the half-dozen Fixed Base Operators offering transient parking, we recommend Atlantic Aviation (ask Ground Control for parking in the Atlantic Midfield). They should be able to assist you with ground transportation, and will waive the ramp fee if you purchase fuel. Please coordinate your schedules and needs in advance through our secretary via email to heather_at_setileague_dot_org.

As attendance by one percent of the League's membership constitutes a quorum, all members in good standing are encouraged to attend. The preliminary agenda for this meeting, per Bylaws Article XII, appears below.

Per Article IV, Section 3 our Bylaws, written or electronic notice of this Meeting is being provided to all members in good standing, not less than ten days nor more than ninety days prior to the meeting date. Members are encouraged to submit additional Old Business and New Business items for inclusion in the Agenda. Please email your agenda items to paul_at_setileague_dot_org, not later than April 1, 2017. For planning purposes, we would appreciate it if members would also RSVP to our secretary, heather_at_setileague_dot_org, if planning to attend.

The annual Board of Trustees Meeting required per Bylaws Article V, Section 3 will immediately follow the Membership Meeting. All SETI League members in good standing are welcome to attend.

Preliminary Agenda

- Call to Order
- Minutes of 2016 Membership Meeting
- Financial Report
- Committee Reports
- Old Business
- New Business
- Good and Welfare
- Adjournment

How Far Can We Hear?

by Michael Busch

Originally posted to quora.com, used by permission

The current and recent past radio leakage from the Earth is dominated by two things:

- Narrow beams from high-power radars, both scientific and military, which are used to monitor objects throughout the inner solar system and in Earth orbit respectively.
- The constant-frequency carrier waves of ground-based television broadcasts.

The radar beams are potentially detectable by current radio facilities such as the Arecibo Observatory and FAST and the planned future Square Kilometer Array at distances of tens to hundreds of thousands of lightyears. However, they are transient and only very rarely aimed at any star because they're tracking objects moving across the sky in the foreground. So unless an astronomer on an Earth duplicate at Tau Ceti were aiming their equivalent of the Deep Space Network directly at the solar system, we would be very unlikely to pick up those radar beams.

Television broadcasts are aimed towards the local horizon, because that's where most of the customers are. This means that a given transmitter sweeps across much of the sky twice a day - once when that part of the sky is rising, and once when it is setting. The exact region of the sky that is being covered by a given transmitter depends on its latitude, but there are enough TV broadcasters around the world to sweep across the sky in all directions many times a day. While the modulation on the television broadcasts that carries the images and sound would be very hard to detect across interstellar distances, the carrier waves are relatively easy to see because each occupies only a narrow frequency range.

We can measure the pattern of TV carrier waves coming off the Earth in multiple ways: by plotting out the known transmitter power and locations of different TV broadcast antennas, or by monitoring the very small fraction of the radio leakage that is reflected back at Earth by the Moon. The latter was first done in the late 1970s. Given that information, we can estimate how far away different radio telescopes could detect the current TV carrier wave radio leakage from Earth. The Arecibo Observatory and FAST could each detect the TV carrier wave leakage out to a distance of about sixteen lightyears. That's a little bit further away than Tau Ceti is. However, both telescopes are too far north to observe Tau Ceti. Arecibo and FAST are both single dishes built into roughly spherically-shaped holes in the ground and are constrained to look within a certain number of degrees of straight overhead. This prevents them from viewing objects that are too far north or south on the sky. FAST can look at things within 2º of Tau Ceti, but that's not quite close enough.

Current radio telescopes in the southern hemisphere, such as Parkes, could only pick up the current TV carrier wave radio leakage at a distance of 3.4 lightyears or so—which is not as far as Proxima Centauri (the nearest star) and less than 30% of the distance to Tau Ceti. However, once the Square Kilometer Array is completed in Australia and Africa, it would be able to detect the current TV carrier wave radio leakage at a distance of about fifty lightyears for objects in the southern hemisphere sky.

Over the course of a year; the SKA would be able to detect the carrier wave leakage at the distance of Tau Ceti, establish that the emission came from radio transmitters on a planet the size of Earth with a rotation period of one day on an orbit in the star's habitable zone (by tracking the Doppler shift of the signals), and map out the transmitter locations across the portion of the planet's surface visible to them. With more extensive monitoring, it would be able to detect different transmitters turn on or off or change operating frequency.

Radio SETI searches have been ongoing to varying degrees since Frank Drake's first project in 1960. SETI astronomers have not found any alien radio signals, but they've considered in detail what they'd be able to learn from any that they might find.

Members' Photos:

Last Fall (before the ground froze) Canadian member Scott Carter, VE3CGN, planted this mast in the ground to support his (now operational) 3 meter Project Argus dish.

In Florida, SETI League life member Bill Kitchens sets up his new Celestron 11 inch telescope, in preparation for some Optical SETI activities.

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.

April 15, 2017, 0000 UTC - 2359 UTC:: Seventeenth annual SETI League Ham Radio *QSO Party*: 3.551, 7.0309, 7.2039, 14.084, 14.204, 21.306, and 28.408 MHz.
April 23, 2017, 1300 EDT: Twenty-Third SETI League Annual Membership Meeting, Little Ferry, NJ.
April 24 - 28, 2017: *AbSciCon 2017* Astrobiology Science Conference, Mesa, AZ.
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.
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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Annual Renewal: Is This Your Last *SearchLites?*

SETI League memberships are issued for the *Calendar Year*. Please check the expiration date indicated on your mailing label. If it reads December 2016 or earlier, you have already expired, and *must* renew your SETI League membership **now!** Please fill out and return this page along with your payment.

Please renew my membership in this category:

Full Member	$50 / yr
Supporting Member (elderly, retired, or disabled)	$35 / yr
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Household Member (same address as a Full Member)	$15 / yr
Household Life Member (same address as a Life Member)	$300
Life Member (until we make contact)	$1,000
Sustaining Life Member – a generous *annual* pledge of:	$1,000 / yr
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.

Pleased to Accept PayPal

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.

Name: ______________________________

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Proceedings of SETICon02	$20	$27
Proceedings of SETICon03 (CD)	$15	$18
Proceedings of EuroSETI04 (CD)	$15	$18
Proceedings of SETICon04(CD)	$15	$18
SARA Conference Proceedings: 2006, 2007, 2008, 2009 (specify)	$20	$27
SETI League Technical Manual (CD)	$10	$13
Project Cyclops 2nd Edition	$20	$30
The Listeners by James Gunn	$15	$21
Sing a Song of SETI (Songbook)	$10	$13
Sing More Songs of SETI (Songbook)	$10	$13
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Demented! (music CD)	$15	$18
T-shirts, specify M, L, or XL	$15	$22
SETI Nerd Gift Set (one each Mouse Pad, Pocket Protector, *Project Cyclops* and *Tech Manual*) at 20% Savings to Members Only:	$30	$45

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