

# THE SETI PROJECT

A proposal by Alberto Caballero



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## 1. What would the SETI Project be?

The SETI Project would be a coordinated effort made by several amateur radio observatories with the objective to find a potential signal of extraterrestrial origin. The initial campaign is intended to last one month. During this time, 4 stars would be scanned, once per week. The project would be extended if a candidate signal is found. The selected stars should be relatively close to Earth, older than the Sun (if possible), and not previously scanned in detail by other observatories.

## 2. Why is it needed?

Amateur organizations such as the SETI League have been coordinating radio observatories for several decades. One of the main goals of the SETI league in Project Argus was to gather 5,000 observatories with the purpose of scanning all the sky 24/7 (SETI League, 2014). The project itself was a great idea. However, such effort never materialized due to difficult in recruiting and coordinating such a high number of observatories. Currently, there are a little over 100 SETI stations registered under the SETI League, but many of them are not active. Moreover, Project Argus covered frequencies between 1.3 and 1.7 GHz searching for unintentional radio signals. Unlike Project Argus, the SETI Project is aimed at observing 24/7 only a few selected stars looking for unintentional signals, especially those that may arise from the communication between an extraterrestrial airport radar and their spacecrafts.

## 3. What could it be achieved?

In principle, if an extraterrestrial civilization located 3,063 light years away used a 1-km antenna, a frequency of 10 GHz, and 20 Terawatts of power, their signal could be detectable by a 3-meter dish with a bandwidth of 20 KHz. The maximum distance at which the radio telescope could detect the signal would be higher than the estimated distance where our furthest target is located.

Alien transmit frequency GHz	10	Receive antenna G/T dB/K	29.9429901172
Alien transmit antenna diameter m	1000	Bandwidth Hz	20000
Alien transmit antenna gain dBi	98.1820775266	Required overall link carrier to noise ratio C/N dB	5
Alien transmit power W	2000000000000	Path (spreading) loss dB	441.7
Alien transmit EIRP dBW	231.192377483	Range km	28976528221807096.0
Receive antenna diameter m	3	Range AU (1AU=Earth to Sun distance)	193693370.5
<a href="#">Receive system noise temperature (antenna+LNA) K</a>	60	Range light seconds	96588427406.0
Receive antenna gain dBi	47.7245026210	Range light minutes	1609807123.4
		Range parsecs	939.1
		Range light years	3063.1

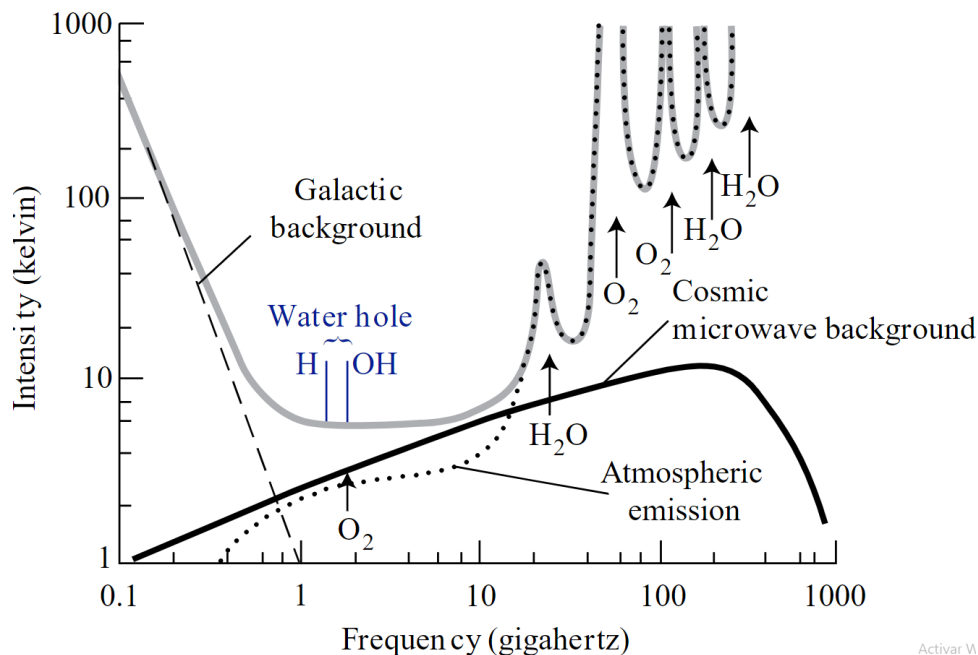
Source: Satsig

#### 4. How could it be organized?

Ideally, each observatory would gather data for approx. 12 continuous hours every week. This way, the total number of radio observatories needed would only be 14 in order to achieve 24/7 coverage of each target at a time. The data could be stored in the own servers of each observatory and linked to the database of the project: <https://exoplanetschannel.wixsite.com/home/groups>. In principle, each observatory would analyse its own data and, if a potential signal is found, the observatory at hand would inform the coordinator of the project in order to organize with the rest of observatories an attempt to confirm the signal.

#### 5. What frequencies would be used?

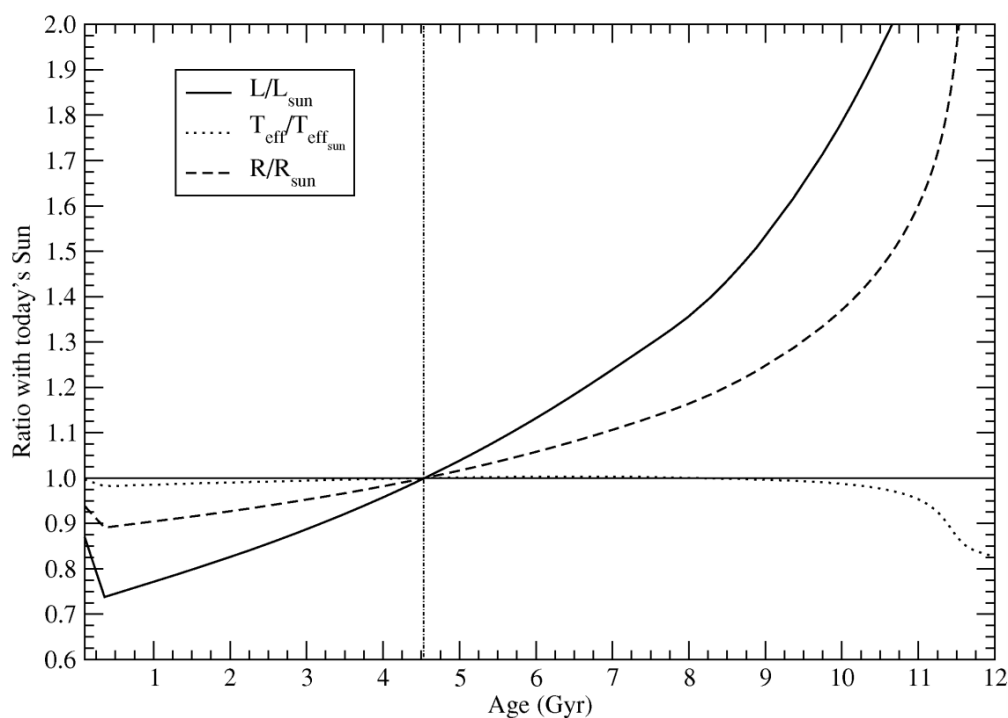
1,420 MHz is the frequency by default in the search for extraterrestrial intelligence. Considering that hydrogen is the most common known element in the universe, the scientific community believes that any civilization is more likely to transmit in this frequency than in any other frequency. However, extraterrestrial civilizations might use other frequencies instead. They might think that precisely because hydrogen is the most known common element in the universe, any signal transmitted in that frequency would be too noisy. Another possibility is that dark matter for example could make up to 27% of the Universe, but we do not know its frequency. In a similar manner, the water hole is a symbolic region for humanity, but a similar extraterrestrial civilization might opt for a frequency with an energy-per-photon slightly higher (all the METI transmissions humanity have sent were on a frequency higher than the water hole) (Dumas, 2015).



An extraterrestrial civilization could use any frequency between 1 and 10 GHz if they want to intentionally send an interstellar radio message to Earth or other star systems. But, considering how unlikely is this, the SETI Project would focus on the range of frequencies used for space communications from Earth, which interval is 2 - 4 GHz (especially 2,025 - 2,110 MHz), and 8 – 12 GHz (US Department of Commerce, 2016). This does not mean that an extraterrestrial civilization would use this range of frequencies or a similar one for their interplanetary traffic, but it falls within the realms of plausibility. The Deep Space Station (DSS), for example, transmits an uplink carrier frequency of 2114.676697 MHz to Voyager 1 and 2113.312500 MHz to Voyager 2, which are the farthest spacecrafts humanity has ever made. In any case, the frequencies of the SETI project would be calculated once the final number of radio observatories involved is known. The hydrogen line would also be observed. In addition, each observatory would need to calculate the bandwidth needed with this Doppler shift calculator: <http://www.setileague.org/software/doppler.xls>

## 6. What are the targets?

1. **2MASS 08052406+6829051** is the oldest potential Sun-like star before the end of its main phase in 4.5 billion years. It was filtered out after estimating what temperature, luminosity and radius the Sun will have when it reaches 9.1 billion years of age. The upper limit for the distance was used based on Maccone (2012) estimation that there is a 75% probability that the closest civilization is between 1,361 and 3,979 light years (2,670 is the mean).



Credit: Ribas (2009)

Filter:

Distance: between 2,670 and 3,979 ly

Temperature: 5,768 – 5,788

Luminosity (including error): 1.45 – 1.65

Radius (including error): 1.24 – 1.26

Data:

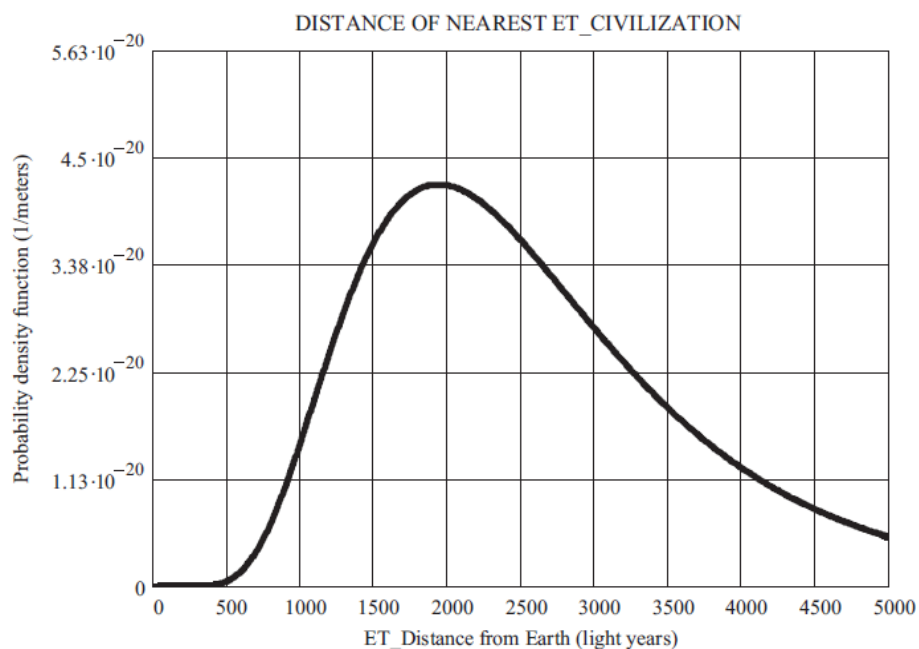
Distance: 2,673 ly

RA: 121.35020751646182

DEC: 68.48477851214948

The star only has a 3-ly difference with respect to Claudio Maccone's mean distance of 2,670 ly at which we can expect to find the closest civilization (Maccone, 2012).

2. **2MASS 08030350+7005349** is the star closest to the distance with the highest probability of existing a communicative civilization according to Maccone (2012), which is 1,933 light years.



Credit: Claudio Maccone (2010)

Filter:

Temperature: 5,768 – 5,788

Luminosity: 0.9 – 1.1

Radius: 0.99 – 1.01

Data:

Distance: 1,933 ly

RA: 120.76475304621607

DEC: 70.09297977706092

3. **2MASS 22423990-5411205** is the closest star (among 5) most similar to the Sun.

Filter:

Distance: between 500 and 2,670 ly

Temperature (including error): 5,768 – 5,788

Luminosity (including error): 0.9 – 1.1

Radius (including error): 0.99 – 1.01

Data:

Distance: 1,377 ly

RA: 340.6666032528256

DEC: -54.189234002856374

The star is within the distance range between 1,361 and 3,979 light years that, according to Maccone (2012), it has a 75% probability of having the closest communicative civilization.

4. **K08253.01** orbits the most potentially Earth-like planet candidate according to the NASA Exoplanet Archive (2020).

Distance: 1,982 ly

RA: 291.529510

DEC: 40.252918

The star only has a 49 ly-difference with respect to Maccone's peak of 1,933 ly.

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