


Lecture 40: SETI

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SETI: The Search for Extraterrestrial Intelligence



Astronomy 141 – Winter 2012

This lecture is about SETI, the Search for Extra-Terrestrial Intelligence.

Searching for artificial radio signals may be the best way to look for extraterrestrial intelligent life.

Natural frequency bands are defined by Hydrogen where other civilizations might also search or broadcast...

Both targeted and piggyback searches are underway at radio telescopes around the world.


We have sent out our own signals, intentional or otherwise, and human artifacts on spacecraft.

Is there intelligent life elsewhere in the Universe?

Highly advanced technological civilizations

Capable of communicating across interstellar distances.

Interested in finding and communicating with other intelligences.


$$N = N_* \times f_p \times n_c \times f_i \times f_c \times \frac{L}{Age}$$
$$= 100 \text{ Billion} \times 0.5 \times 1 \times 0.1 \times 1 \times \frac{100 \text{ yr}}{10 \text{ Gyr}}$$

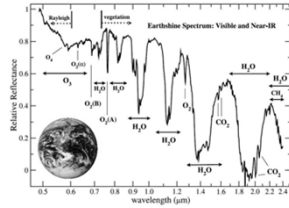
= 50 communicating civilizations

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One approach to searching for intelligent life is to start by searching for their likely homes...



Discovery of exoEarths...



...followed by searching for biomarkers in their spectra

Another approach is to assume intelligent life is common and search directly for signals from them.

Assumes intelligent civilizations all have the ability and the desire to communicate.



Skips over the hard stuff and goes straight for the ultimate answer.

But if we find nothing, the reason will be elusive.
No Life? No Intelligence? No Technology? Bad methods?

If you want to bridge vast interstellar distances, use light to send messages.

Talk is cheap...

Messages travel at the speed of light

Very low energy cost

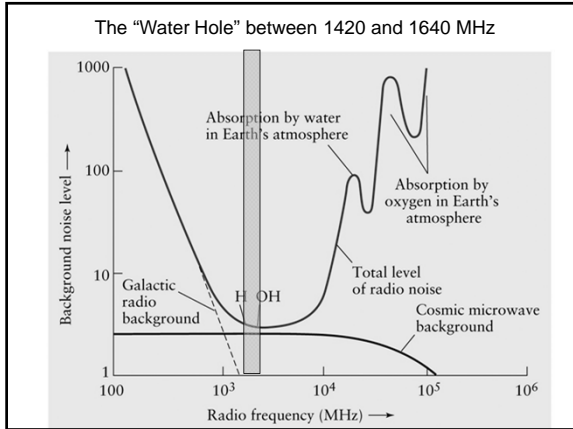
What type of light to use?



Microwaves: 1000-10,000 MHz is a region of relatively low cosmic background "noise"

Visible or IR lasers: very few natural lasers in the sky to cause confusion

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SETI: The Search for Extra-Terrestrial Intelligence

A relatively inexpensive search strategy to look for signals from extraterrestrial civilizations.


Two strategies:

Targeted Surveys use dedicated observing facilities to search specifically for signals

"Piggyback" use auxiliary receivers on telescopes doing other research work.



Frank Drake




Jill Tarter (SETI Institute)

SERENDIP (Search for Extraterrestrial Radio Emissions from Nearby Developed Intelligent Populations)

Operated by UC Berkeley and Cornell

Piggy-back study using the Arecibo Observatory in Puerto Rico



1000-foot Arecibo Radio Telescope
SERENDIP main receiver

Operates the SETI@home project to crunch the data on home PCs (runs as a screensaver).

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Allen Telescope Array

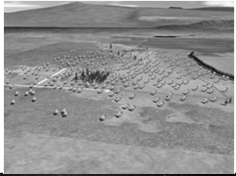

Operated by the SETI Institute in Mountain View, California

Targeted Survey

350 Antennas planned
42 installed to date

Funded in part and named for Microsoft founder Paul Allen.

Operates the crowd-sourcing setilive.org website.

First ATA antennas at Hat Creek

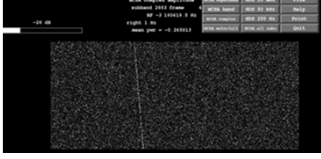
All SETI projects are searching for a signal that appears "artificial" in origin.

Very narrow "bandwidth" (<300Hz, the narrowest natural sources)

Pulsed signals (common way to encode information)

Very little frequency "drift"

So far, no detections of anything sustained...

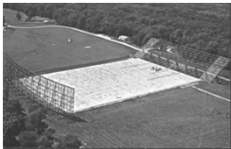



Pioneer 10 spacecraft detected using Project Phoenix

The "Wow!" signal...

An early SETI project was conducted at OSU's "Big Ear" radio telescope near Delaware, Ohio (closed in 1998).

1977 August 15: a strong, narrowband signal detected

Jerry Ehman's notation "Wow!" on the receiver's data printout.

The signal lasted 72 seconds but was never seen again...
