

Tuesday, November 23
SETI: Search for ExtraTerrestrial Intelligence

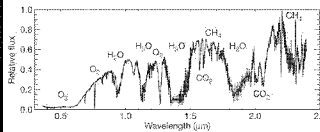
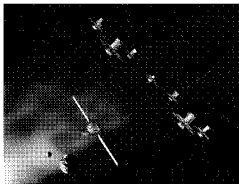


P.S. #4 will be due Monday, Nov. 29.

SETI
Key Concepts

- 1) Searching for artificial radio signals may be the best way to look for intelligent life.
- 2) Both targeted and “piggyback” searches are underway at radio telescopes.
- 3) We have sent our own radio signals (intentional & otherwise) into space.

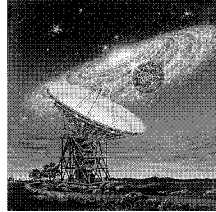
One approach to searching for intelligent life is to look for its likely homes.



Indirect & direct detection of exoEarths can be followed up by a search for biomarkers in their spectra.

Another approach is to search directly for signals from intelligent beings.

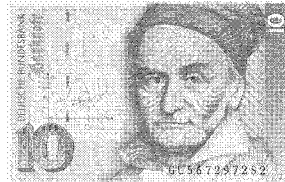
This assumes that some intelligent beings have the ability & desire to communicate.



If we **don't** detect signals, the reason will be unclear.

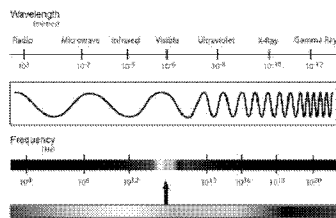
If you want to send messages over vast interstellar distances, use **light**.

Light is **faster** than a spacecraft. Sending a light signal is **cheaper** than sending a spacecraft.



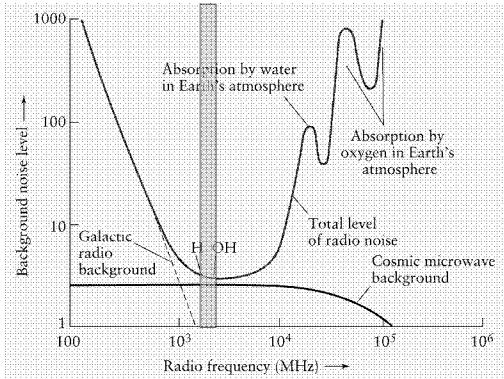
In 1822, Carl Gauss suggested using 100 large mirrors to signal our presence to inhabitants of the Moon.

What **type** of light is best for interstellar communications?



Microwaves: frequencies of 1000 to 3000 MHz are good because of low cosmic "noise".

The "Water Hole" between 1420 and 1640 MHz



The term "SETI" generally refers to a search strategy to look for radio signals from extraterrestrial civilizations.

Two varieties of SETI:

Targeted surveys use dedicated observing facilities to look specifically for signals.

"Piggyback" surveys use auxiliary receivers on radio telescopes looking for natural sources.



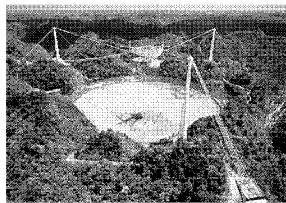
Frank Drake



Jill Tarter (SETI Institute)

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

It's an ongoing piggyback study using the huge Arecibo radio telescope in Puerto Rico.



1000-foot Arecibo Radio Telescope
SERENDIP main receiver

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

ATA (Allen Telescope Array)

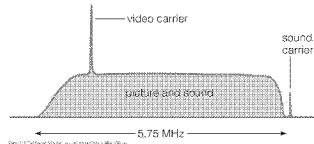
It's an array of 350 telescopes, currently under construction in California, to do a targeted survey.



Funded in part by Paul Allen (Microsoft co-founder); 30 megabucks so far.



SETI projects are searching for radio signals that appear artificial in origin.

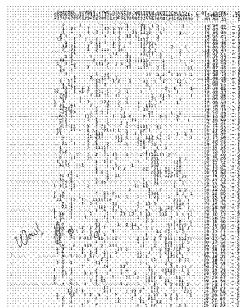
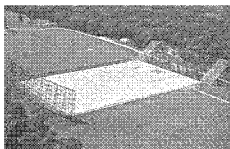


Artificial signals have a very narrow bandwidth. They frequently are pulsed (think "Morse code"). They have little drift in frequency.

So far, there have been no sustained detections of radio signals with these properties.

The WOW! signal

In the 1960s and 70s, OSU ran the "Big Ear" radio telescope near Delaware.

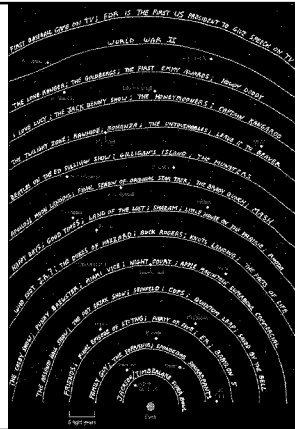


On August 15, 1977, a narrowband signal was detected – it lasted 72 seconds & was non-terrestrial in origin. Very intriguing...

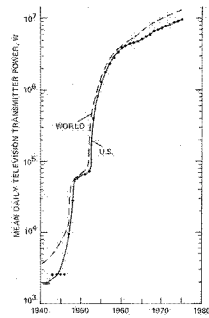
The Earth is already broadcasting to neighboring stars.

With current technology, we could detect Earth's radio & TV broadcasts from many light-years away.

What will the neighbors think?



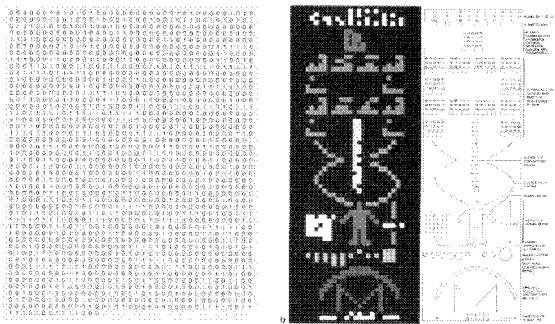
The Earth's luminosity at radio & TV broadcast frequencies went up steeply in the 20th century, but is now starting to decline.



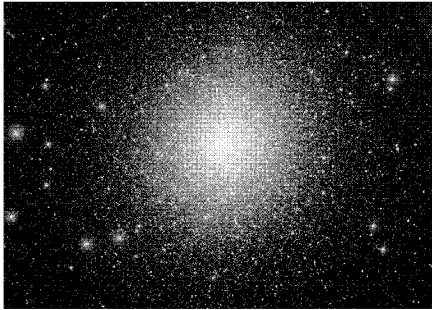
Reasons for the decline?
 Spread of cable TV.
 "Directed" communications (fiber optics, beaming, etc.).
 Lower-power digital broadcasts.

Advanced civilizations may become "radio quiet"; we won't be able to eavesdrop on them.

The Arecibo Message, sent in 1974 from the refurbished Arecibo Radio Telescope

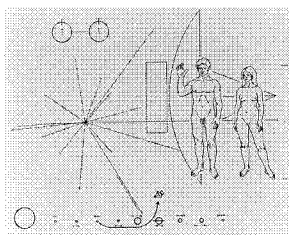


The Arecibo Message was beamed one time towards the globular star cluster Messier 13.

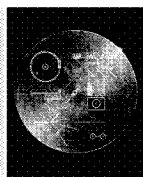


25,000 light years away!

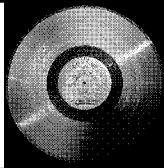
Physical artifacts describing ourselves and our home are onboard the Pioneer and Voyager spacecraft.



Pioneer 10 plaque



Voyager Record



Tomorrow's Lecture:
Colonizing the Galaxy

This Week's Reading:
Chapter 13