BREAKTHROUGH LISTEN

TECHNOSIGNATURE SEARCHES FROM THE LUNAR FARSIDE

ANDREW P. V. SIEMION

W/ ERIC MICHAUD, PETE WORDEN, JAMIE DREW
AND THE BREAKTHROUGH LISTEN TEAM

IAA SYMPOSIUM ON LUNAR FARSIDE NEGOTIATIONS
WE ARE NOT ALONE
Scientists say there must be other life in the universe. Here's how they're searching for it.

Gloria Steinem on #MeToo / The Other Russia 'Witch Hunt'?
GALILEO: LAUNCHED OCTOBER 18, 1989
A search for life on Earth from the Galileo spacecraft

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Diagram showing radio transmitters, C/A, Type III radio bursts, and frequency plots.
Detectable Signatures of Intelligence: Technosignatures

High-power TV and Radio

Planetary Radar Systems

High-power Lasers
Arecibo Planetary Radar

~ Solar System

~ 15 - 30 lightyears

Mars 2020

LUVOIR

~ 10000 lightyears

x 10 million times more stars

Green Bank Telescope

~ Solar System

Arecibo Planetary Radar
BREAKTHROUGH INITIATIVES

July 2015
Royal Society, London

Are we alone?
Now is the time to find out
Is Intelligence a Common Outcome?
1 Million Stars  

1 day of Breakthrough Listen = 1 year of any previous search
All data and software open-source and publicly available

HTTP://BREAKTHROUGHHINITIATIVES.ORG

100 Galaxies
PUBLIC DATA RELEASE 2.0: 2 PETABYTES
NEARBY STARS,
THE GALACTIC PLANE,
EXOTICA

BREAKTHROUGH
LISTEN
THE BREAKTHROUGH LISTEN SEARCH FOR INTELLIGENT LIFE: A 3.95–8.00 GHz SEARCH FOR RADIO TECHNOSIGNATURES IN THE RESTRICTED EARTH TRANSIT ZONE
SOFIA SHEIKH ET AL 2020 (APJ SUBMITTED)
COSMIC SETI AT THE VLA

COMMENSAL OPEN-SOURCE MULTIMODE INTERFEROMETER CLUSTER
SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE AT THE VERY LARGE ARRAY
Detectable Signatures of Intelligence: Technosignatures

High-power TV and Radio

Planetary Radar Systems

High-power Lasers
The Singular Challenge of Radio Frequency Interference...
A Quiet Place...

Takahashi 2003

Attenuation of radio interference at the lunar surface

-0 dB  -80 dB  -160 dB

angle from incidence (0=Nearside, 90=Limb, 180=Farside)

Takahashi 2003
Antenna concepts for interstellar search systems

Roy P. Basler, George L. Johnson, and Richard R. Vondrak

Radio Physics Laboratory, Stanford Research Institute, Menlo Park, California 94025

Lunar craters would be ideal locations for Arecibo-type antennas, but the high cost of building and operating such a system make the moon an unattractive site for an interstellar search system.
Geolocation of Terrestrial RF-emitters
Three pathfinders commissioned Feb 2019

Space-qualified software-defined-radio (SDR) technology, leverages open-source (GNURadio, RFNoC, Drivers)

NEMO-15 bus, 15 kg wet, UTIAS + DSI

Operational
Three pathfinders commissioned Feb 2019

Space-qualified software-defined-radio (SDR) technology, leverages open-source (GNURadio, RFNoC, Drivers)

NEMO-15 bus, 15 kg wet, UTIAS + DSI

Operational
★ The lunar farside is a unique environment enabling dramatic and qualitatively novel new capabilities for probing the universe for other civilizations.

★ Pathfinder experiments are tractable today at modest cost.

★ The window of relative quietness will be limited.