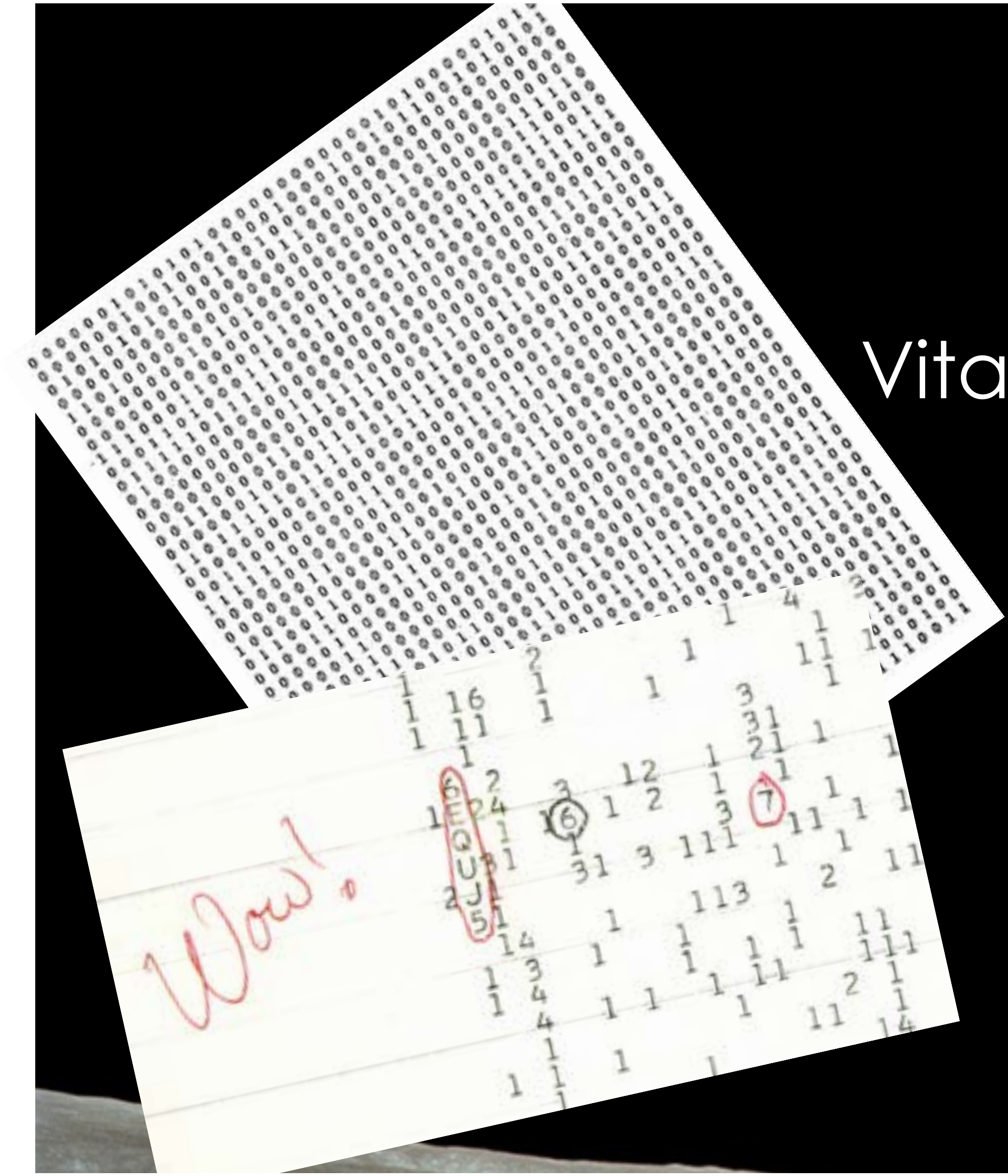
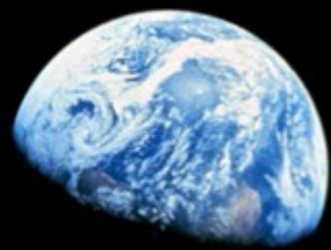


Vita extraterrestre intelligente?

R. Claudi



La ricerca della vita nella storia

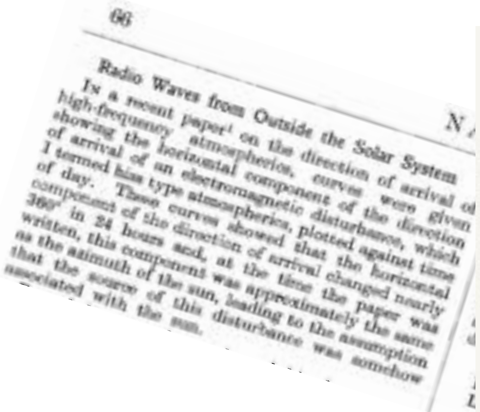
1820	Gauss	Piantare piante di diverso colore in Siberia per rappresentare il teorema di Pitagora in modo che possa essere visibile da Marte o da Venere
1950	Tsiolkovskij	Comunicare con i marziani per mezzo di segnali luminosi
1959	Cocconi & Morrison	Comunicare con extraterrestri per mezzo di segnali radio a 1.420 GHz (emissione a 21 cm dell'Idrogeno neutro)
1960	Drake	OZMA precursore del SETI: non più comunicazione ma ricerca di segnali da civiltà intelligenti
2000	ESA NASA	Ricerca dei pianeti abitabili con missioni spaziali

1886 H. R. Hertz

Le onde radio vengono riflesse da oggetti solidi

anni ‘30-’40: Tiberio, Marconi, Watson Watt

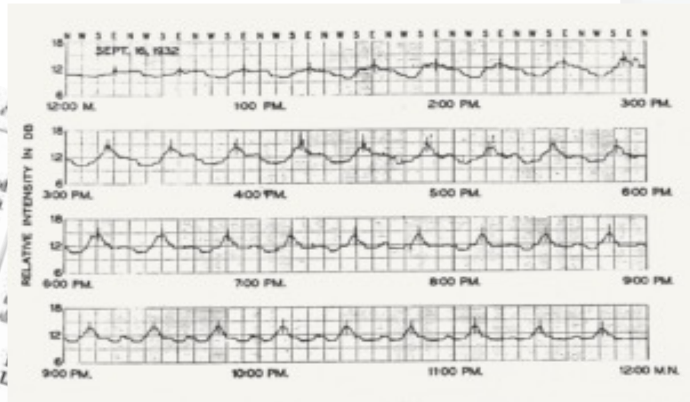
RADAR: **RA**dio **D**etection **A**nd **R**anging

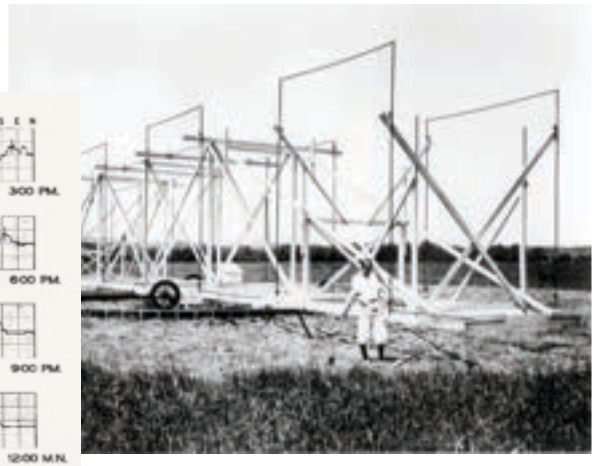


66

Radio Waves from Outside the Solar System

In a recent paper[1] on the direction of arrival of high-frequency atmospherics, curves were given showing the horizontal component of the direction of arrival of an electromagnetic disturbance, which I termed his type atmospherics, plotted against time of day. These curves showed that the horizontal component of the direction of arrival changed nearly 360° in 24 hours and, at the time the paper was written, this component was approximately the same as the azimuth of the sun, leading to the assumption that the source of this disturbance was somehow associated with the sun.





Merry-go-round NRAO

Karl Guthe Jansky

1932: Segnali Radio da Sgr A*

The Search for Life

If we never search the chance of success is zero!

(Cocconi &Morrison1959)

SEARCHING FOR INTERSTELLAR COMMUNICATIONS

By GIUSEPPE COCCONI* and PHILIP MORRISON†

Cornell University, Ithaca, New York

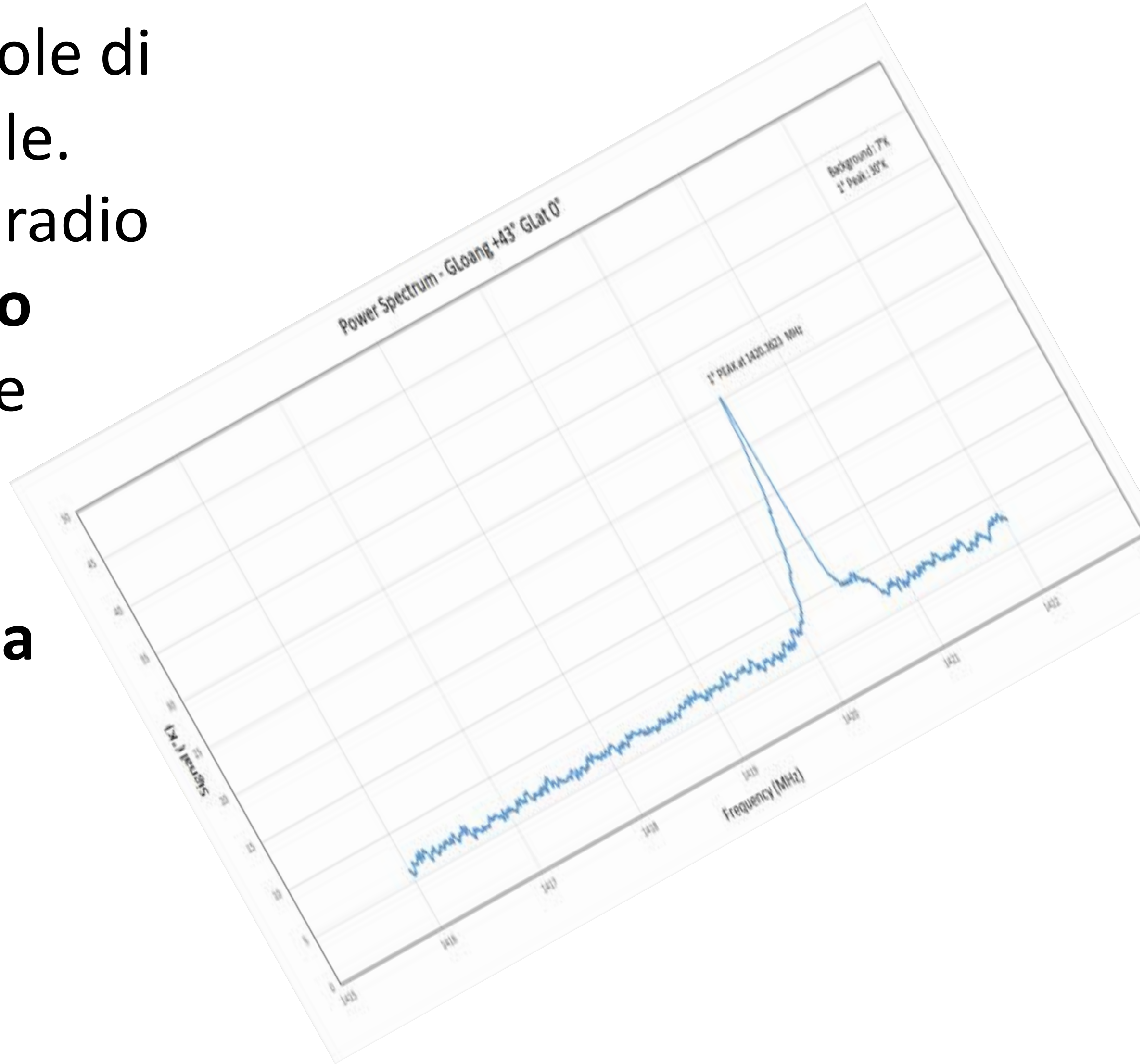
No theories yet exist which enable a reliable estimate of the probabilities of (1) planet formation; (2) origin of life; (3) evolution of societies possessing advanced scientific capabilities. In the absence of such theories, our environment suggests that stars of the main sequence with a lifetime of many billions of years can possess planets, that of a small set of such planets two (Earth and very probably Mars) support life, that life on one such planet includes a society recently capable of considerable scientific investigation. The lifetime of such societies is not known; but it seems unwarranted to deny that among such societies some might maintain themselves for times very long compared to the time of human history, perhaps for times comparable with geological time. It follows, then, that near some star …

To the beings of such a society, our Sun must appear as a likely site for the evolution of a new society. It is highly probable that for a long time they will have been expecting the development of science near the Sun. We shall assume that long ago they established a channel of communication that would one day become known to us, and that they look forward patiently to the answering signals from the Sun which would make known to them that a new society has entered the community of intelligence. What sort of a channel would it be?

The Optimum Channel

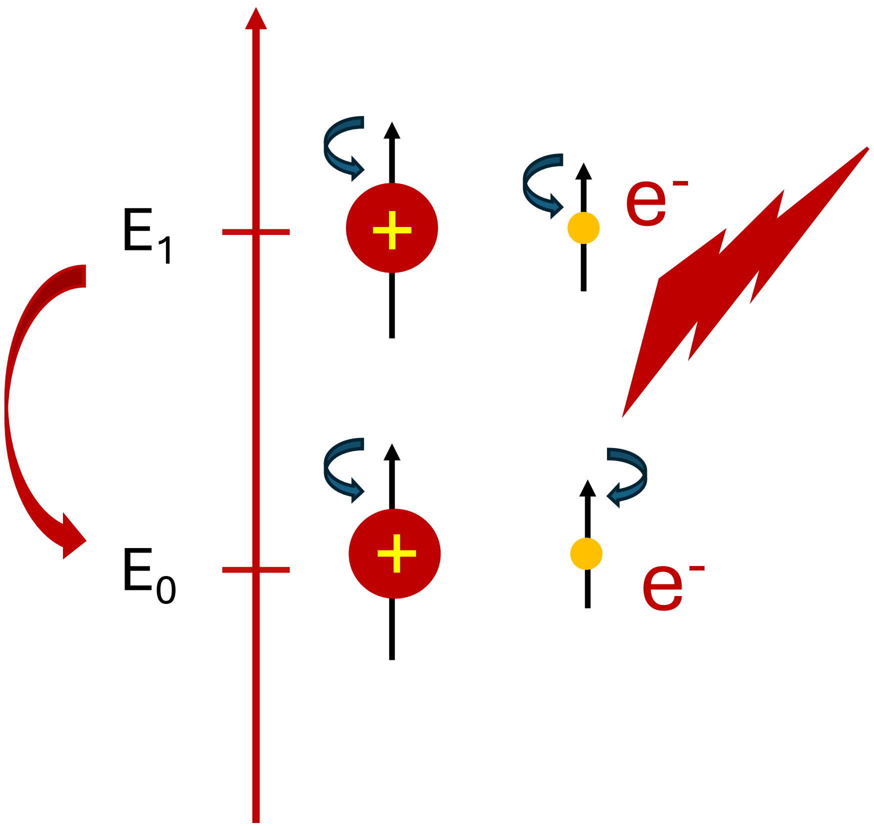
Interstellar communication across the galactic plasma without dispersion in direction and flight-time …

Una ricerca per un segnale debole di frequenza ignota è molto difficile. Esiste una regione nel dominio radio dove si ha **un unico ed obiettivo standard** di frequenza che deve essere conosciuto da ogni osservatore nell’Universo: **l’eccezionale riga di emissione a 1420 Hz (21 cm) dell’Idrogeno Neutro.**



Cocconi & Morrison, 1959, Nature, 184, 844

Emissione a 21 cm Idrogeno neutro: Transizione iperfine

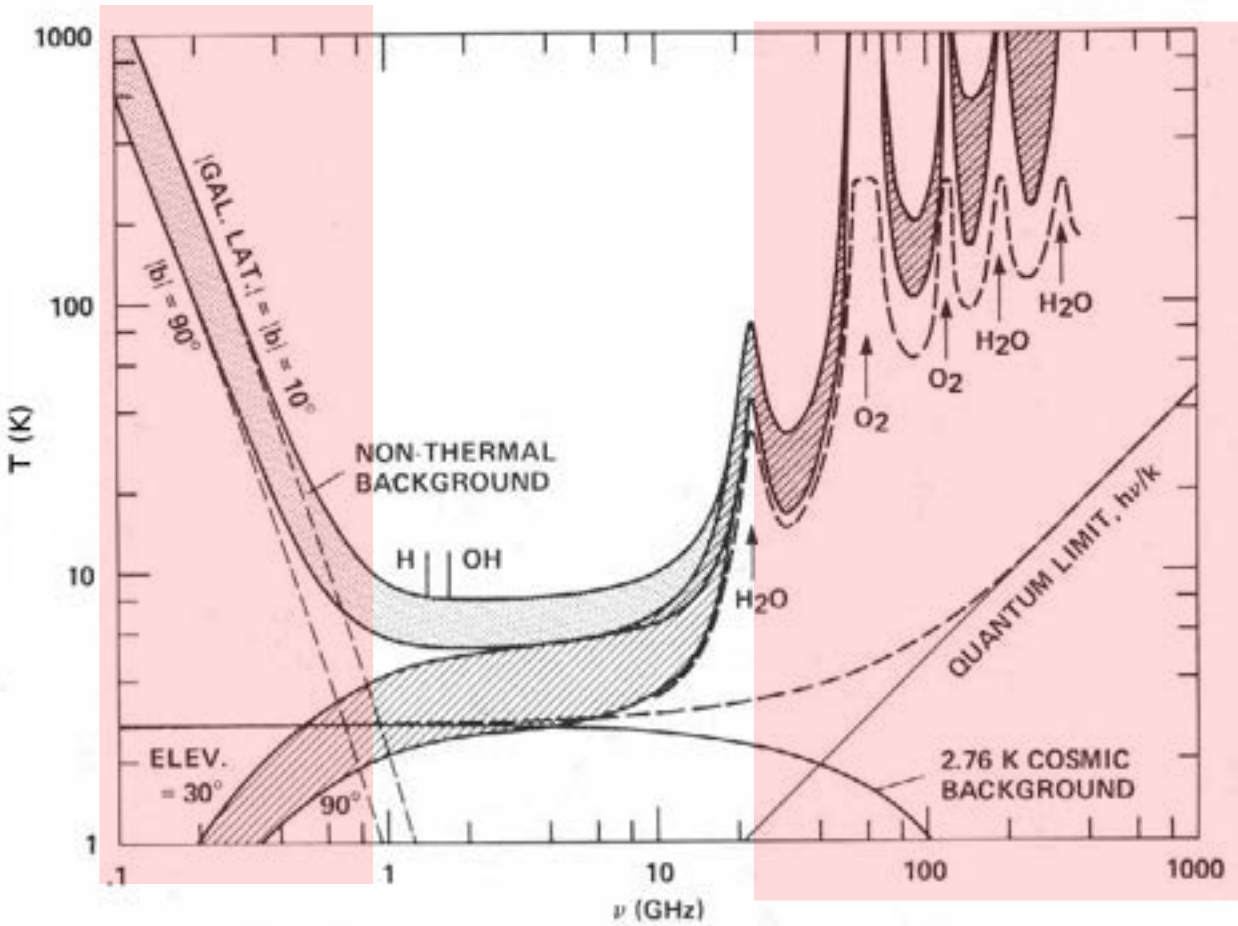


1 Evento ogni 10^7 anni
75% massa della Galassia è H

$$\Delta E = 9.42 \times 10^{-25}\, J = 5.87 \mu eV$$

$$\nu = 1420\ MHz$$
$$\lambda = 21.106\ cm$$

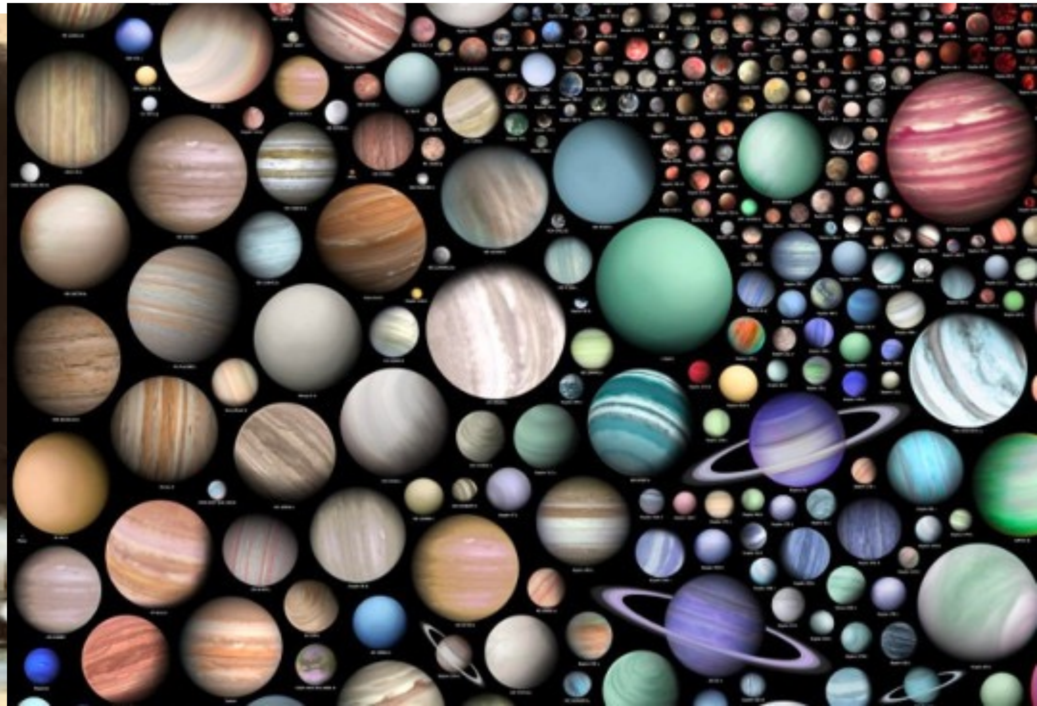
Fondo Galattico dovuto alla radiazione di sincrotrone dai raggi cosmici

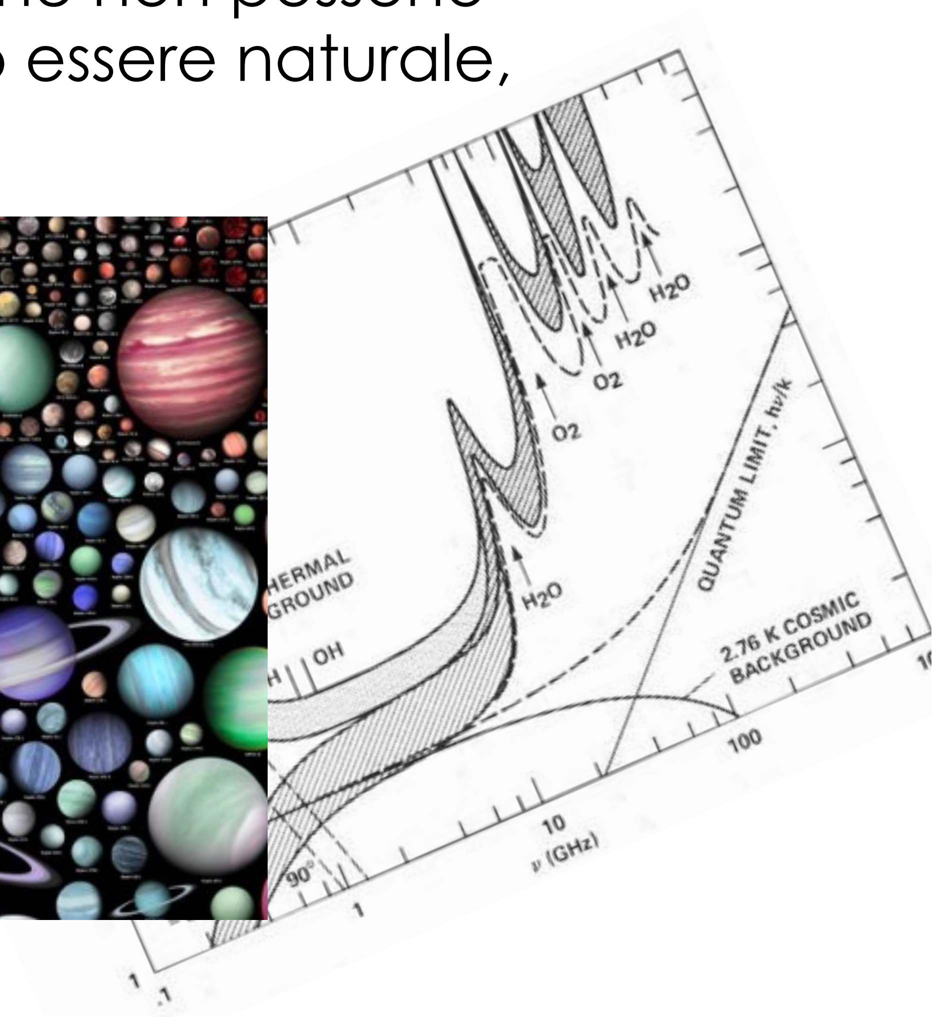


Assorbimento dovuto all'acqua nell' atmosfera Terrestre

WATER HOLE (1. ~ 20 Ghz)

Punto di Schelling: o punto focale, è il punto di incontro di due persone che non possono comunicare fra di loro e può essere naturale, rilevante o speciale





No. 4772 April 15, 1961 NATURE 205

INTERSTELLAR AND INTERPLANETARY COMMUNICATION BY OPTICAL MASERS

By Dr. R. N. SCHWARTZ and Prof. C. H. TOWNES*

Institute for Defense Analyses, Washington, D.C.

40

PROJECT OZMA

By F. D. Drake

THE question of the existence of intelligent life elsewhere in space has long fascinated people, but until recently has been properly left to the ... been very successful in explaining observational facts. Although perhaps not accurate in detail, at least in their broad general form they are very probably correct

Cocconi & Morrison 1959

Dyson, 1960

Reports

Search for Artificial Stellar Sources of Infrared Radiation

Abstract. If extraterrestrial intelligent beings exist and have reached a high level of technical development, one by-product of their energy metabolism is likely to be the large-scale conversion of starlight into far-infrared radiation. It is proposed that a search for sources of infrared radiation should accompany the recently initiated search for interstellar radio communications.

... events if these beings had originated in a solar system identical with ours. Taking our own solar system as the model, we shall reach at least a possible picture of what may be expected to happen elsewhere. I do not argue that this is what *will* happen in our system; I only say that this is what *may have* happened in other systems.

The material factors which ultimately limit the expansion of a technically advanced species are the supply of mat...

drive an intelligent species to adopt some such efficient exploitation of its available resources. One should expect that, within a few thousand years of its entering the stage of industrial development, any intelligent species should be found occupying an artificial biosphere which completely surrounds its parent star.

If the foregoing argument is accepted, then the search for extraterrestrial intelligent beings should not be confined to the neighborhood of visible stars. The most likely habitat for such beings would be a dark object, having a size comparable with the Earth's orbit, and a surface temperature of 200° to 300°K. Such a dark object would be radiating as copiously as the star which is hidden inside it, but the radiation would be in the far infrared, around 10 microns wavelength.

It happens that the earth's atmos...

670 NATURE May 28, 1960 Vol. 186

COMMUNICATIONS FROM SUPERIOR GALACTIC COMMUNITIES

By Prof. R. N. BRACEWELL

Radioscience Laboratory, Stanford University, California

SINCE Morrison and Cocconi[1] published the suggestion that there might be advanced societies elsewhere in the Galaxy, superior to ourselves in technological development, who are beaming transmissions at us on a frequency of 1,420 Mc./s., Drake[2] has described equipment under construction to look ... planetary systems. Beyond their immediate neighbourhood, it might be feasible for them to spray some number of suitable stars, say, one thousand, with modest probes. Each probe would be sent into a circular orbit about one of the thousand stars, at a distance within the habitable zone of temperature...

Sfera di Dyson


Reports

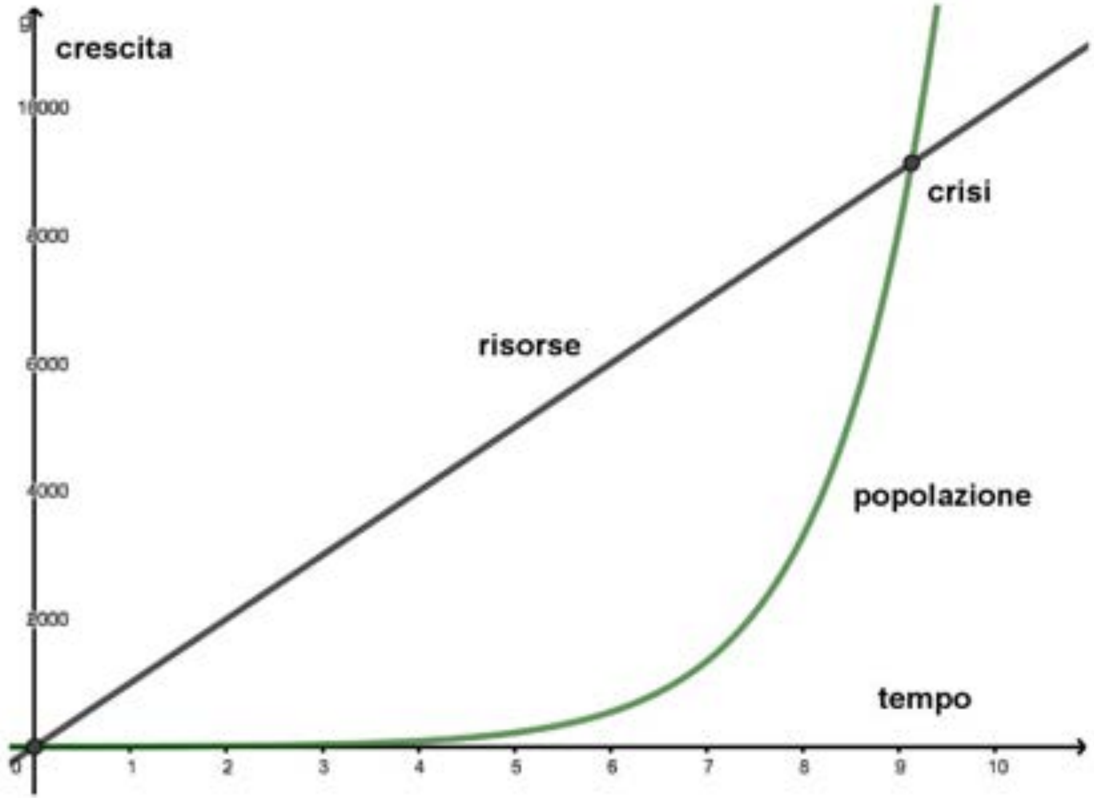
Dyson, 1960, Science, 131, 1667

Search for Artificial Stellar Sources of Infrared Radiation

Abstract. If extraterrestrial intelligent beings exist and have reached a high level of technical development, one by-product of their energy metabolism is likely to be the large-scale conversion of starlight into far-infrared radiation. It is proposed that a search for sources of infrared radiation should accompany the recently initiated search for interstellar radio communications.

Cocconi and Morrison (1) have called attention to the importance and feasi-

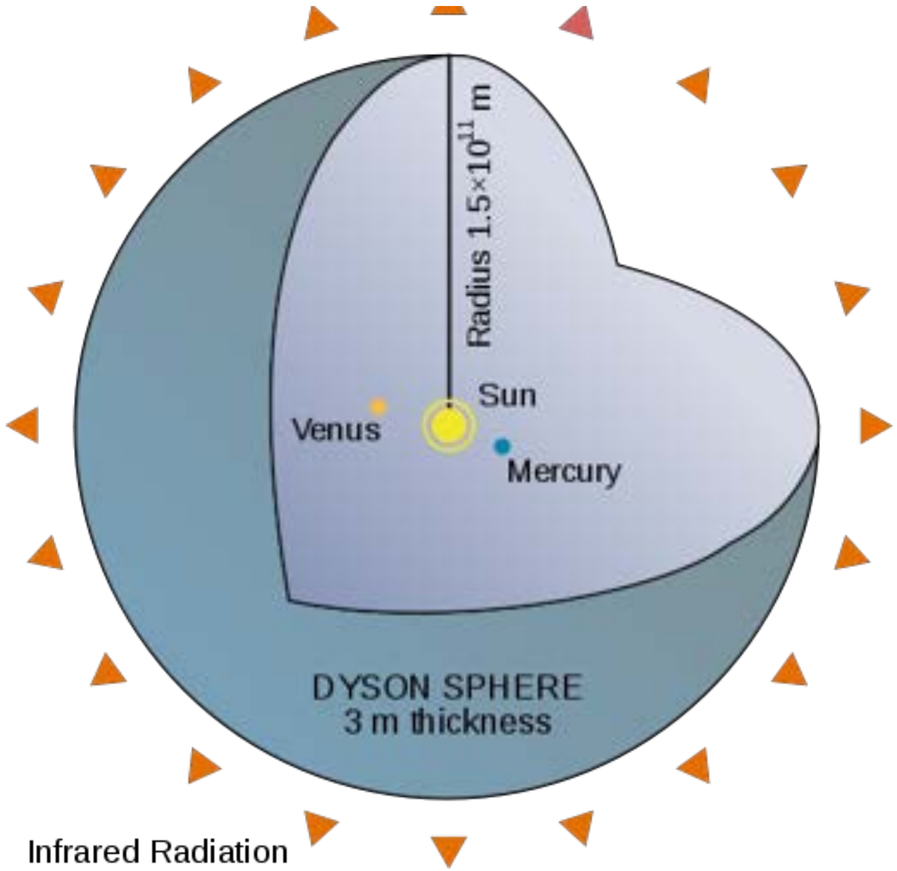
Teoria Malthusiana



1923-2020
QED Scientist

Sfera di Dyson

… La massa di Giove se distribuita in un guscio sferico che ruota intorno al Sole a due colte la distanza della Terra dal Sole, dovrebbe avere uno spessore tale da avere una densità superficiale pari a 200 g/cm^2. Questo spessore dovrebbe essere di 2-3 m che lo renderebbe abitabile e capace di contenere i macchinari necesssari per sfruttare la radiazione Solare.



Progetto OZMA

Drake, 1961 (Phys. Today) ha proposto il progetto OZMA (dal nome della regina della terra di OZ).

Green Bank Radio Telescope
NRAO (Virginia)
Disco 26 m
in operatività dal 1959.

Drake 1960 decise di osservare intensamente le due stelle di tipo solare più vicine alla Terra.

Tau Ceti
G8.5 V
D= 3.63 pc
2012: 5 super terre, 2 in HZ

Eps. Eridani
K2 V
D=3.22 pc
2000: 1 0.7 M_J

Le due stelle furono osservate per 150 ore, ma non fu osservato nessun segnale e il progetto fu cancellato.

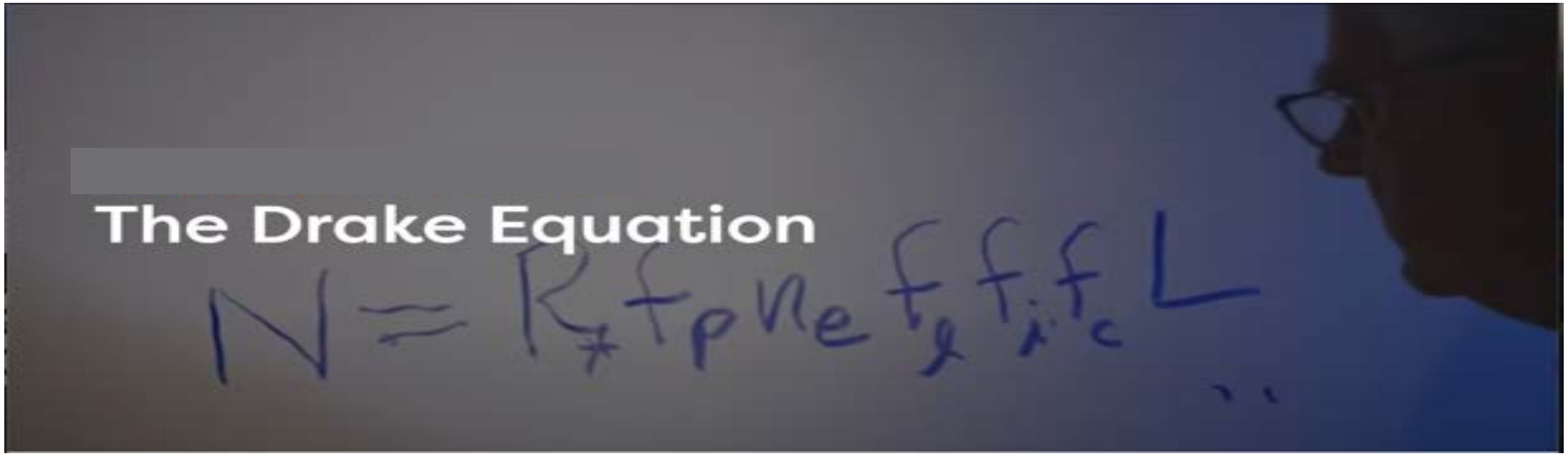
Drake, 1960, Physic Today

La prima Conferenza SETI

1-11-1961: Green Bank NRAO Observatory

- **Frank Drake:** Astronomo e figura chiave del Progetto SETI.
- **Carl Sagan:** Astronomo.
- **John C. Lilly:** Scienziato di neuroscienze, Famoso per il suo Lavoro sulla intelligenza e la comunicazione dei delfini
- **Philip Morrison:** Fisico ed Astronomo coinvolto nel Progetto Orion
- **Otto Struve:** Radio Astronomo Russo.
- **Melvin Calvin:** Chimico e premio Nobel.
- **Su-Shu Huang:** Astronomo, fu il primo a parlare di Zona Abitabile intorno ad una stella.
- **Barney Oliver:** Pioniere dell'informatica ed inventore.
- **Dana Atchley:** Uomo d'affari ed esparto di Radio.
- **J. Peter Pearman:** CoOrganizzatore della conferenza.


The Order of the Dolphins



$$N = R_{*} f_{P} n_{e} f_{l} f_{i} f_{c} L$$

- https://www.seti.org/research/seti-101/drake-equation/

N:	Numero di civiltà nella Galassia le cui emissioni elettromagnetiche sono osservabili.
$\mathbf{R_*}$	Tasso di formazione delle stelle utili allo sviluppo di vita intelligente
$\mathbf{f_p}$	Frazione delle stelle con sistemi planetari
$\mathbf{n_e}$	Numero di pianeti abitabili per Sistema planetario.
$\mathbf{f_l}$	Frazione di pianeti abitabili sui quali appare la vita.
$\mathbf{f_i}$	Frazione dei pianeti che hanno vita in cui emerge la vita intelligente
$\mathbf{f_c}$	Frazione delle civiltà che producono segni della loro esistenza
L	La durata media delle civiltà che producono tali segnali (anni).

Table 7.1. *Estimates of factors in the Drake Equation for communicative civilizations*

Author	Date	R^*	f_p	n_e	f_l	f_i	f_c	L	N
Green Bank	1963	1–10	.5	1–5	1	1	.1	10^3–10^8	$< 10^3$–10^9
Cameron	1963		1	.3	1	1	.5	10^6	2×10^6
Sagan	1963	10	1	1	1	.1	.1	10^7	10^6
Shklovskii/ Sagan	1966	10	1	1	1	.1	.1	10^7	10^6
Byurakan	1971	10	1	1	———	.01	———	10^7	10^6
Oliver	1971	20	.5	1	.2	1	.5	?	$= L$
Rood/ Trefil	1981	.05	.1	.05	.01	.5	.5	10^4	.003

R^* = rate of star formation, f_p = fraction of stars forming planets, n_e = number of planets per star with environments suitable for life, f_l = fraction of suitable planets on which life develops, f_i = fraction of life-bearing planets on which intelligence evolves, f_c = fraction of intelligent cultures communicative over interstellar distances, L = lifetime of a communicative civilization, N = number of communicative civilizations in the Galaxy at a given time.

Note: For references see Steven J. Dick, *The Biological Universe,* p. 441.

Table 4
Drake Equation Parameters

Variable	Value	Unit	Description
R_*	2	stars yr^{-1}	Rate of star formation in our galaxy
f_p	0.7	⋯	Fraction of stars with planets
n_e	0.1	⋯	Number of planets that can support life, per star with planets
f_l	0.2	⋯	Fraction of planets that support life
f_i	0.2	⋯	Fraction of life-harboring planets that develop intelligent life
f_c	1.0	⋯	Fraction of intelligent life that develops deep space communications capability
L	150	yr	Length of time for which such communications exist

N=0.87

Ashtari, R. 2023, ApJ, 957, 15

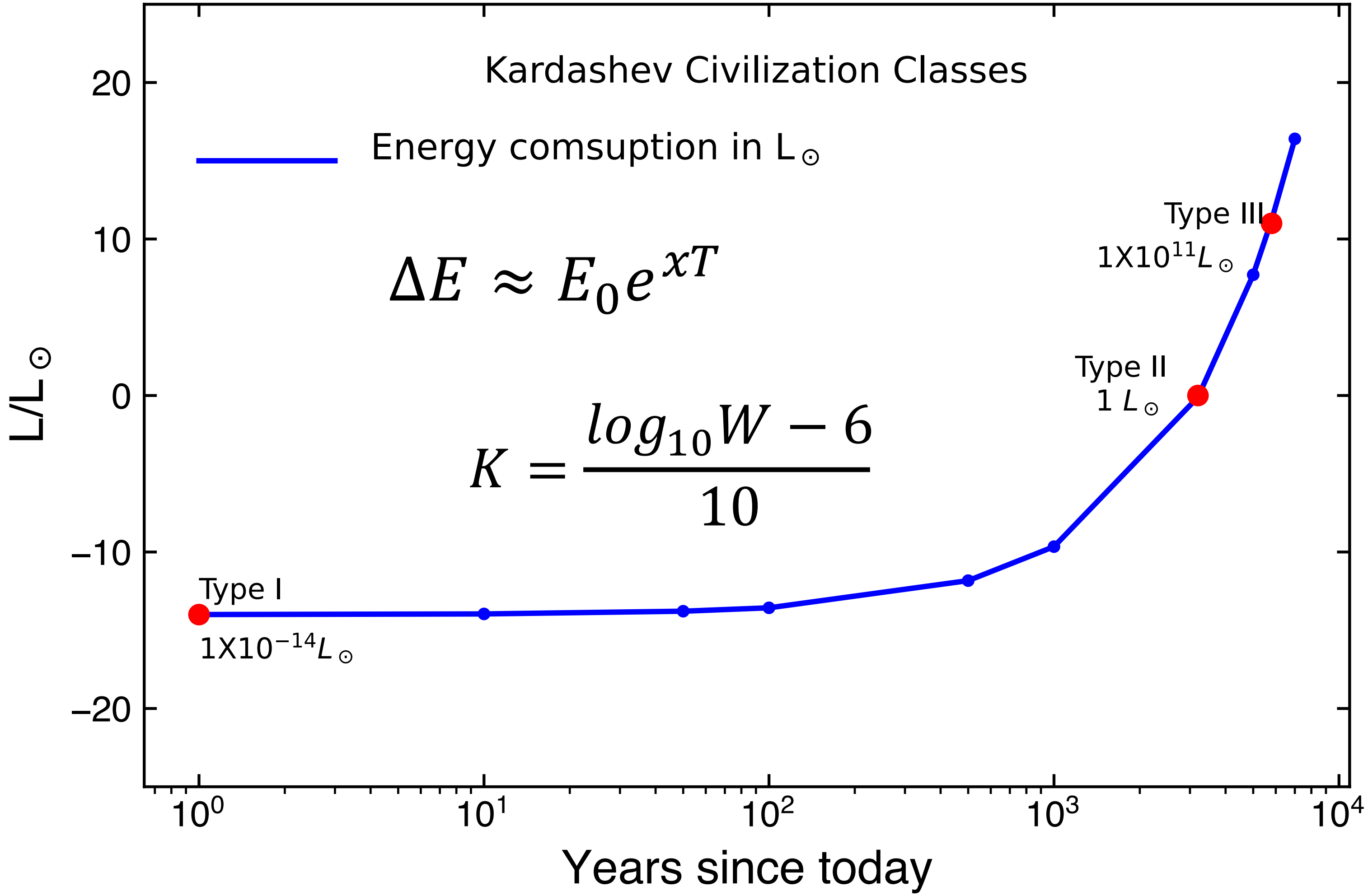
1962: I.S. Shklovsky Universe, Life, Intelligence

Sholomitsky

Kardashev

Shklowsky

Kardashev 1964 Sv. A. 8, 217



Kardashev, Sholomintsky e CTA-52 e CTA-102

CTA-21 (ICRF J031857.8+162832, Seyfert 2 Galaxy) e
CTA-102 (4c 11.69 Blazar) furono osservate per 80 ore da 8 antenne.
In CTA- 102 Osservano un’emissione ritenuta non naturale.

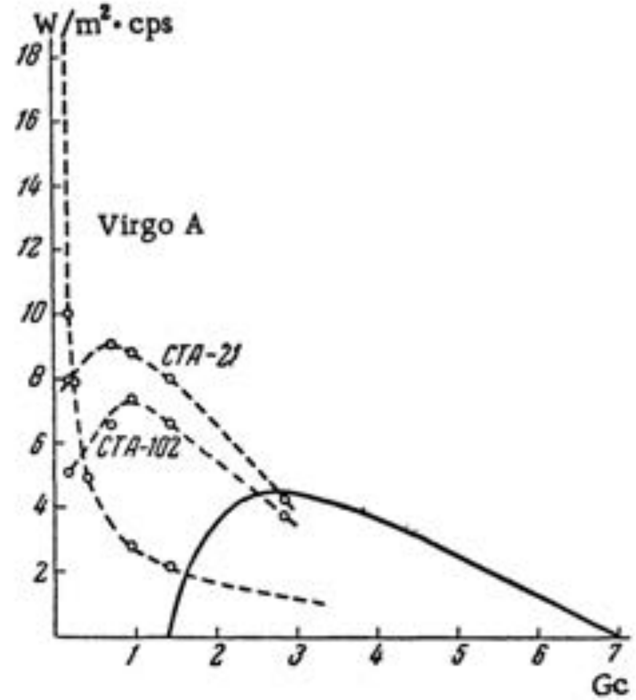


Fig. 2. ——) Anticipated emission spectrum of radio transmitters of extraterrestrial civilizations; - - - -) spectrum of radio sources CTA-21 and CTA-102, suspected of being artificial radio sources, and spectrum of a typical natural radio source Virgo A.

Segnali dallo Spazio!?

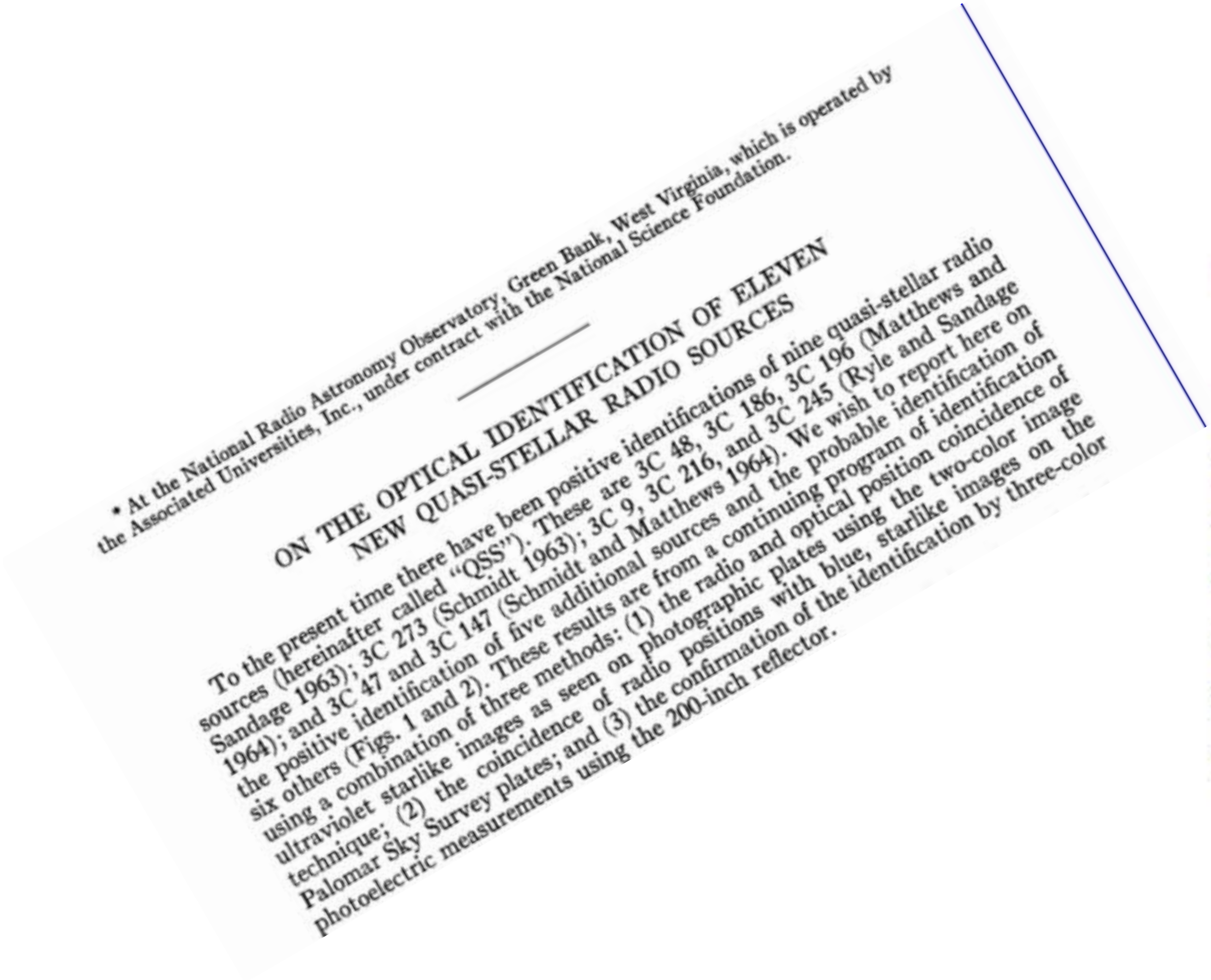
La TASS diffuse la notizia e venne pubblicata in un editorial del New York Times nel Marzo del 1965

1967 The Byrds
Album: Younger than yesterday, c'è il brano: CTA-102 (terza traccia)

C.T.A. 102
Year over year receiving you
Signals tell us that you're there
We can hear them loud and clear
We just want to let you know
That we're ready for to go
Out into the universe

We don't care who's been there first
On a radio telescope
Science tells us that there's hope
Life on other planets might exist

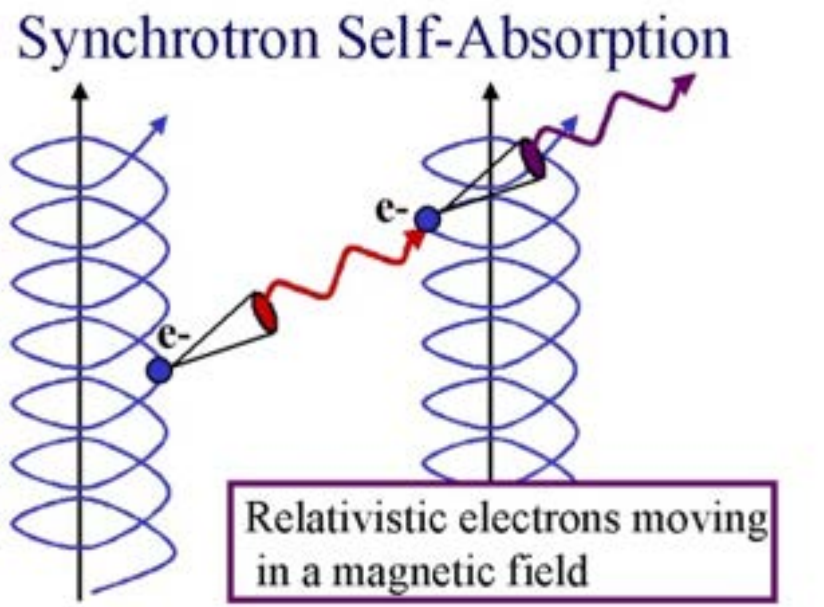
…no. Auto assorbimento di Sincrotrone



* At the National Radio Astronomy Observatory, Green Bank, West Virginia, which is operated by the Associated Universities, Inc., under contract with the National Science Foundation.

ON THE OPTICAL IDENTIFICATION OF ELEVEN NEW QUASI-STELLAR RADIO SOURCES

To the present time there have been positive identifications of nine quasi-stellar radio sources (hereinafter called "QSS"). These are 3C 48, 3C 186, 3C 196 (Matthews and Sandage 1963); 3C 273 (Schmidt 1963); 3C 9, 3C 216, and 3C 245 (Ryle and Sandage 1964); and 3C 47 and 3C 147 (Schmidt and Matthews 1964). We wish to report here on the positive identification of five additional sources and the probable identification of six others (Figs. 1 and 2). These results are from a continuing program of identification using a combination of three methods: (1) the radio and optical position coincidence of ultraviolet starlike images as seen on photographic plates using the two-color image technique; (2) the coincidence of radio positions with blue, starlike images on the Palomar Sky Survey plates; and (3) the confirmation of the identification by three-color photoelectric measurements using the 200-inch reflector.



Sandage & Wyndhanm, 1965, ApJ, 141, 328

Little Green Men …

Nel 1967 Jocelyn Bell (Studiava le variazioni di luminosità radio dei quasar), ha osservato un segnale periodico ripetuto che per gioco chiamò LGM.

Observation of a Rapidly Pulsating Radio Source

by

A. HEWISH
S. J. BELL
J. D. H. PILKINGTON
P. F. SCOTT
R. A. COLLINS

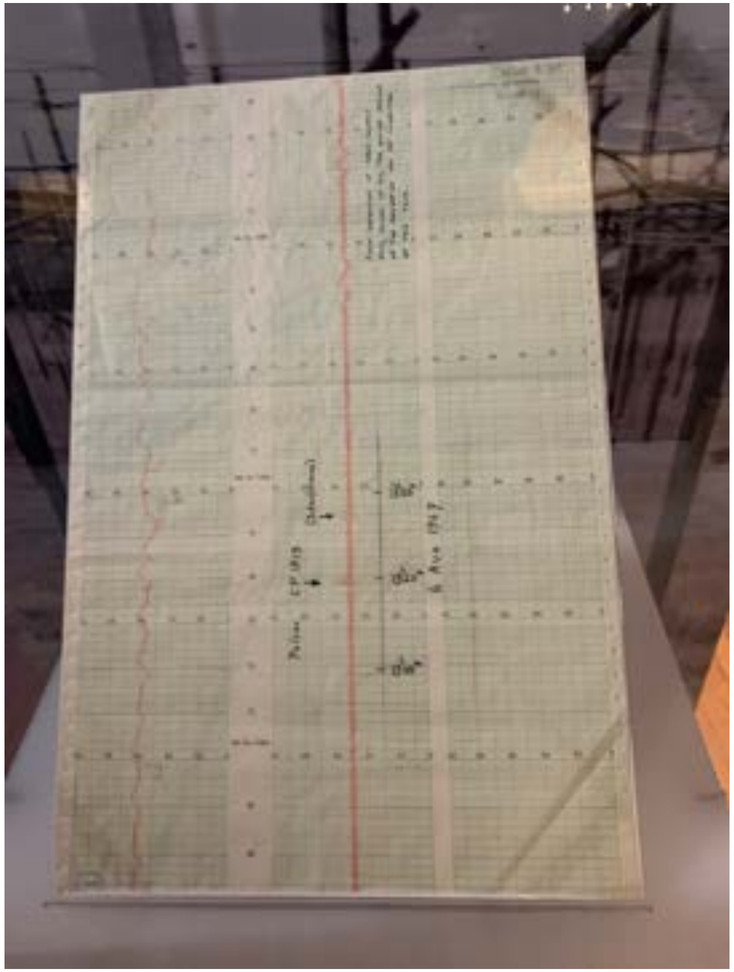
Mullard Radio Astronomy Observatory,
Cavendish Laboratory,
University of Cambridge

Unusual signals from pulsating radio sources have been recorded at the Mullard Radio Astronomy Observatory. The radiation seems to come from local objects within the galaxy, and may be associated with oscillations of white dwarf or neutron stars.

In July 1967, a large radio telescope operating at a frequency of 81.5 MHz was brought into use at the Mullard Radio Astronomy Observatory. This instrument was designed to investigate the angular structure of compact radio sources by observing the scintillation caused by the irregular structure of the interplanetary medium[1]. The initial survey includes the whole sky in the declination

of three others having remarkably similar properties which suggests that this type of source may be relatively common at a low flux density. A tentative explanation of these unusual sources in terms of the stable oscillations of white dwarf or neutron stars is proposed.

Position and Flux Density



Hewish (suo tutor) prese il premio Nobel nel 1974 (solo lui) per la scoperta delle Pulsar

1971: Team della NASA: Progetto Ciclopi

John Billigam

Bernard Olliver

Obiettivo: Studiare come condurre la ricerca di intelligenza extraterrestre (SETI).

Tecnologia proposta: Un sistema di ricerca coordinata con 1.000-2.500 telescopi radio da100 metri per cercare segnali radio da civiltà extraterrestri.

Stato: Il progetto è stato abbandonato per i costi elevati, ma il rapporto è diventato fondamentale per il lavoro SETI futuro.

La Seconda Conferenza SETI

Communication with Extraterrestrial Intelligence (CETI), The First International Conference on Extraterrestrial Civilizations and Problems of Contact with Them fu tenuta all’Osservatorio di Byurakan (Armenia) nel Settembre 1971.

Tentativi di Comunicazione (CETI): Pioneer 10 (1972) e 11 (1973); Voyager 1 e 2(1977)

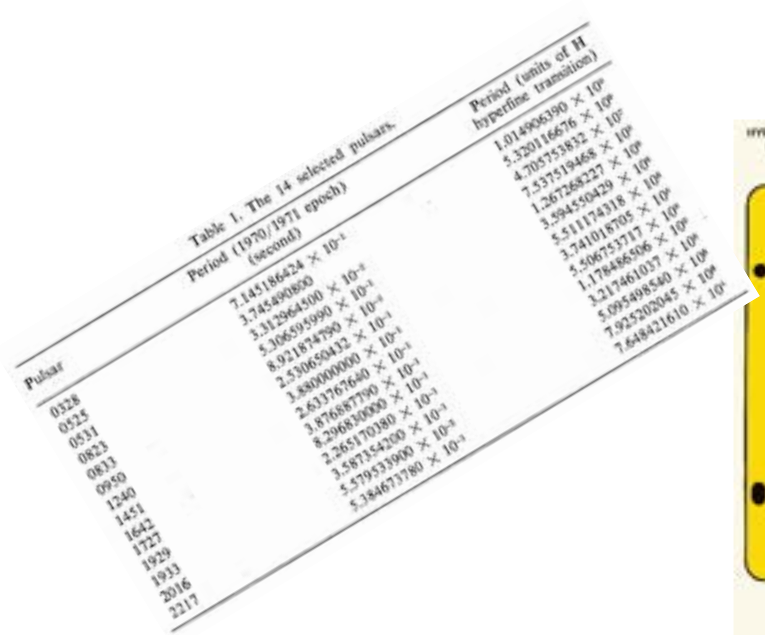
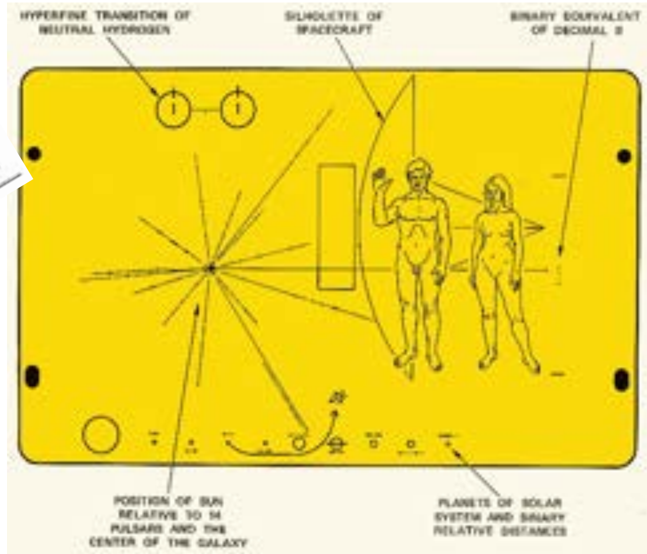
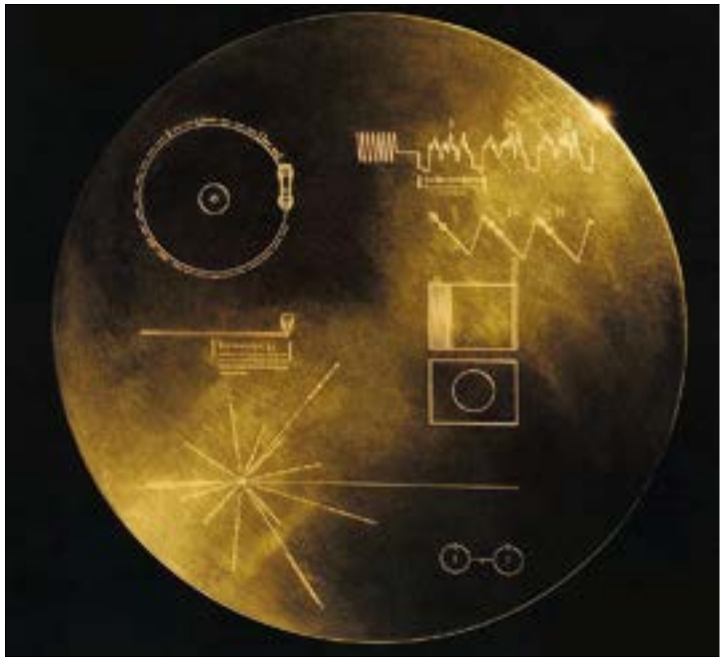


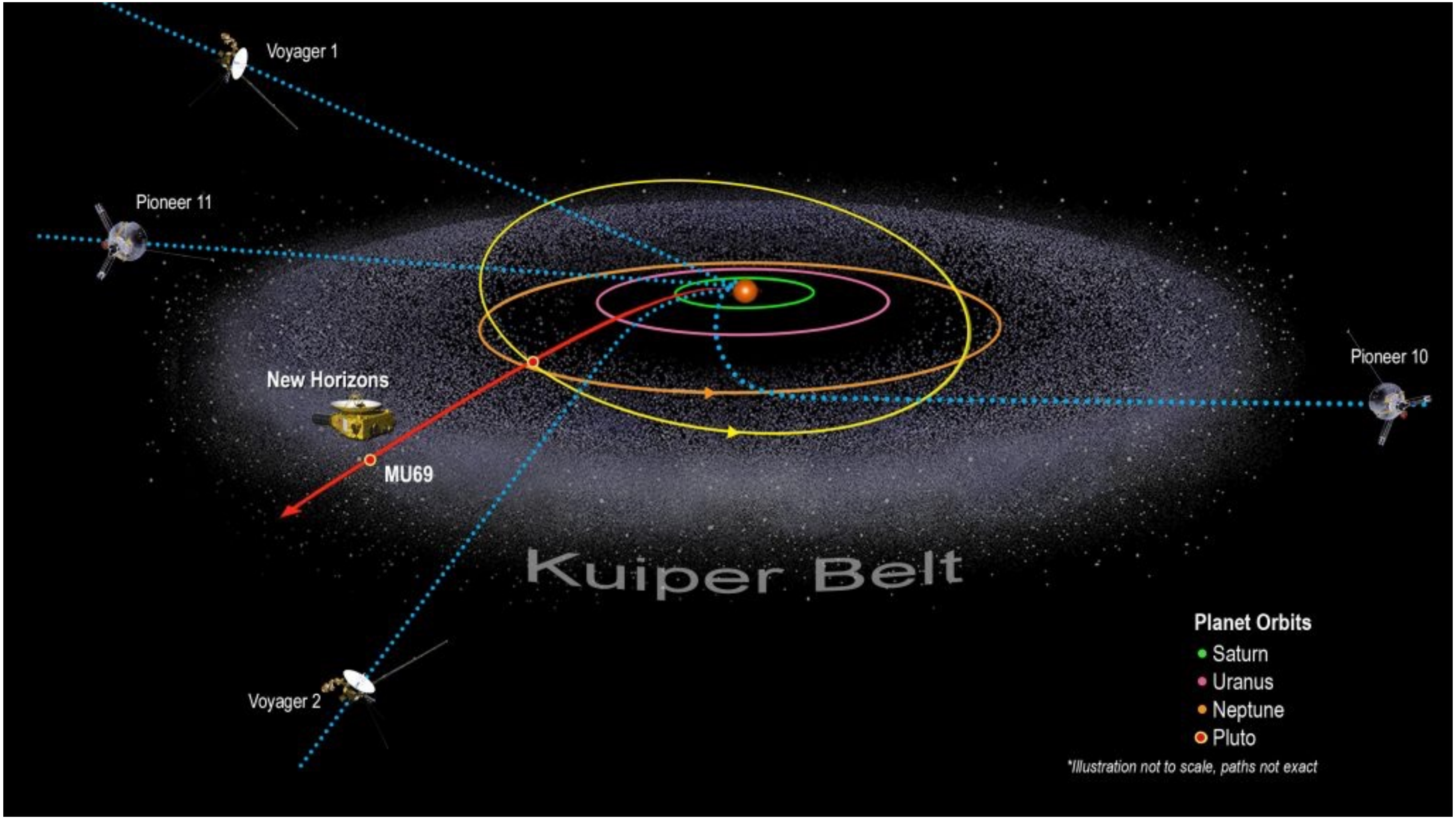
Table 1. The 14 selected pulsars.

Pulsar	Period (1970/1971 epoch) (second)	Period (units of H hyperfine transition)
0328	$7.145186424 \times 10^{-1}$	$1.014906390 \times 10^{9}$
0525	3.745490800	$5.320116676 \times 10^{9}$
0531	$3.312964500 \times 10^{-2}$	$4.705753832 \times 10^{7}$
0823	$5.306595990 \times 10^{-1}$	$7.537519468 \times 10^{8}$
0833	$8.921874790 \times 10^{-2}$	$1.267268227 \times 10^{8}$
0950	$2.530650432 \times 10^{-1}$	$3.594550429 \times 10^{8}$
1240	$3.880000000 \times 10^{-1}$	$5.511174318 \times 10^{8}$
1451	$2.633767640 \times 10^{-1}$	$3.741018705 \times 10^{8}$
1642	$3.876887790 \times 10^{-1}$	$5.506753717 \times 10^{8}$
1727	$8.296830000 \times 10^{-1}$	$1.178486506 \times 10^{9}$
1929	$2.265170380 \times 10^{-1}$	$3.217461037 \times 10^{8}$
1933	$3.587354200 \times 10^{-1}$	$5.095498540 \times 10^{8}$
2016	$5.579533900 \times 10^{-1}$	$7.925202045 \times 10^{8}$
2217	$5.384673780 \times 10^{-1}$	$7.648421610 \times 10^{8}$





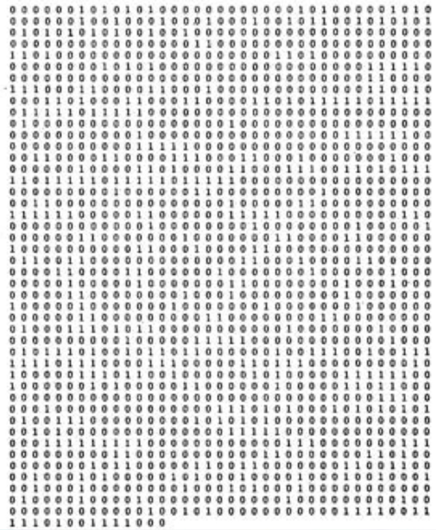
Sagan et al, 1972, Science, 175, 881

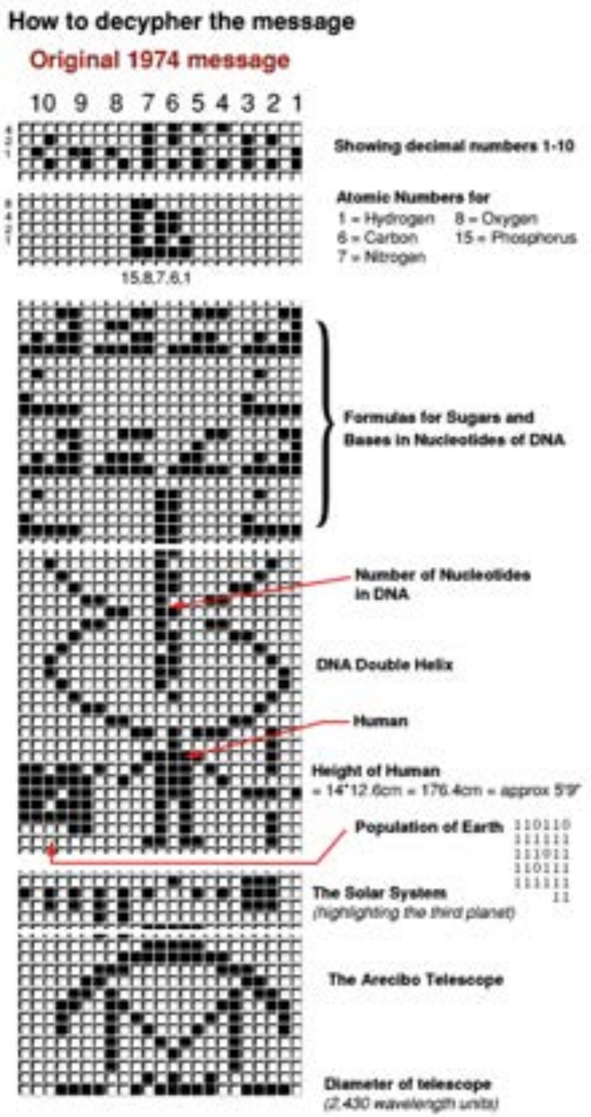


Voyager 1
Pioneer 11
Pioneer 10
New Horizons
MU69
Kuiper Belt
Voyager 2
Planet Orbits
Saturn
Uranus
Neptune
Pluto
*Illustration not to scale, paths not exact

CETI: il messaggio di Arecibo
11 novembre 1974

Matrice binaria 23X79 (numerio primi) irradiata dal radiotelescopio di Arecibo verso il globular cluster M13 (in Ercole) D=22.18 ly





1973 Ohio State University Inizia Osservazioni SETI

Secondario
Parabolico

Primario, Piatto,
Parte Mobile

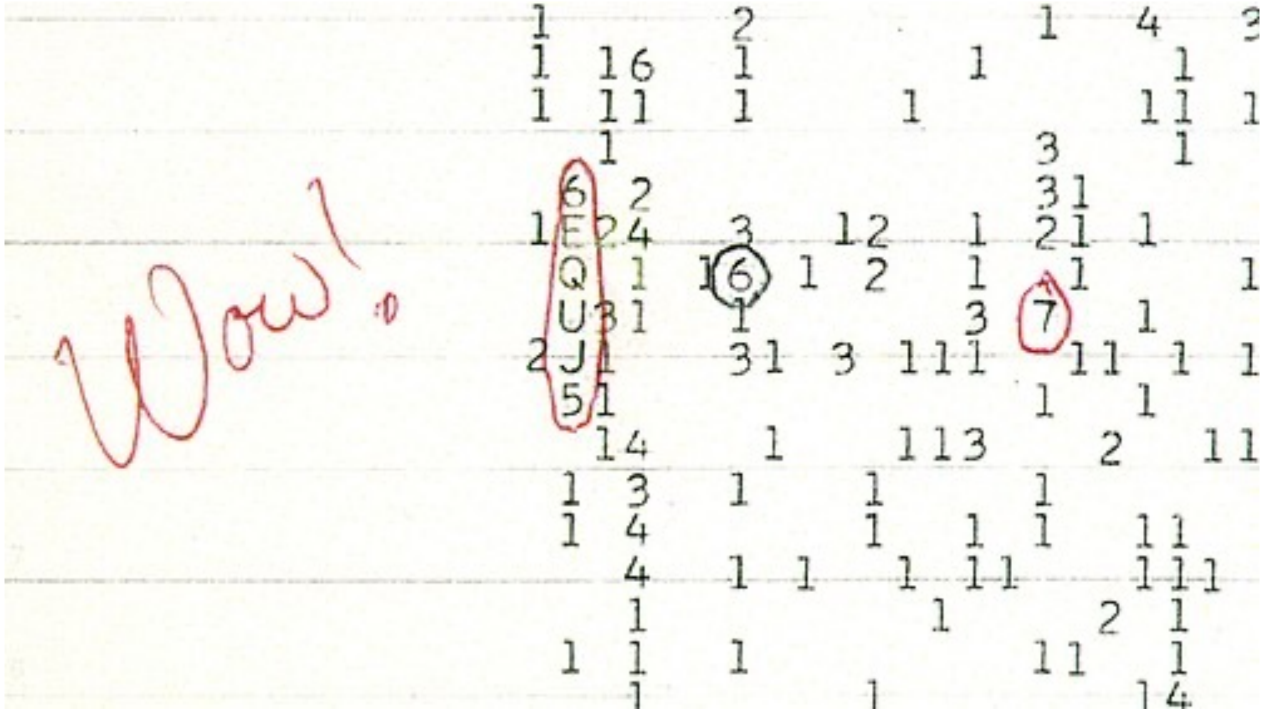
Carrello Mobile

Radio Telescopio Big Ear. Radio Telescopio di tipo Kraus: Come uno strumento dei passaggi. Primario piatto mobile che riflette verso un secondario parabolico con un carrello mobile focale che si muove da Est a Ovest. In funzione fino al 1997. Dismesso nel 1998 e trasformato in campo da Golf.

1977: WOW! Signal

Osservato dal radio telescopio BIG EAR dell'Università statale dell' OHIO.

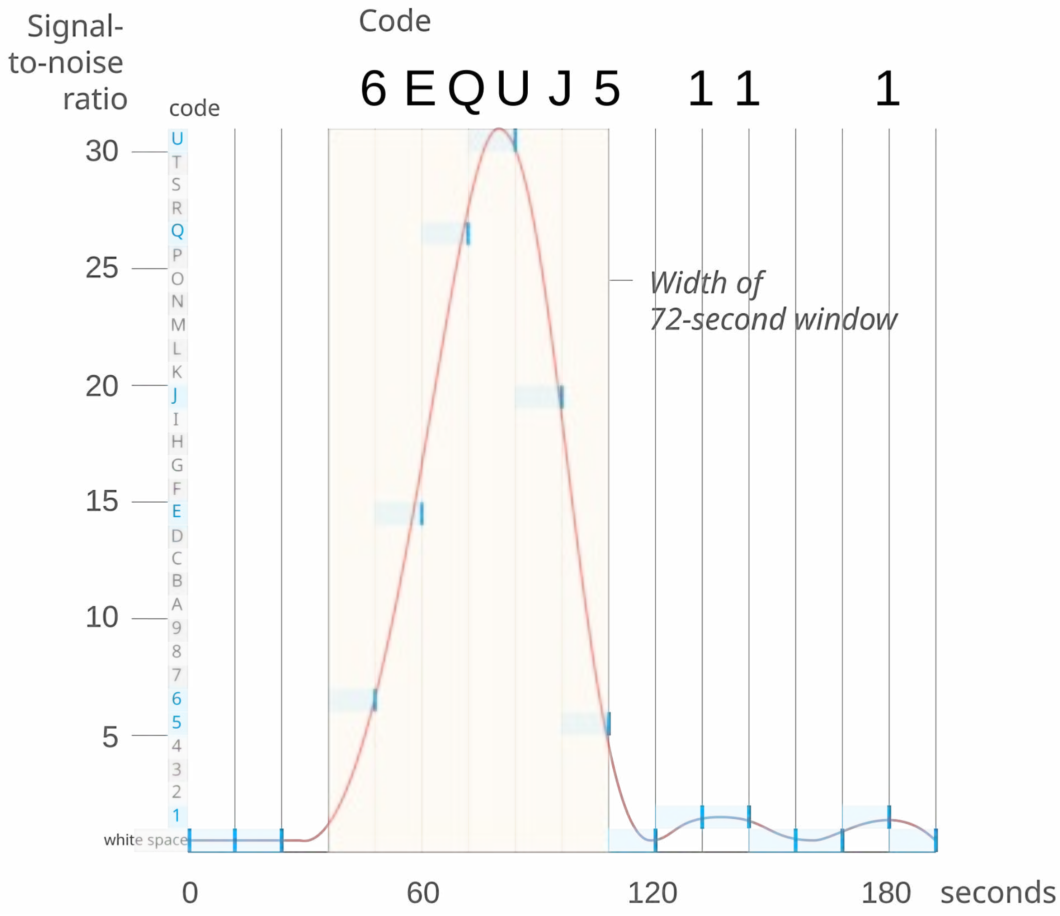
Jerry R. Ehman Trovò un picco di emissione a 1.420 GHz. Il segnale durò circa due minuti con un'intensità 30 volte maggiore del fondo



Interpretazione del WOW! Signal

Il segnale è durato 72 s
(limite temporale del Big Ear)
con un punto ogni 12 s

Codice	Valore SNR
Spazio	0.000 → 0.999
1 → 9	1.000 → 9.999
A	10.000 → 10.999
B	11.000 → 11.999
. . .	. . .
E	14.000 → 14.999
Q	26.000 → 26.999
U	30.000 → 30.999



Interpretazione del WOW! Signal

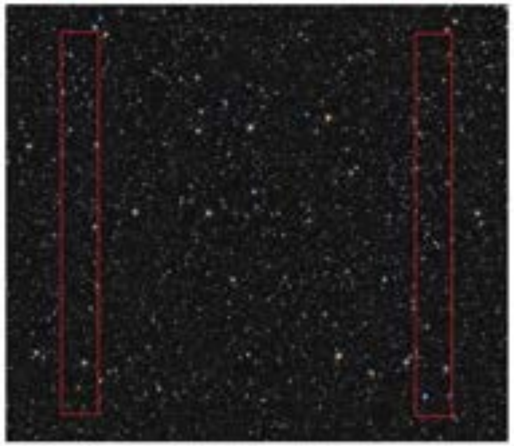
Il Segnale non si è ripetuto.

Possibili spiegazioni:

1. Frank Drake: segnale emesso una sola volta (come il messaggio di Arecibo) da una civiltà extraterrestre che avrebbe focalizzato tutta l'energia di emissione in breve tempo e in una banda stretta
1. Scintillazione interstellare dovuta a fluttuazioni di Plasma
2. Pulsar lontane
3. Riflesso di un segnale Terrestre da parte di un detrito spaziale
4. Paris et al. 2015 JWAS, 101, 25. Segnale emesso da nuvole di idrogeno della cometa 266P/Christensen e/o P/2008 Y2
5. Mendez et al 2025, astroph2508.10657. Fenomeno naturale generato da una emissione stimolata nella riga H (maser) che nel tragitto verso la Terra incontra una nube fredda di H neutro.

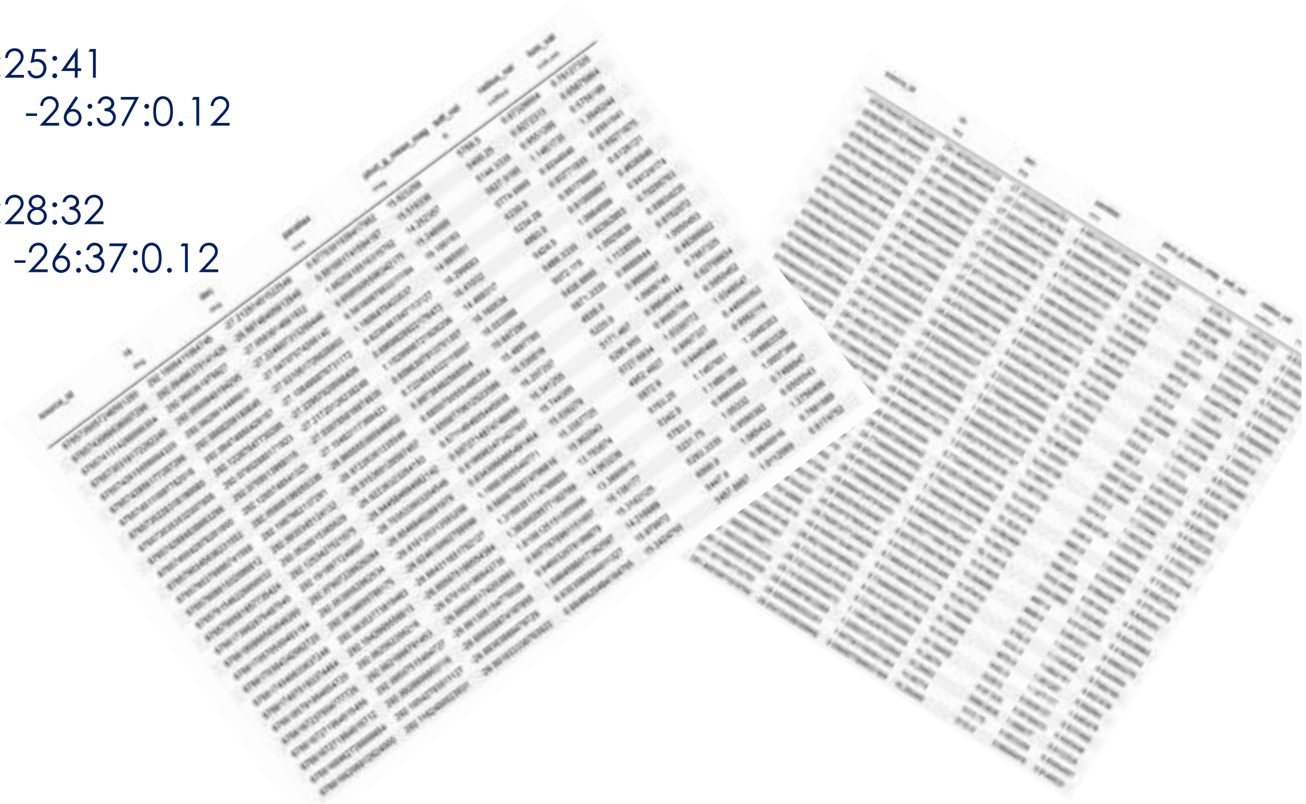
Identificazione della provenienza del WOW! Signal

Diversi tentativi. L'ultimo da parte di Caballero 2025.



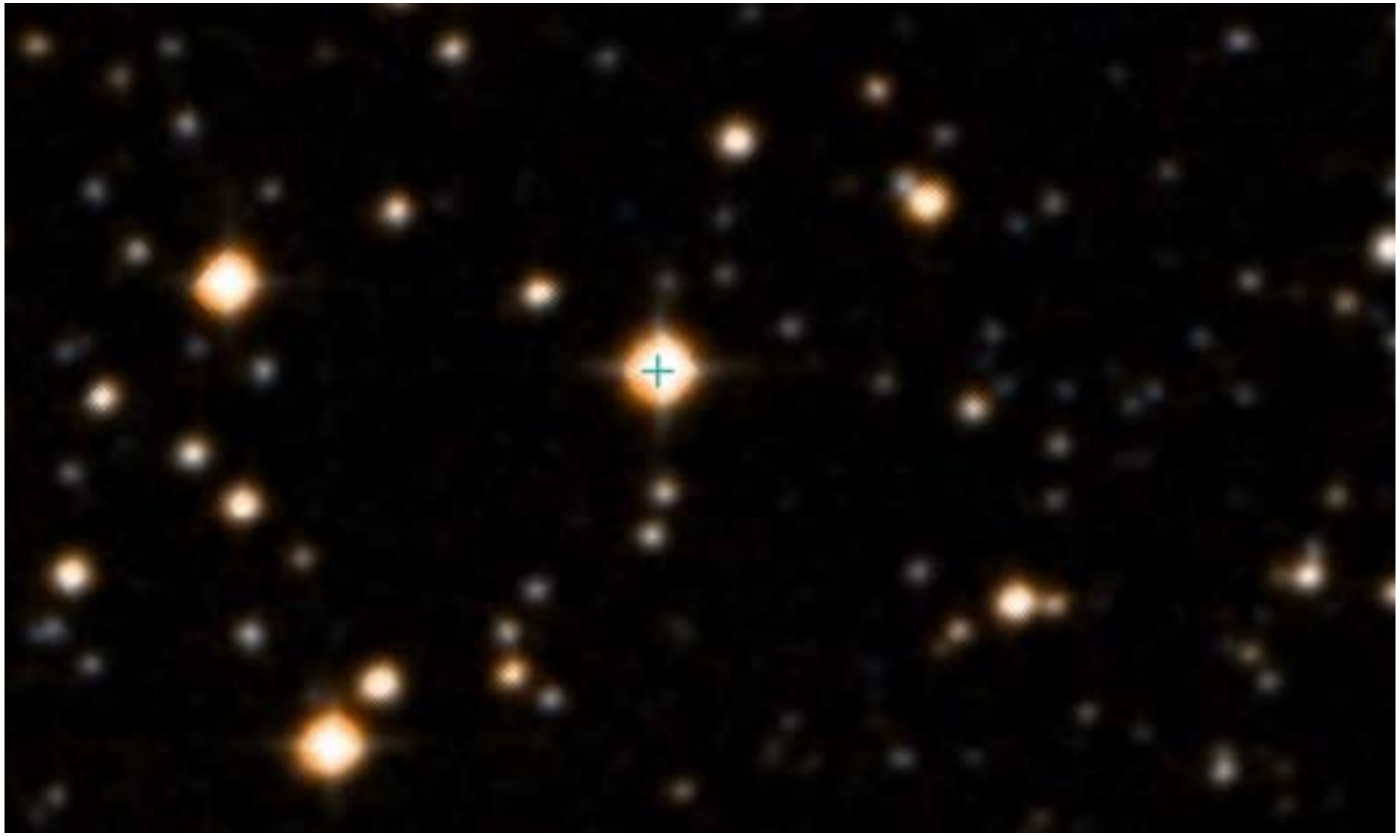
RA 19:25:21 ; 19:25:41
DEC -27:16:59.8; -26:37:0.12

RA 19:28:12 ; 19:28:32
DEC -27:16:59.8; -26:37:0.12



Dopo aver analizzato le due parti di cielo osservate da Big Ear, ha identificato nell'archivio GAIA DR2 un totale di 66 stelle G e K più lontane di circa 500 ly.

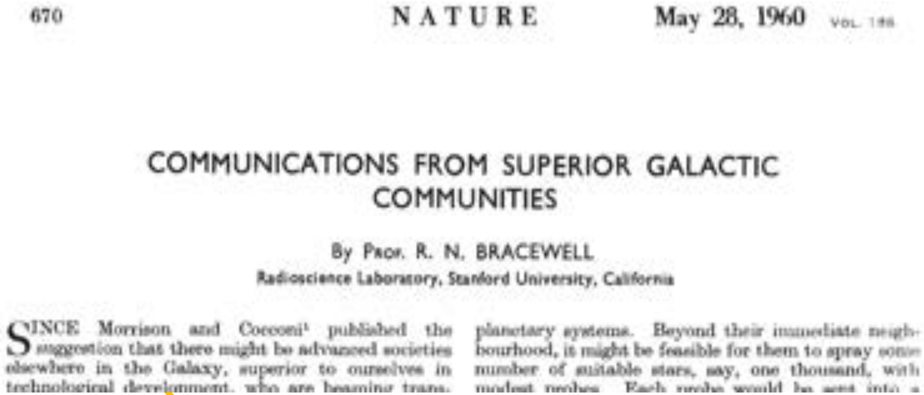
2MASS J19281939-2641507



V=12.44
T=5783 K
R=0.996 R_{SUN}
L=1.0007 L_{SUN}
P=1.2059 +/- 0.0264
d=552 pc=1801 ly

Caballero, 2024, Int. Jou. of Astr., 21,129

Emissari Robotici



670 NATURE May 28, 1960 VOL. 186

COMMUNICATIONS FROM SUPERIOR GALACTIC COMMUNITIES

By Prof. R. N. BRACEWELL

Radioscience Laboratory, Stanford University, California

SINCE Morrison and Cocconi[1] published the suggestion that there might be advanced societies elsewhere in the Galaxy, superior to ourselves in technological development, who are beaming trans- planetary systems. Beyond their immediate neighbourhood, it might be feasible for them to spray some number of suitable stars, say, one thousand, with modest probes. Each probe would be sent into a

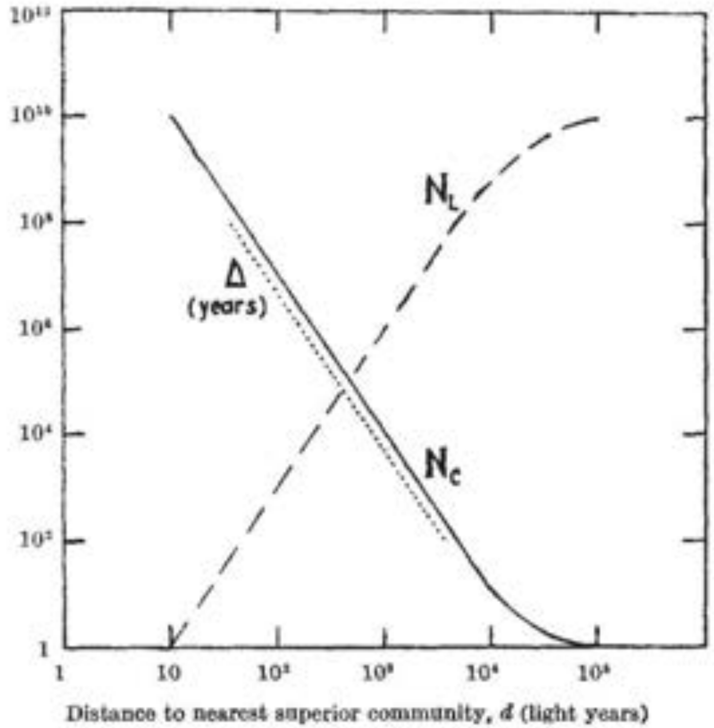
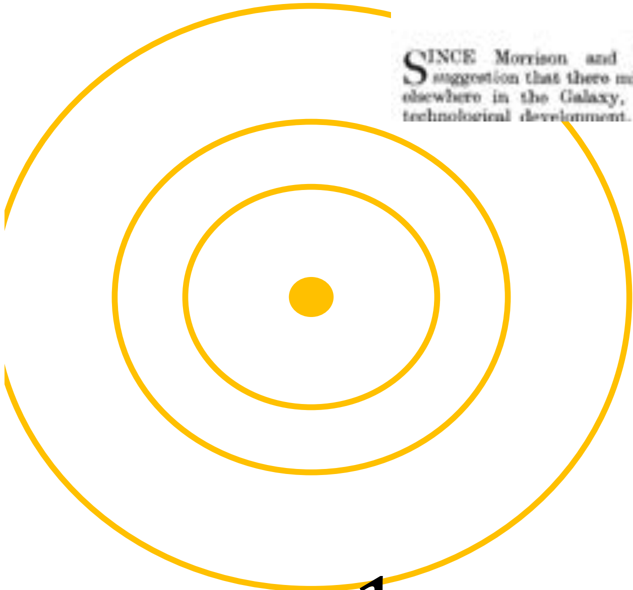


Fig. 1. N_C, total number of communities in the galaxy the technology of which is superior to ours; N_L, total number of likely stars out to a distance d; Δ, average life-time of a superior community



$$P \propto \frac{1}{D^2}$$

Per questa ragione noi dovremmo indirizzare i nostri sforzi per cercare nel Sistema solare sonde spaziali inviate dai nostri vicini più tecnologicamente avanzati

Sistema solare:… Terra

UFO: Parola usata dal 1952

A. Hynek 1972 ha definito una scala per categorizzare gli incontri con UFO

SETA Search for Extraterrestrial Artifacts

SETV Search for extraterrestrial visitation

Table 7.2. Natural phenomena mistaken for UFOs (after Menzel 1972)

A. Material objects
- 1. Upper atmosphere
  - meteors
  - satellite re-entry
  - rocket firings
  - ionosphere experiments
  - sky-hook balloons
- 2. Lower atmosphere
  - planes
    - reflection of sun
    - running lights
    - landing lights
  - weather balloons
    - luminous
    - nonluminous
    - clusters
  - clouds
  - contrails
  - blimps
    - advertising
    - illuminated
  - bubbles
    - sewage disposal
    - soap bubbles
  - military test craft
  - military experiments
    - magnesium flares
  - birds migrating
    - flocks
    - individual
    - luminous
- 3. Very low atmosphere
  - paper and other debris
  - kites
  - leaves
  - spider webs
  - insects
    - swarms
    - moths
  - luminous
    - (electrical discharge)
  - seeds
    - milkweed, etc.
  - feathers
  - parachutes
  - fireworks
- 4. On or near ground
  - dust devils
  - power lines
  - transformers
  - elevated street lights
  - insulators
  - reflections from windows
  - water tanks
  - lightning rods
  - TV antennas
  - weathervanes
  - automobile headlights
  - lakes and ponds
  - beacon lights
  - lighthouses
  - tumbleweeds
  - icebergs
  - domed roofs
  - radar antennas
  - radio astronomy antennas
  - insect swarms
  - fires
  - oil refineries
  - cigarettes tossed away

B. Immaterial objects
- 1. Upper atmosphere
  - auroral phenomena
  - noctilucent clouds
- 2. Lower atmosphere
  - reflections of searchlights
  - lightning
    - streak
    - chain
    - sheet
    - plasma phenomena
    - ball lightning
  - St. Elmo's fire
  - parhelia
    - sundogs
  - paraselene
    - moondogs
  - reflections from fog and mist
    - haloes
    - pilot's halo
    - ghost of the Brocken
  - mirages
    - superior
    - inferior

C. Astronomical objects
- planets
- stars
- artificial satellites
- sun
- moon
- meteors
- comets

D. Physiological phenomena
- after-images
  - sun
  - moon
  - reflection from bright sources
  - electric lights
  - street lights
  - flashlights
  - matches
    - (smoker lighting pipe)
- autokinesis
- stars unsteady
- stars changing places
- falling leaf effect
- autostasis
  - (irregular movement)
- eye defects
  - astigmatism
  - myopia (squinting)
  - failure to wear glasses
  - reflection from glasses
  - entopic phenomena
    - retinal defects
    - vitreous humour

E. Psychological phenomena
- hallucination

F. Combinations and special effects

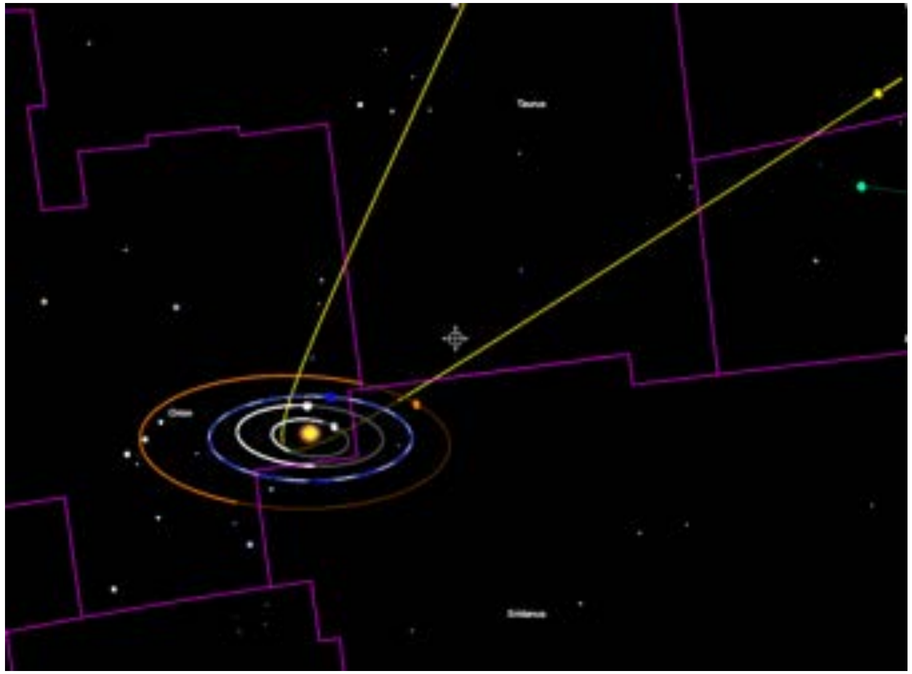
G. Photographic records
- development defects
- internal camera reflections

H. Radar
- anomalous refraction
- scattering
- ghost images
- angels
- birds
- insects
- multiple reflections

I. Hoaxes

Il caso Oumuamua

Il 19 ottobre 2017 il telescopio Pan-Starrs 1 (**Panoramic Survey Telescope and Rapid Response System)**, alle Hawaii, ha osservato il **Primo asteroide interstellare** e chiamato 1I/2017 U1.



Durante il passaggio al perielio è stata registrata un'accelerazione non gravitazioneale pari a 0.000005 m/s^2.

COULD SOLAR RADIATION PRESSURE EXPLAIN 'OUMUAMUA'S PECULIAR ACCELERATION?

SHMUEL BIALY* AND ABRAHAM LOEB
Harvard Smithsonian Center for Astrophysics, 60 Garden st., Cambridge, MA, 02138

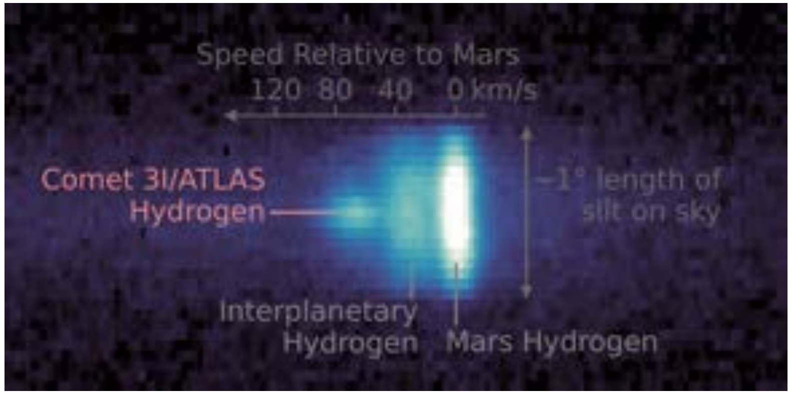
Draft version November 1, 2018

ABSTRACT

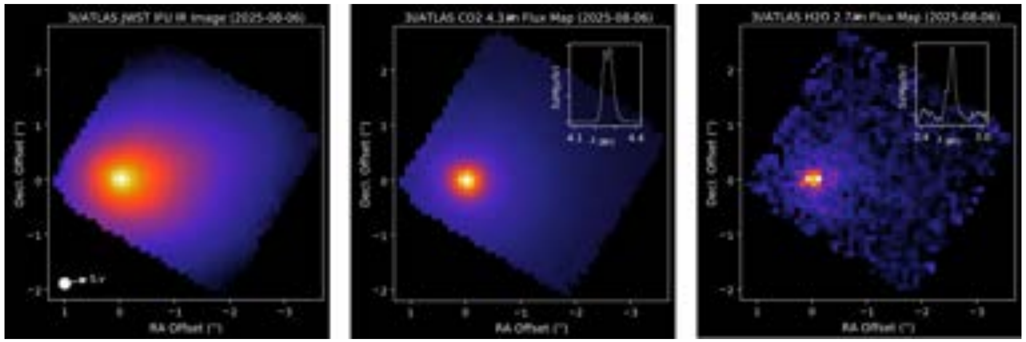
'Oumuamua (1I/2017 U1) is the first object of interstellar origin observed in the Solar System. Recently, Micheli et al. (2018) reported that 'Oumuamua showed deviations from a Keplerian orbit at a high statistical significance. The observed trajectory is best explained by an excess radial acceleration $\Delta a \propto r^{-2}$, where r is the distance of 'Oumuamua from the Sun. Such an acceleration is naturally expected for comets, driven by the evaporating material. However, recent observational and theoretical studies imply that 'Oumuamua is not an active comet. We explore the possibility that the excess acceleration results from Solar radiation pressure. The required mass-to-area ratio is $(m/A) \approx 0.1$ g cm^{-2}. For a thin sheet this requires a width of $\approx 0.3 - 0.9$ mm. We find that although extremely thin, such an object would survive an interstellar travel over Galactic distances of ~ 5 kpc, withstanding collisions with gas and dust-grains as well as stresses from rotation and tidal forces. We discuss the possible origins of such an object including the possibility that it might be a lightsail of artificial origin. Our general results apply to any light probes designed for interstellar travel.

Subject headings: ISM: individual objects (1I/2017 U1) – minor planets, asteroids: individual (1I/2017 U1) – General: extraterrestrial intelligence – Minor planets, asteroids: general

Cometa 3I/ATLAS



Cometa Interstellare: Le osservazioni del JWST mostrano una coda con Ghiaccio e grani di silicati, CO_2 e H_2O



Avi Loeb analizzando l'orbita propone che questo oggetto non sia una cometa, ma un oggetto tecnologico, una sonda interstellare

https://avi-loeb.medium.com/a-remarkable-new-anomaly-of-3i-atlas-420065c2cddf

1979: Serendip I (Search for extraterrestrial Radio from Nearby Developed Population

1982: NASA SETI HRMS (High Resolution Microwave Survey)

1984: SETI Institute supportato dalla NASA

1985: META(Mega-Channel Extraterrestrial Essay)

1986: SERENDIP II

1988: TARGET (Telescope Antenna Researching Galactic Extraterrestrial Transmission

1990: COSETI (Columbus Otical SETI) & METAII (Argentina)

1993: Il Senato americano elimina i fondi per HRMS

1995: SETI Project Phoenix (privato)

1999: SETI@HOME

SETI MODERNO

•**Breakthrough Listen:** Iniziato nel 2015, Finanziato privatamente. Obiettivo: Esaminare un milione di stelle vicine, l'intero piano galattico e cento galassie circostanti, utilizzando i più potenti radiotelescopi e osservatori ottici a livello globale. **Strumenti Collaborativi:** Green Bank Telescope (USA); Parkes Observatory (Australia); FAST (Five-hundred-meter Aperture Spherical radio Telescope, Cina); Sardinia Radio Telescope (SRT, Italia).

•**Allen Telescope Array (ATA)** radiotelescopio interferometrico gestito dall'**Istituto SETI** ed UCLA. Primo radio telescopio progettato specificamente per le ricerche SETI.

•**COSMIC (Commensal Open-Source Multimode Interferometer Cluster)** Un nuovo sistema di elaborazione del segnale installato sul **Very Large Array (VLANM USA).** Usa per SETI osservazioni VLA effettuate per altri scopi.

•**SETI Ottico (OSETI - Optical SETI)** Programmi che cercano impulsi laser brevi e potenti o segnali luminosi di origine artificiale.

ALLEN TELESCOPE ARRAY

42 paraboloidi con D= 6.10 m. In 2010 furono aggiunti altri 350 elementi su un’Area con un diametro pari a D= 1 km.

Deboer + 2004

1 dicembre 2020 ore 12:55

BLC1 da Proxima Centauri b

B**reakthrough **L**isten **C**andidate **1

nature astronomy — ARTICLES

OPEN

Analysis of the Breakthrough Listen signal of interest blc1 with a technosignature verification framework

Sofia Z. Sheikh, Shane Smith, Danny C. Price, David DeBoer, Brian C. Lacki, Daniel J. Czech, Steve Croft, Vishal Gajjar, Howard Isaacson, Matt Lebofsky, David H. E. MacMahon, Cherry Ng, Karen I. Perez, Andrew P. V. Siemion, Claire Isabel Webb, Andrew Zic, Jamie Drew and S. Pete Worden

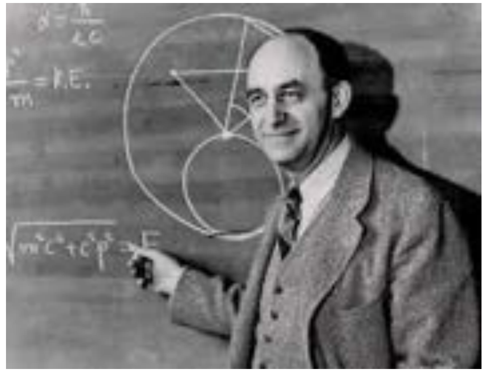
Table 1 | Basic characteristics of blc1

Characteristic	Value
Detection date	2019 April 29
Time at first detection	13:17:35.232 UTC
Time at last detection	18:19:26.400 UTC
Length of persistence	5.03 h
Signal frequency at first detection	982.0024 MHz
Signal frequency at last detection	982.0028 MHz
Initial drift rate	0.0326 Hz s^{-1}
Average signal-to-noise ratio[a]	17.956
Signal bandwidth	<3.81 Hz

[a] Average signal-to-noise ratio is calculated as the average of the signal-to-noise ratios from the five 30 min observations in which blc1 appeared.

Parkes Observatory in Asutralia

Fermi's Paradox (1950)



"Se esistono… dove sono tutti?

Età del Sole: ~4.55 Gy

Età della Galassia: ~8 Gy

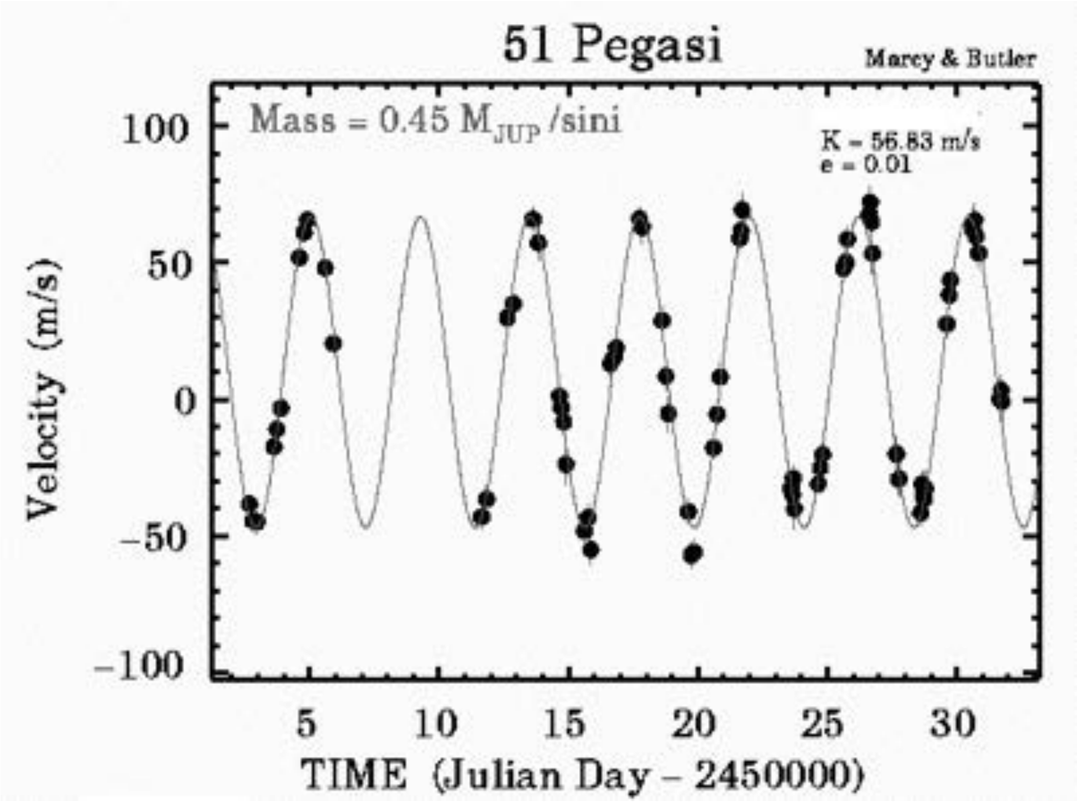
Tempo necessario per sviluppare una civiltà intelligente:~3.5 Gy

Una volta che si ha la tecnologia necessaria: Tempo di attraversamento della Galassia: 10-100 Myr

Non ci sono!

- Extraterrestri Esistono
  - Nessun Viaggio Interstellare
    - Troppo costosi
    - Fisicamente Impossibili
    - Troppo insicuri
  - Viaggio troppo lento
  - Tasso di colonizzazione lento
  - Non sono stati scoperti
  - Esistono limiti di crescita
  - Troppo lontani
  - Non sono interessati
- Extraterrestri non Esistono

1995 … the U turn



51 Peg (The star):

SP=G2IV

mV=5.49

M=1.11 MSUN

R=1.27 RSUN

[Fe/H]=0.2

Age= 4.0±2.5 Gyr

51 Peg b (The Planet)

M=0.47 MJ

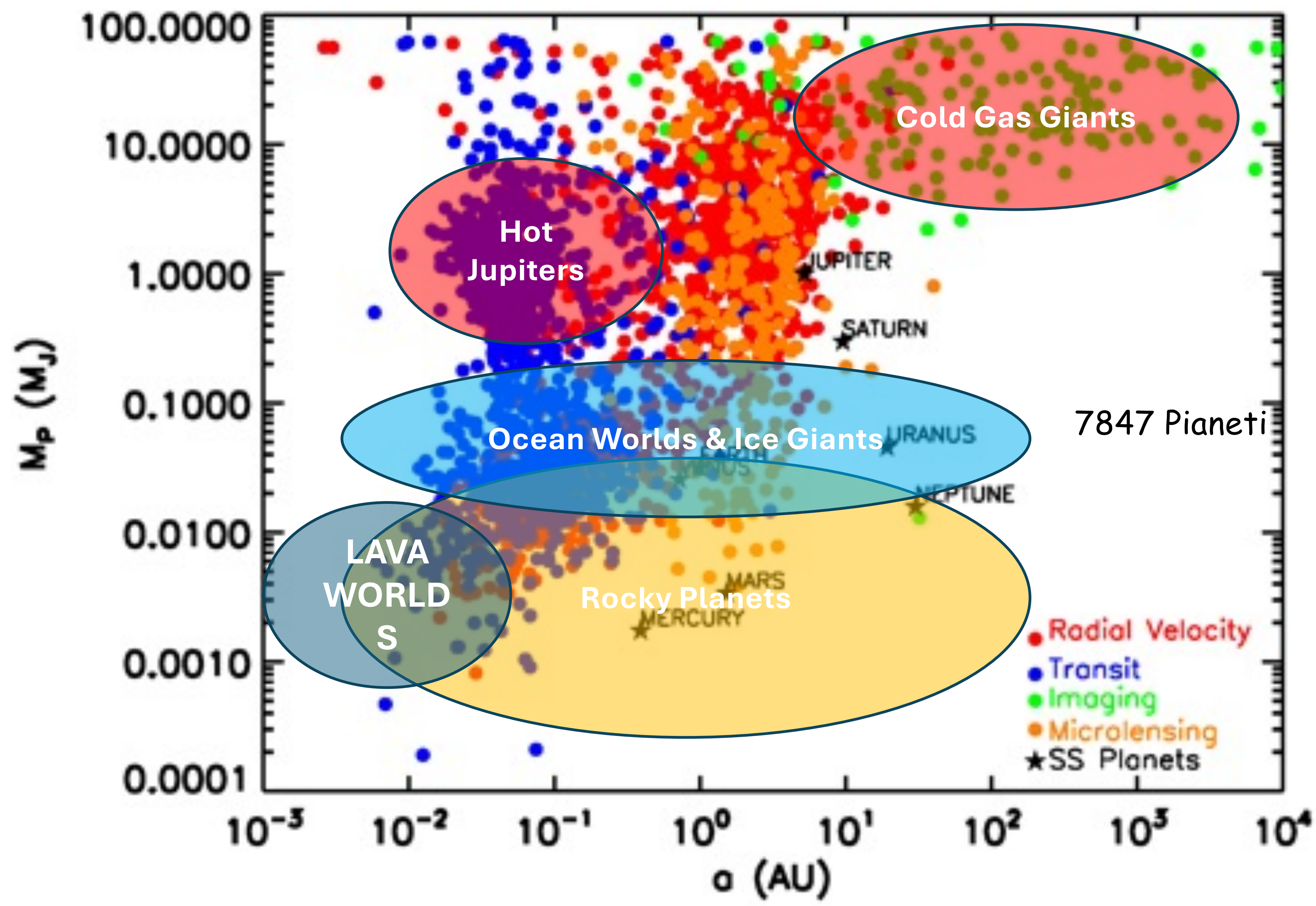
R=1.0 RJ

a= 0.052 au

e=0.0069

P=4.23 d

i=80°



Cold Gas Giants
Hot Jupiters
JUPITER
SATURN
Ocean Worlds & Ice Giants
URANUS
NEPTUNE
7847 Pianeti
LAVA WORLDS
Rocky Planets
MARS
MERCURY
Radial Velocity
Transit
Imaging
Microlensing
SS Planets
100.0000
10.0000
1.0000
0.1000
0.0100
0.0010
0.0001
M_p (M_J)
10^{-3}
10^{-2}
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
a (AU)

Technosignature

Il termine “technosignatures,” è una contrazione di “technological signatures” o “signatures of technology,”

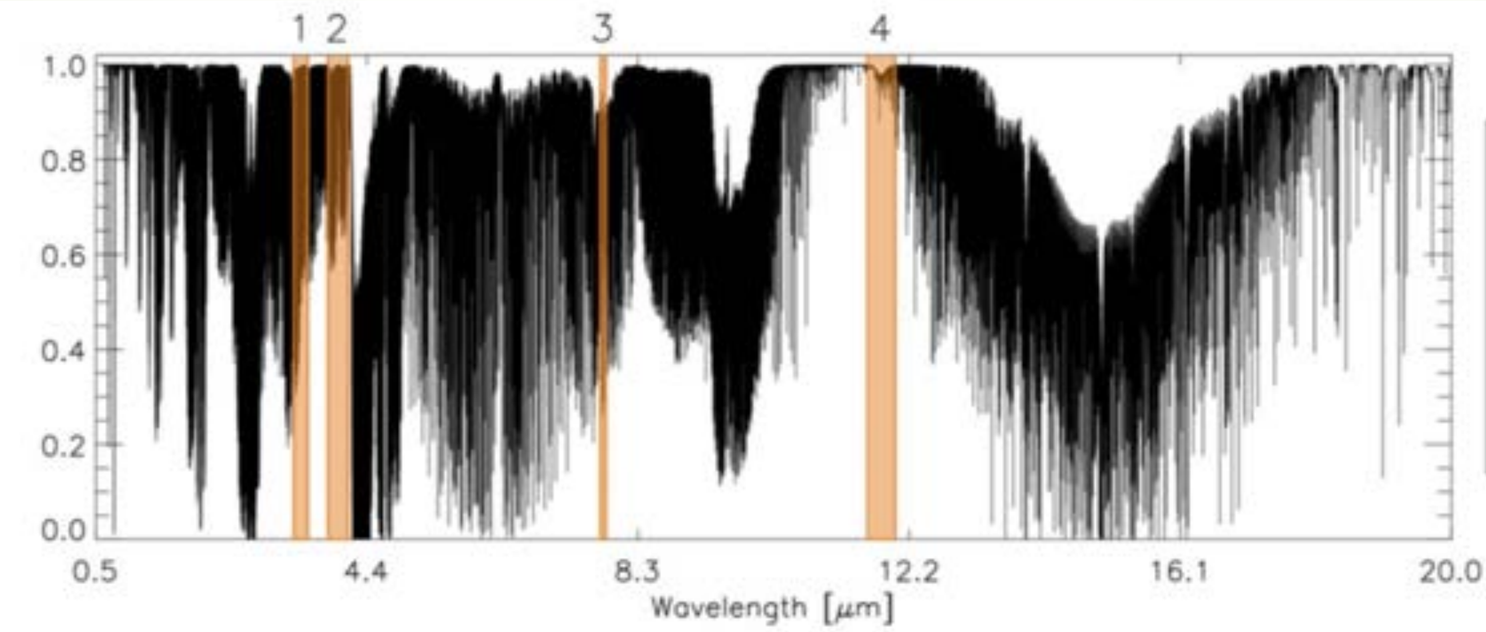
- TECHNOSIGNATURES INDUSTRIALI.
- SEGNALI RADIO
- SEGNALI LASER OTTICI/NIR
- MEGASTRUCTURE
- TECNOSIGNATURE NEL SISTEMA SOLARE

https://www.hou.usra.edu/meetings/technosignatures2018/agenda/Technosignature-Report.pdf

TECNOSIGNATURE INDUSTRIALI

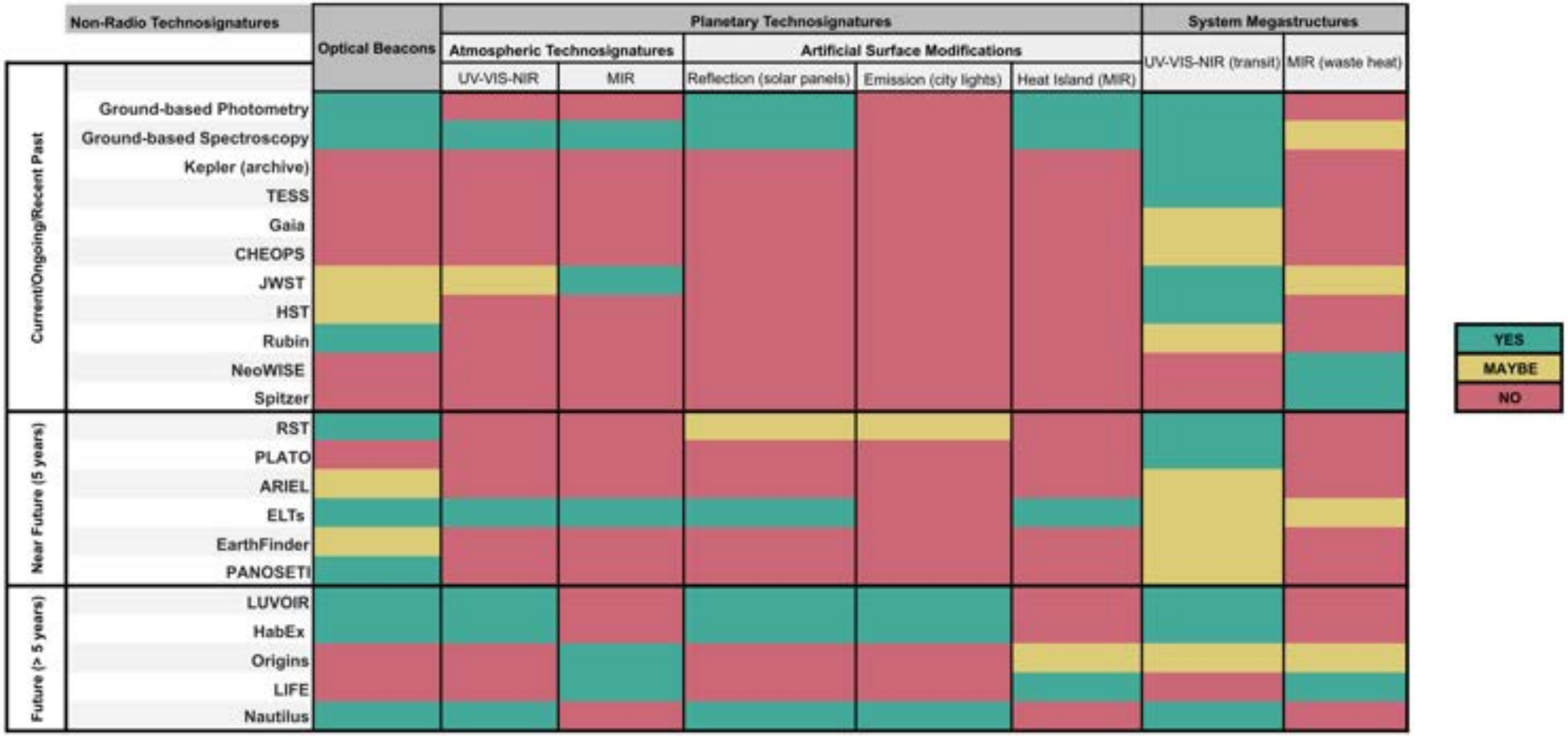
- CF_4 (tetrafluoromethane) $7.76 < \lambda < 7.84\ \mu m$

- CCl_3F (trichlorofluoromethane) $11.6 < \lambda < 12.0\ \mu m$

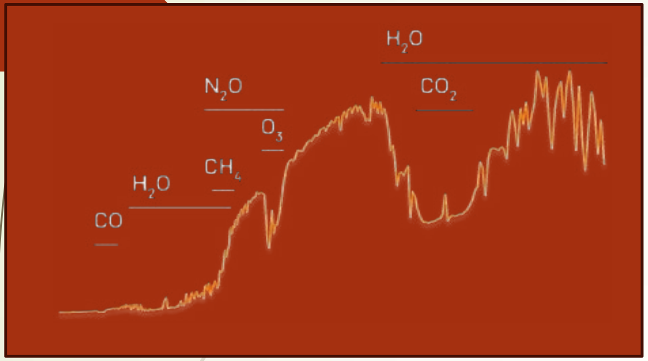


Lin et al 2014, ApJL, 792, L7

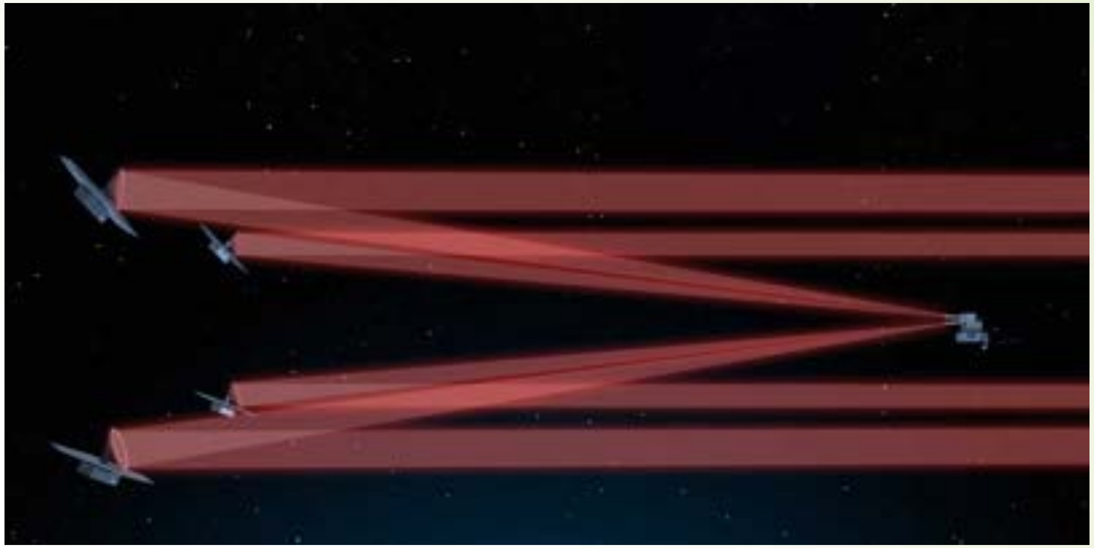
TECHNOSIGNATURES DETECTION

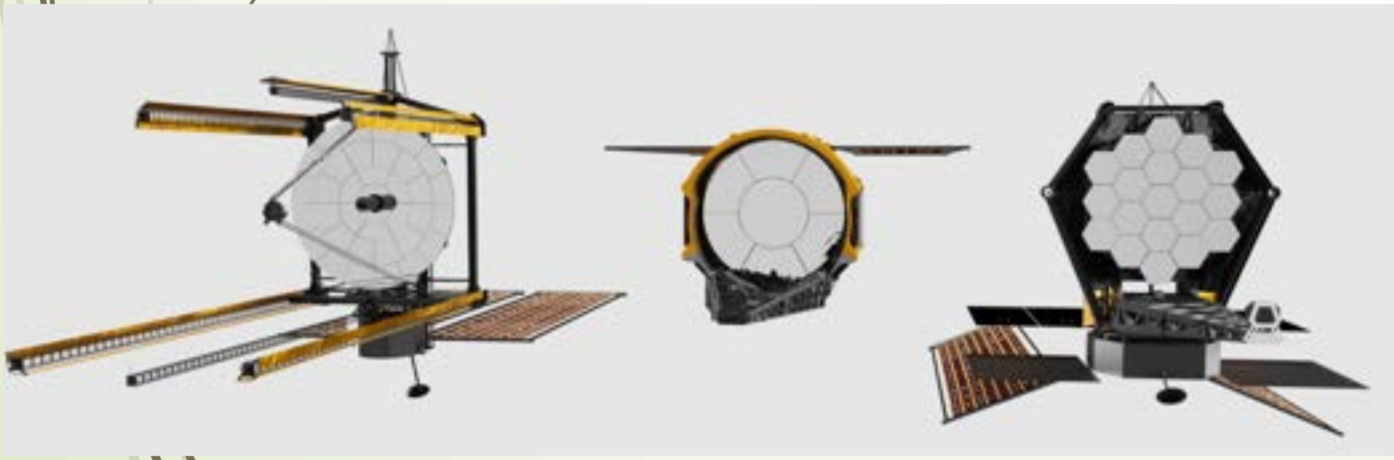


Haqq- Misra et al 2022



LIFE





HWO


WE GOT YOUR MESSAGE, LIKE, 50 YEARS AGO, BUT IT WENT INTO A JUNK FOLDER.
5-29
©2025
COVERLY
SPEEDBUMP.COM