50-й симпозиум МАА* по поиску внеземного разума (SETI) на Международном астронавтическом конгрессе (IAC-2021)

Дубай, 25-29 октября 2021

* Международная академия астронавтики

IAF and IAC


72ND INTERNATIONAL ASTRONAUTICAL CONGRESS
Inspire, Innovate & Discover for the Benefit of Humankind
25-29 October 2021 | Dubai
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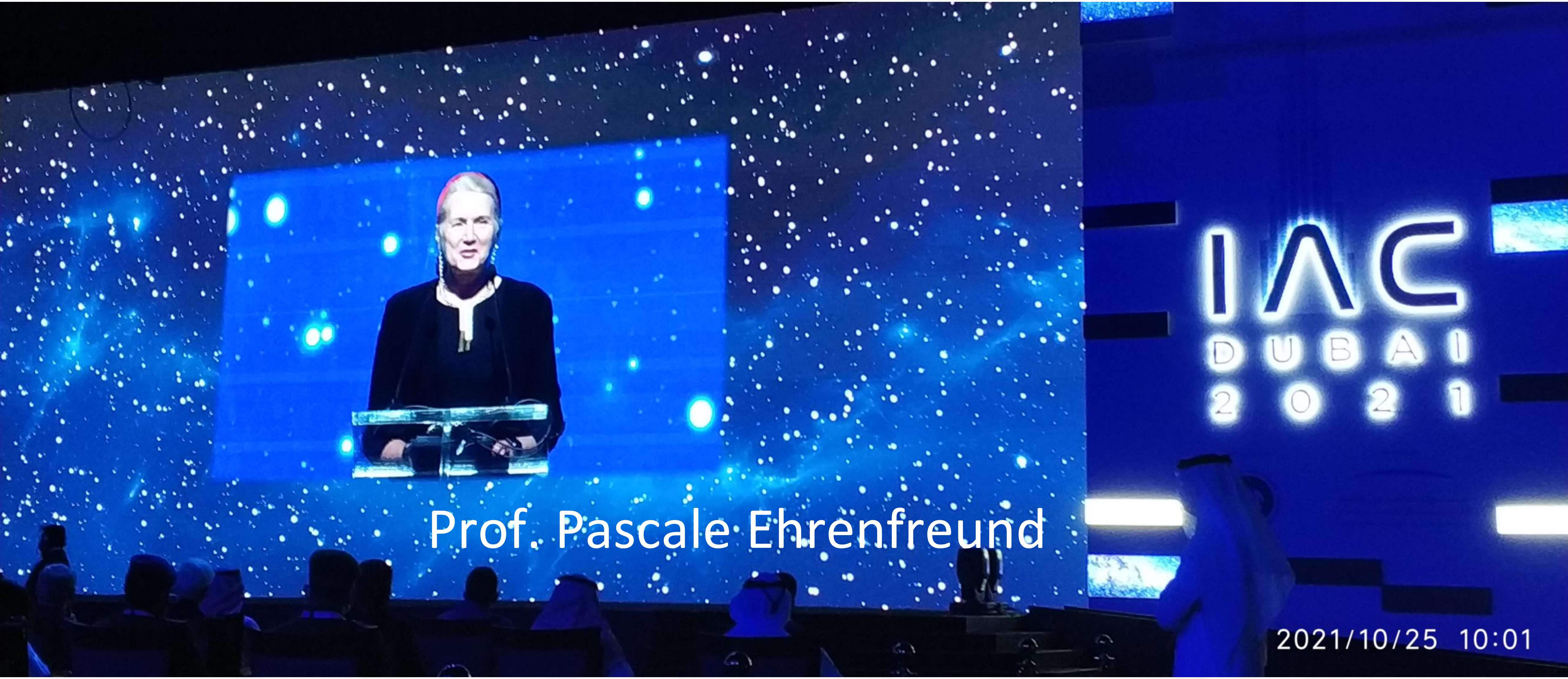
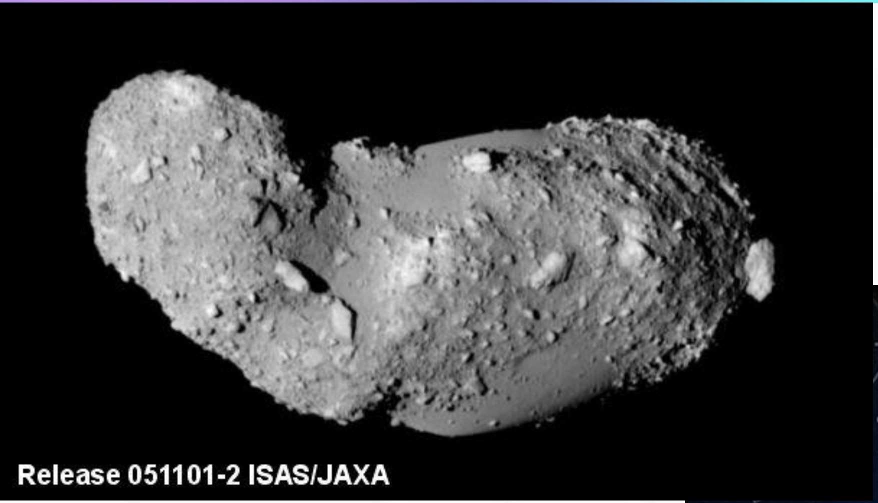
2021/10/24 19:16

IAF and IAC



Prof. Pascale Ehrenfreund

IAF awards



Астероид Итокава

Хаябуса берёт образцы грунта

60-летие первого полета человека в космос

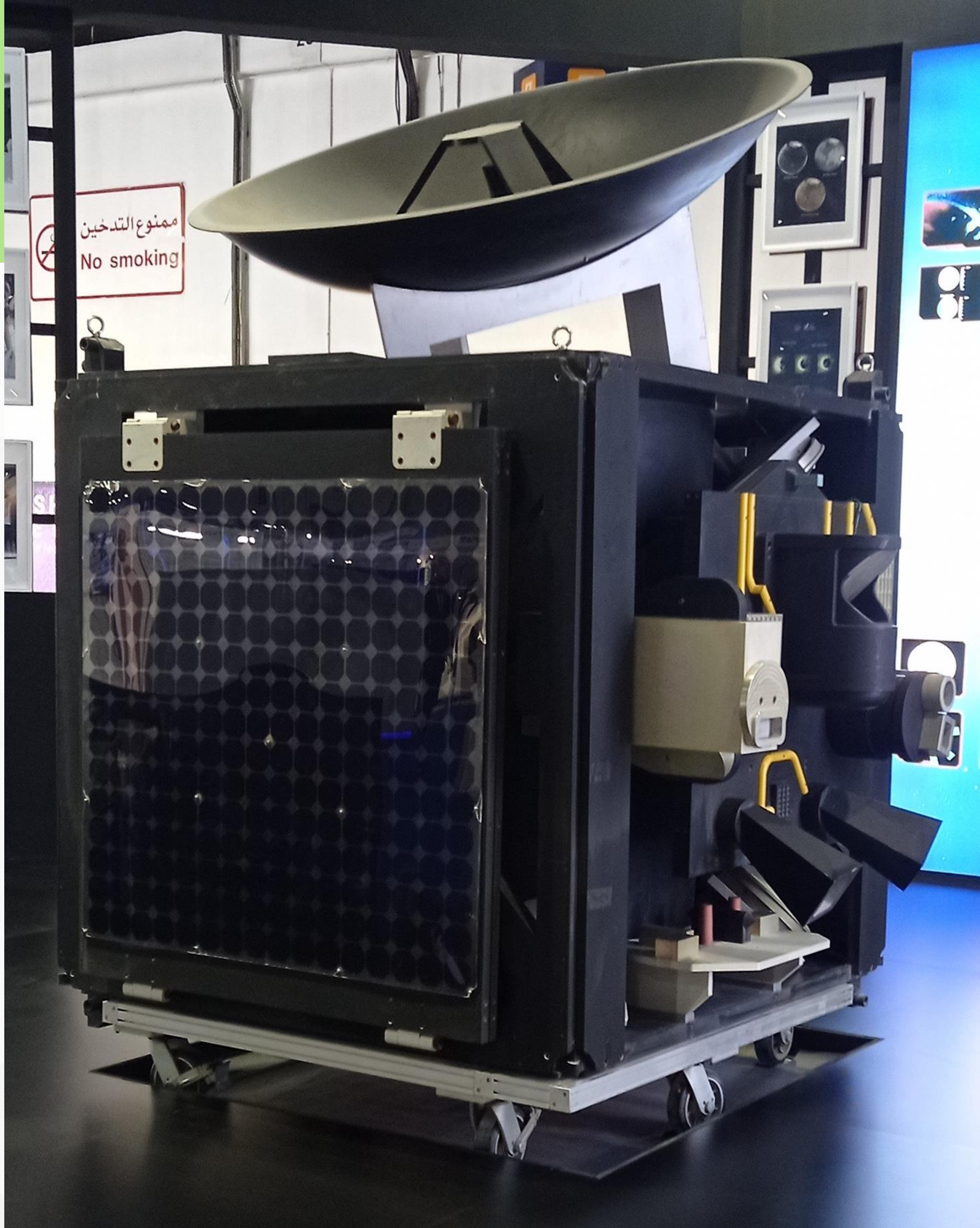
Ю.А.Гагарин перед стартом полёта (12.04.1961)

Копия ракеты «Восток», ВДНХ

Астронавты ОАЭ

Миссия ОАЭ на Марс

Аль-А́маль — автоматическая межпланетная станция космического агентства ОАЭ по исследованию Марса, запущенная в рамках программы Emirates Mars Mission. Запуск АМС Аль-Амаль осуществлен 19 июля 2020 в 21:58:14 UTC с космического центра Танегасима в Японии.



Симпозиум по SETI (A4)

A1. A2. A3. A4. A5. A6. A7. B1. B2. B3. B4. B5. B6. C1. C2.
C3. C4. D1. D2. D3. D4. D5. D6. E1. E2. E3. E4. E5. E6. E7.
E8. E9. GTS.

Symposium A4.

50th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps

1.	**SETI 1: SETI Science and Technology**	*All technical aspects involved in the search for extraterrestrial intelligence, including current and future search strategies.* Tuesday, 26 Oct 2021 | 9:45 | Room: Sheikh Rachid A
2.	**SETI 2: SETI and Society**	*All aspects concerning the societal implications of extraterrestrial intelligence are considered, including public reaction to a discovery, risk communication and the possible impacts on society.* Tuesday, 26 Oct 2021 | 14:45 | Room: Sheikh Rachid A
IP.	**Interactive Presentations - 50th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps**	*This session offers a unique opportunity to deliver your key messages in an interactive presentation on any of the subjects of SETI addressed in the classic Sessions. The presentation will be displayed on a digital screen in a dedicated location and available for view by all Congress attendees for the entire Congress week. In addition, one afternoon is dedicated exclusively for the attendees to view the Interactive Presentations, and the author will be assigned a specific ten minute slot to personally present the topic and interact with the attendees present. The Interactive Presentation may take advantage of all electronic display capabilities, such as: PowerPoint charts, embedded hot links, pictures, audio and video clips etc. An award will also be presented to the author of the best Interactive Presentation in the A Category at a special ceremony. An Abstract that follows the standard format must be submitted by the deadline for standard IAC abstracts.*

IAF and IAC

Order	Time	Paper title	Mode	Presentation status	Speaker	Affiliation	Country
1 ✓	09:45	Breakthrough Listen: Green Bank Telescope Observations, Analysis, and Public Data	10	confirmed	Dr. Steve Croft	University California Berkeley	United States
7 ✓	09:55	Breakthrough Listen Search for Intelligent Life in the Galactic Plane with the Parkes Telescope	10	confirmed	Ms. Karen Perez	Columbia University	United States
10 ✓	10:05	From Dust to Technosignatures: Searching for Stellar Occulters with Machine Learning	10	confirmed	Dr. Daniel Giles	SETI Institute	United States
13 ✓	10:15	Search for nanosecond optical transients with TAIGA-HiSCORE array for the SETI problem.	10	confirmed	Ms. Alexandra Krivopalova		Russian Federation
17 ✓	10:25	The Drake equation and SETI in the JWST era	10	confirmed	Dr. Amri Wandel	Hebrew University of Jerusalem	Israel
18 ✗	10:35	Moon Farside Protection and Astronomy Protection are URGENT	7	confirmed	Dr. Claudio Maccone	International Academy of Astronautics (IAA) and Istituto Nazionale di Astrofisica (INAF)	Italy
1002 ✗	10:42	Energy-intensive civilisations and their imprint on astronomical data	10		Prof. Mike Garrett	University of Manchester	United Kingdom
1003 ✗	10:52	Interferometric SETI searches with the Breakthrough Listen initiative	10		Dr. Cherry Ng	University of Toronto	Canada

Breakthrough Listen: Greenbank observations

50th IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) – The Next Steps (A4)
SETI 1: SETI Science and Technology (1)

Author: Dr. Steve Croft
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Dr. Andrew Siemion
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BREAKTHROUGH LISTEN: GREEN BANK TELESCOPE OBSERVATIONS, ANALYSIS, AND PUBLIC DATA

Abstract

Breakthrough Listen (BL) is carrying out the largest SETI search to date, using dedicated digital backends deployed to telescopes worldwide. These powerful compute clusters consist of commercial-off-the-shelf hardware, configured as spectrometers capable of digitizing billions of frequency channels at once, across gigahertz of the radio band.

BL's primary radio facility in the Northern Hemisphere is the Green Bank Telescope (GBT), the largest steerable radio dish in the world. BL observes as primary user for around 1/5 of the available time on the telescope. The GBT is observing a selection of targets that includes nearby stars, the centers of nearby galaxies, exoplanet candidates, and a survey of our own Galactic Plane, in addition to other objects including some Solar System targets.

As of March 2021, BL has generated over almost 14 PB of archival data products. 2 PB are currently available in a publicly accessible archive (including 1 PB of data from GBT), which continues to grow as data are transferred from the telescope sites. Our open-source strategy also includes a software suite which enables data to be ingested into Python programs, and software that performs searches for narrow-band Doppler drifting signals.

I will describe the current status of BL's observing program at GBT, the analysis pipeline, highlighted public datasets, collaborations with academia and industry, and some of our latest science results.

Breakthrough Listen: Parkes telescope SETI

BREAKTHROUGH LISTEN SEARCH FOR INTELLIGENT LIFE IN THE GALACTIC PLANE WITH THE PARKES TELESCOPE

Abstract

Over the last decade, discoveries of numerous Earth-type exoplanets have extended the possibility of other life-bearing worlds. However, the question of the existence of intelligent life might remain elusive unless a dedicated attempt is made to extensively Search for Extraterrestrial Intelligence (SETI). The Breakthrough Listen (BL) program is a 10-year effort to conduct the most sensitive, comprehensive, and intensive search for advanced intelligent life on other worlds ever performed. One of the primary targets of the BL program is a comprehensive blind survey of the entire Galactic Plane to search for artificial narrowband transmitters from ETIs (Isaacson et al. 2017). The Galactic Plane is an ideal direction to search for such signals due to the increased likelihood that transmitters would emit toward this region as opposed to random directions (Grimaldi 2020). Here, we discuss our findings from two full scans of the Galactic Plane over 1200–1550 MHz using the Parkes Telescope's 21cm Multibeam Receiver, covering roughly 3000 square degrees over Galactic longitudes $-174^\circ < l < 60^\circ$ and latitudes $|b| < 6.5^\circ$ during 1200 hours and observing billions of stars in the Milky Way in the process. This is one of the largest and most sensitive blind surveys ever performed to search for signs of intelligent life. Moreover, the Parkes 13-beam receiver allows a unique opportunity to discriminate terrestrial interferences from truly sky localized signals among all 30 million hits. We have extended the multibeam coincidence rejection technique used for detecting Fast Radio Bursts to scrutinize narrowband signals detected across 13-beams. Such techniques have never been used in the search for ETIs before and has allowed some of the best possible ways to reject large fractions of false positives. I will review our strategy and search results, as well as its applications going forward as we look towards expanding our search with other multibeam telescopes.

Kepler and TESS photometry data for SETI

Author: Dr. Daniel Giles
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FROM DUST TO TECHNOSIGNATURES: SEARCHING FOR STELLAR OCCULTERS WITH MACHINE LEARNING

Abstract

Over the last decade, NASA has launched two major space missions that were designed to collect photometry data over a large swath of sky: the Kepler telescope and Transiting Exoplanet Survey Satellite (TESS) have each monitored hundreds of thousands to millions of stars on sub-hour cadence over month or longer timescales, respectively. The quality of photometry in terms of precision, sampling frequency, and sheer number of targets is far superior to that traditionally obtained from the ground. While these missions were conceived to detect and investigate the populations of exoplanets in our galaxy, both are making significant contributions to other areas of astrophysics as well. Stellar brightness fluctuations encode a diverse range of phenomena, from outbursts and explosions, to exoplanetary transits, to asteroseismic pulsations. If there are other advanced civilizations in the galaxy, we may also be able to detect their "technosignatures" via monitoring large numbers of stars. In particular, artificial structures around a host star (e.g., Dyson swarms; Dyson 1960) may produce pronounced fading events in light curves. This possibility was recently brought to the forefront with the discovery of Boyajian's Star (KIC 8462852), which displayed erratic brightness dips. Various hypotheses have been put forth for the behavior of this object, from artificially-engineered megastructures to transiting exocomets.

While no theory provides a perfect explanation for the fading events seen in Boyajian's star, the large volume of imaging data emerging from the TESS mission is now enabling a new search for similar behavior in additional objects. Our team has created light curves for a set of 50 million relatively bright stars across the sky. We are using a combination of supervised and unsupervised machine learning to discover and classify rare fading events. We will follow up on the most unusual objects with ground-based optical and radio observatories to determine the origin of such variability. Ultimately, this program will either discover or put an upper limit on the frequency of transiting artificial megastructures around main sequence stars in our galaxy.

TAIGA-HiSCORE for the SETI problem

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Dr. Grigoriy Beskin
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SEARCH FOR NANOSECOND OPTICAL TRANSIENTS WITH TAIGA-HISCORE ARRAY FOR THE SETI PROBLEM.

Abstract

The open air, wide-angle integrating Cerenkov array TAIGA-HiSCORE (FOV ~0.6 ster) is part of the TAIGA installation for high-energy gamma-ray astronomy and cosmic ray physics. Today this array includes nearly 100 optical detector stations distributed over an area of ~1 km 2 in Tunka Valley near lake Baikal, Siberia, Russia. Due to high accuracy and stability of time synchronization of the optical stations (~1 ns), the arrival direction of EAS from the primary particle can be reconstructed to a precision of 0.1. This array is used to search for nanosecond astrophysical transients in the optical range. The sensitivity of the HiSCORE telescope is shown to allow to register signals of distant (up to 1000 light-years and even more) nanosecond lasers having rather moderate energies and sizes, therefore, such observations are of interest for the SETI problem. This report discusses the method of searching for astrophysical transients using the HiSCORE array and demonstrates its performance on the example of detecting laser pulses from an Earth-bound satellite mission. Search for optical transients in the HiSCORE data of 2018-2019 winter season has been carried out. One candidate for recurrent transient has been detected, but the estimated probability of random chance by fluctuation of background EAS is at least 10%. An upper bound on the event frequency of optical transients with a spectral energy density of more than 1.5 $\times 10^{-3}$ erg/sec/cm^2 and a duration of $\geq$ 1 ns has been found to be 0.05 events/ster/day.

Drake equation an SETI in the JWST era:

The Drake equation and SETI in the JWST era

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Abstract

We extend our earlier analyses "SETI in the Kepler era" (Wandel 2015) to space-probes sent by alien civilizations, which may detect Earth's biosignature. Such a civilization may identify biotic transiting exoplanets within the Habitable Zone of their host star (IAC-21-A1.6.1). Using the Copernican Principle, it is argued that Earth does not seem special to putative extraterrestrial civilizations. Unless sufficiently nearby, such civilizations would not be motivated to send probes or directed transmissions to the Solar System. The probability that an alien civilization is close enough is shown to be extremely low, unless civilizations are highly abundant. While eventual positive biosignature detections may give an estimate of the abundance of biotic exoplanets (the biological parameter in the Drake equation), they can also be the target of deeper and prolonged listening, as well as active messaging. On the more philosophical side, one can argue that such messaging procedures would be used by other civilizations to message at the biotic Earth, leading to a third-level Fermi paradox (the first level being the original one, "where are they all?", the second one - the Fermi-SETI paradox (Wandel 2017) "where are their radio transmissions?". Eventually Earth's radiosphere, the expanding envelope of radio transmissions, may attract alien probes or messages, yet also in that case the probability is shown to be very small, unless civilizations are highly abundant. While the radiosphere expands, the probability that it will engulf an alien civilization increases. A "contact age" is defined, at which alien probes or messages become more probable. Shown to be of the order of thousands of years after the onset of radio-emissions, the contact age may suggest a new solution to the Fermi Paradox and to the Great Silence.

Keywords: SETI; Fermi Paradox; Drake equation; exoplanets; biosignatures

The Fermi Paradox Where are they?

Resolutions:

- Life or intelligence are rare
- Spaceflight is too difficult or expencive
- Self-destruction

...and many more

A new solution: The biotic Earth is not special, while the technological Earth is still un-detected

Oumuamua: Scout from an extraterrestrial civilization?

Unidentified Aaerial Phenomena
(UFOs)

- The Pentagon report on UAP (June 2021)
- Over 100 unexplained sightings, photos and video recordings

- Natural atmospheric phenomena?
- Artificial objects of Earthly origin? (e.g. experimental planes)
- artificial objects of extraterrestrial origin? (space probes or space-crafts)

The Fermi-SETI Paradox

Where are the transmissions? (The Great Silence)

- Life or intelligence are rare

~~Spaceflight is too difficult or expensive~~

- Radio quiet communication (e.g., fiber optics),
- the radio-era is short

Wandel 2015: there are no alien transmissions directed at Earth, as the distance to the nearest civilization is larger than the radiosphere: our transmissions are still un-detected

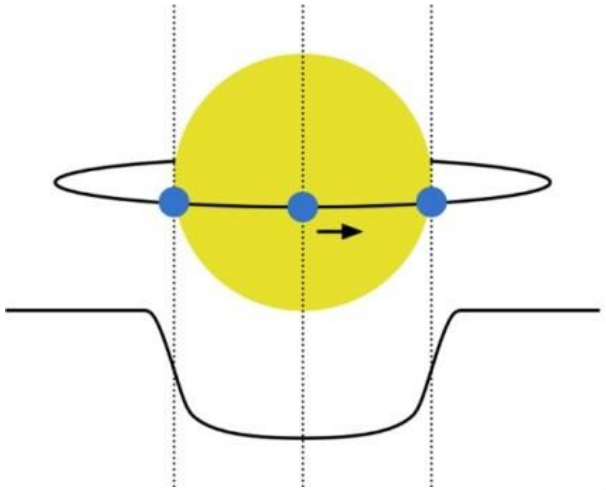
The Copernican Principle

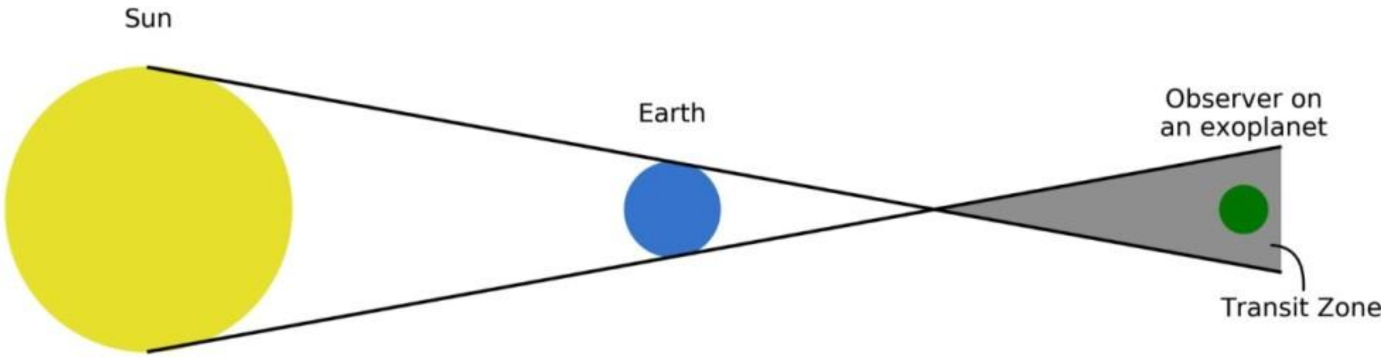
Earth is not special, neither by location nor by the evolution of life

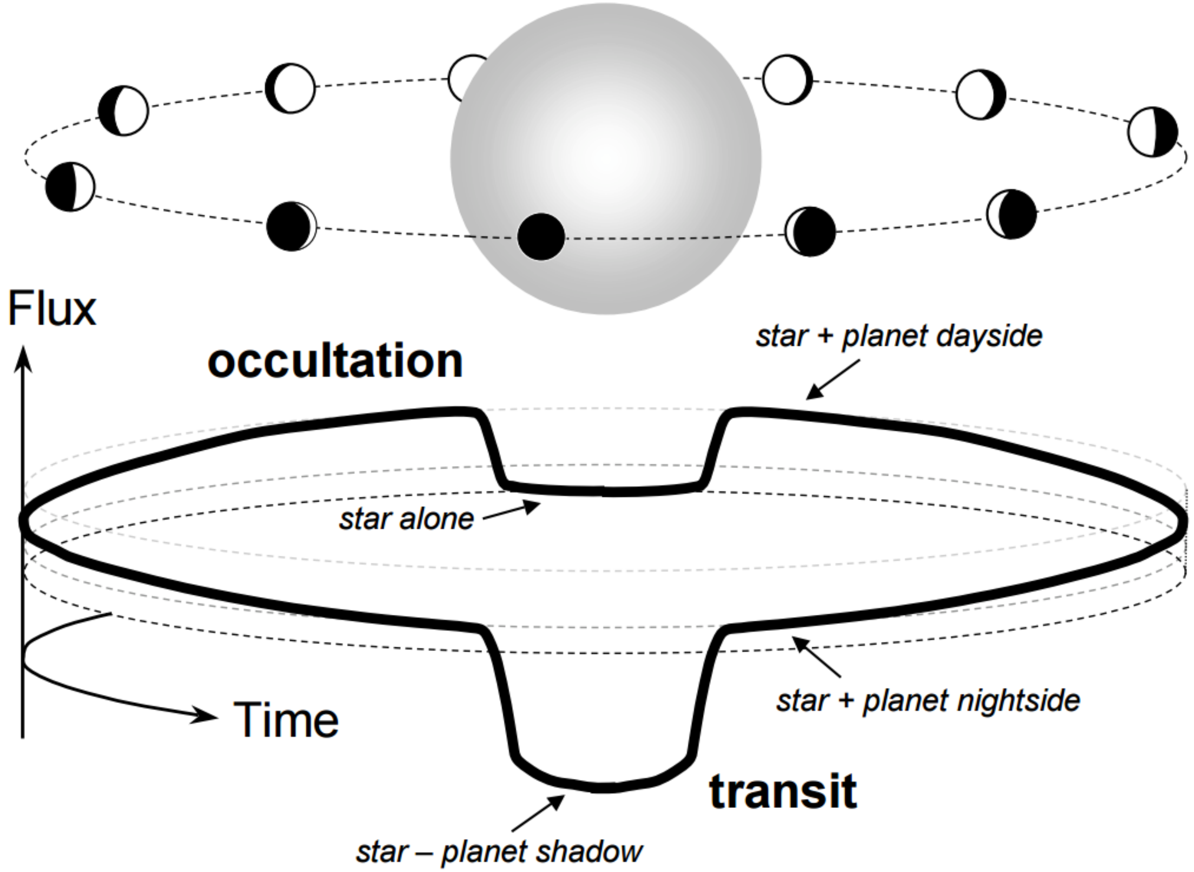
50% of the stars have habitable Earth-size planets (Bryson 2020, the Kepler data).

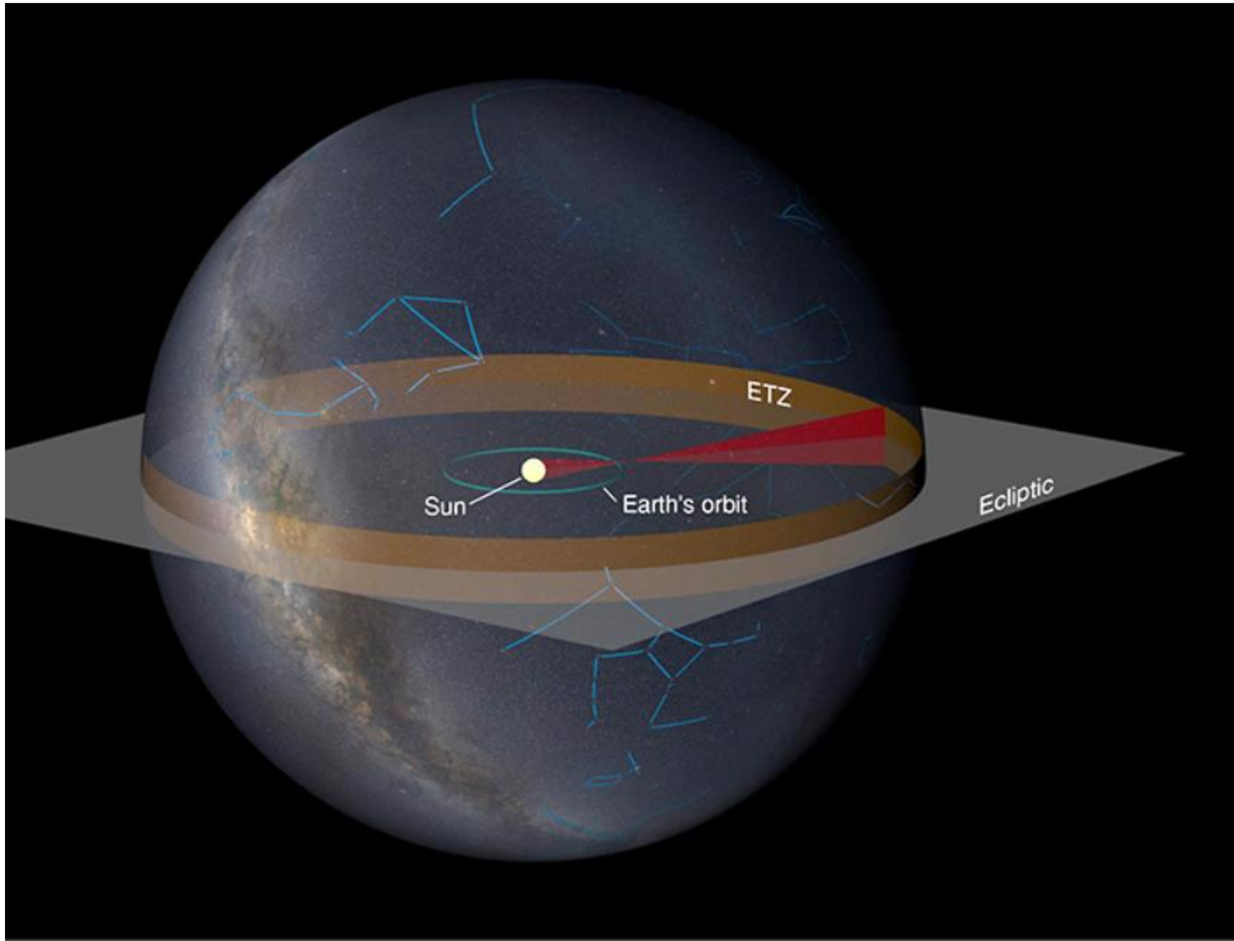
How abundant is biotic life?

The biotic Drake parameter: F_b




Sun
Earth
Observer on
an exoplanet
Transit Zone


Flux
occultation
star + planet dayside
star alone
Time
star + planet nightside
transit
star – planet shadow


ETZ
Sun
Earth's orbit
Ecliptic

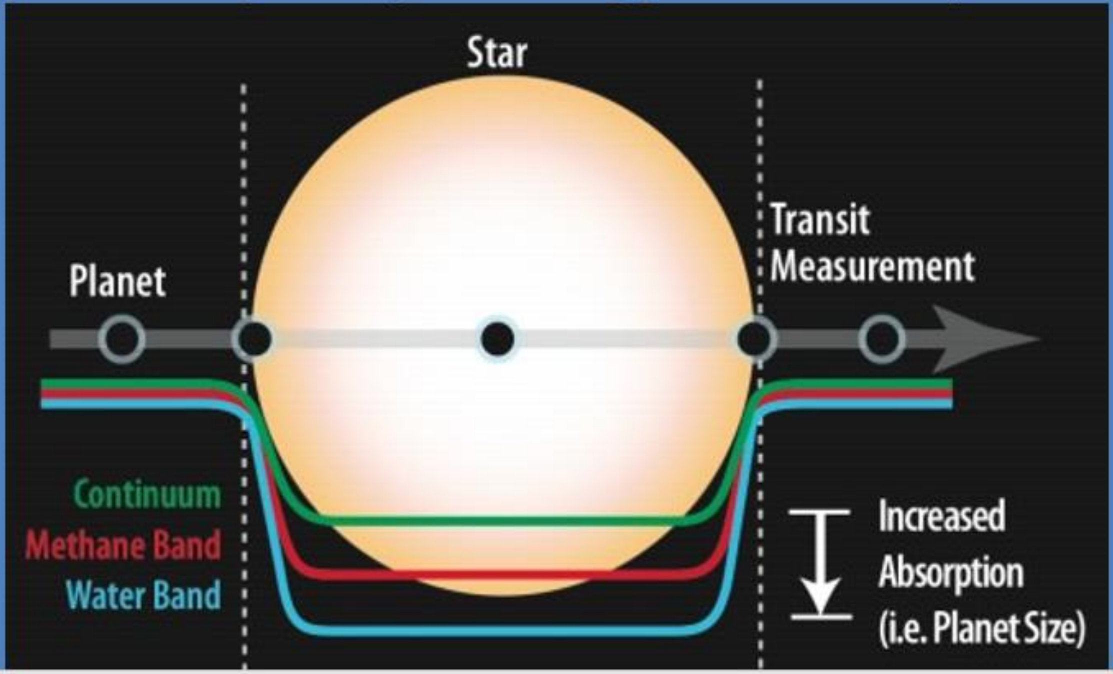
The Transit Zone of Earth

JWST may detect biosignatures of transiting exoplanets

A civilization in the ETZ, with a JWST-equivalent technology could detect the biosignature of Earth

If they see only a few biotic transiting planets at this distance, Earth does look special

Within 100 pc there are ~1700 stars which see Earth in transit or saw it in the last 5000 years (Kaltenegger &Faherty 2021)



The Radiosphere probe-range

The first short-wave radio transmissions were broadcasted less than 100 years ago.

The maximal distance of a civilization that could detect Earth's radiosphere and send back a message that would reach Earth at present is ~50 ly.

For a probe of speed $v=\beta c$, the maximal distance is

$$a=100/(1+1/\beta)\ \mathrm{ly}$$

E.g. at a velocity of *0.2c*, a probe could reach the solar system in 2017 only from civilizations nearer than 16 ly.

Ближайшая цивилизация в Транзитной зоне Земли может рассматривать, по-видимому, просто биотическую Землю как особенную из-за ее биосигнала, предполагая, что она может наблюдать только несколько других близлежащих биотических планет. Вероятность такого совпадения очень мала, если только цивилизации не очень многочисленны (миллионы в Галактике или больше). Шансы на то, что цивилизация расположена достаточно близко к Земле, чтобы обнаружить нашу радиосферу и отправить космический зонд, который достиг бы Солнечной системы в настоящее время, также невелики. Если цивилизации очень многочисленны и одна или несколько отправили зонды, сигналы связи с зондами должны быть легко обнаружены SETI. Это означает, что внешне таинственные особенности Уомуамуа могут быть объяснены более приземленно, чем то, что это инопланетный космический корабль. Точно также НЛО, скорее всего, являются природными явлениями, которые мы еще не понимаем, или искусственными объектами земного происхождения, чем инопланетными посетителями. По мере расширения нашей радиосферы возрастает вероятность того, что она достигнет ВЦ. Однако прибытие инопланетной передачи или зондирования становятся вероятными только от сотен до тысяч лет после начала радиосвязи, которая могла бы разрешить парадокс Ферми, а также Великое Молчание SETI. Наконец, показано, что выведены условие межцивилизационного общения и ограничение на долговечность коммуникативных цивилизаций.

Дубай туристический

Дубай туристический

Спасибо за внимание!