International Astronautical Congress IAC24

The Interstellar Presentations Part 1

Here are our first reports from the 2024 International Astronautical Congress held in Milan 2024.

Edited by John I Davies

Introduction

i4is reports on presentations that relate to interstellar travel and communications - and to the Solar System infrastructure which must precede the extension of our species beyond it.
It is the first of two news features following the Congress. The second will follow in P48, February 2025.
All of the programme items listed here are text credited to the International Astronautical Federation (IAF) and are visible via the Programme: iafastro.directory/iac/browse/IAC-24/.

Contents

These are the presentations and papers we report on in this issue - in order of IAC24 reference -

The Programme

Here are the reports with IAF identifying codes for the symposium sessions. Shown alphabetically by IAF identifying code under session title, objective, date and time.
Format of programme reports -

IAF identifying code	Title	Presenter	Institution	Country
IAF Abstract: [see also P46 report] IAF Cited Paper: IAF Cited Presentation/Video: Open Paper: if available Reported By:				

The Interstellar Programme reports

A4,1 SETI 1: SETI Science and Technology. All scientific and technical aspects associated with the search for extraterrestrial intelligence, including current and future developments and search strategies.
2024-10-15 10:15 White Hall 1

A4,2,1,x81576	**KEYNOTE: Billingham Cutting-Edge Lecture - Global outreach and cultural impact of A Sign in Space, an interdisciplinary simulation of a First Contact scenario**	**Ms Daniela De Paulis**	**-**	**Netherlands**
IAF Abstract See also P46 report:	iafastro.directory/iac/proceedings/IAC-24/data/abstract.pdf/IAC-24,A4,2,1,x81576.brief.pdf			
IAF Cited Paper:	iafastro.directory/iac/proceedings/IAC-24/IAC-24/A4/2/manuscripts/IAC-24,A4,2,1,x81576.pdf			
IAF Cited Presentation/ Video:	-			
Open Paper: if available	None found			
Reported By:	Simone Caroti			

This paper constitutes a progress report on A Sign in Space (henceforth ASIS), a SETI Institute initiative for the analysis of extraterrestrial signals created and led by media artist Daniela de Paulis [1]. The title of the project comes from Italo Calvino's eponymous short story contained in his 1965 collection Cosmicomics. Another inspiration for ASIS came from a scenario proposed in 2019 by linguist Sheri Wells Jensen and quoted in the paper itself:

> Give it to every adult and every child on the planet who wants it. Toss it to the dolphins and whales. Show it to the other primates. And, we need to encourage people to express that data in all kinds of ways: in strings of 1s and 0s, in grids, using different pitches of sound, with colored lights, played backward, interpreted as instructions for origami, expressed in bead work or knotted threads or in mosaics made of M and Ms.

Essentially, ASIS is an ongoing thought experiment on an open-source approach to the interpretation of signals received from extra-terrestrial civilizations. Launched on 24 May 2023, ASIS started with a simulated message sent to Earth from the Trace Gas Orbiter, an ESA orbiter around Mars. The pretend-alien

[1] De Paulis et al *A sign in space: An interdisciplinary exploration of the potential reception of an extraterrestrial signal*, Acta Astronautica, Volume 212, November 2023 www.sciencedirect.com/science/article/abs/pii/S0094576523004344

signal was received by six arrays, including two in the US and one in Italy, during a live public-domain broadcast sponsored by SETI [1]. Anyone and everyone who wanted to participate was invited to provide their own interpretation of the message's meaning.

By all accounts, the results have been encouraging. Thousands of posts by everyday people – beautifully described throughout the text with the moniker 'citizen scientists' – appeared on Discord over a period of several months, with a concomitant wide variety of interpretive avenues and formatting solutions. Thus, the philosophy behind ASIS – that the interpretation of extraterrestrial signals is best served by the widest possible access to the greatest possible number of interpreters – appears to have a bright future.

The challenges the initiative had to meet in order to be successful were considerable. Spreading the news about ASIS was one such challenge, but the media campaign SETI arranged was effective: in the first week after the initiative's launch, about 145 million people were exposed to it. Another challenge was technical: Discord is not available in China and some other nations, so that a dedicated forum on the initiative's website was devised to allow the citizens of those countries to present their interpretations. Other challenges were linguistic (English was the main language, so fluency in it was necessary to engage in complex conversations) and aptitude-based (not everyone is well-versed in mathematics, say).

Another important effect of ASIS' approach was the self-confidence it generated among its citizen-scientist responders, who accurately felt that their interpretive efforts contributed to the advance of the discipline.

ASIS is still continuing, but its results have already gone a long way toward demonstrating the validity of its open-ended, all-inclusive approach to signal interpretation. Hopefully, we will see more such initiatives in the future.

Co-authors: Bettina Forget, Claudia Mignone, Irene Fabbri, Gianfranco De Vito

A4.2.2,x80945	**Re-examining AI as a "Great Filter" for Advanced Civilizations: The Transition to Post-Biological Life and its Implications for Technosignatures**	**Prof Mike Garrett**	**University of Manchester**	**United Kingdom**

replacing

A4,2,15,x80945	Silent Stars, Awakening Minds: AI's Potential Role in Resolving the Fermi Paradox	Prof Mike Garrett	University of Manchester	United Kingdom

IAF Abstract See also P46 report:	iafastro.directory/iac/proceedings/IAC-24/data/abstract.pdf/IAC-24,A4,2,2,x80945.brief.pdf
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IAF Cited Presentation/Video:	-
Open Paper: if available	none found
Reported By:	Simone Caroti

This paper constitutes a speculative look at the possibility that the current technological state of the art of our society – which the author describes as "biological civilisation" – might be a universally occurring short-lived phase along the road to the development of ASI, or "Artificial Super Intelligence," an essentially posthuman form of AI that would be completely outside the control of its human designers [2].

The resulting "post-biological civilisation," this paper argues, would probably be under considerable existential threat from its now-independent machine counterparts. Such threats would comprise – but not be limited to – several forms of inter-civilizational or multi-civilizational conflicts as different cadres of AIs and different human factions vied for power either internally within one civilization or externally among several. The postulated universal nature of such a development – biological civilisations across the universe always exist for a short time and always lead to post-biological civilisations – would, if correct, represent a profound paradigm change in our understanding of our future.

[1] I presume the author is referring to the SETI Institute.

[2] Prof Garret's thinking is reported in an article in Principium 45 May 2024, *Biological intelligence vs AI - and the Fermi Paradox: Is artificial intelligence the great filter that makes advanced technical civilisations rare in the universe?* i4is.org/principium-45/

The consequences for SETI's mission statement are equally far-reaching. Even if an ASI civilization were to endure with its biological population intact, the author argues, its now greatly advanced communication and signaling protocols might well prove unintelligible by civilizations still at a biological stage. Essentially, this means that SETI's mission could be fatally crippled by our inability to understand messages coming to Earth from a largely post-biological universe. The "technosignatures" of such advanced societies, which might include "Non-Radiative Communication," "Quantum-Based Computing," and "Nanotechnology Swarms" among others, could be so far ahead of ours that it would be unlikely for us to even understand we have received a communication, let alone interpret or respond to it.

In order to respond to such a scenario, the paper argues, SETI might have to completely rethink its signal-detection parameters to include hitherto unguessed approaches. One such approach could be the opening up of interdisciplinary fields involving disciplines like astrobiology, particle and quantum physics, AI studies, and philosophy to broaden our understanding of what a technosignature is or could be.

Co-authors: none

A4,2,3,x89071	**Causal Impotence and Cosmic Messaging: A Logical Response**	**Dr Chelsea Haramia**	**University of Bonn**	**Germany**
IAF Abstract	iafastro.directory/iac/proceedings/IAC-24/data/abstract.pdf/IAC-24,A4,2,3,x89071.brief.pdf			
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IAF Cited Presentation/ Video:	-			
Open Paper if available:	none found			
Reported By:	John I Davies			
Dr Haramia aims to refute the "Barn Door" argument against METI [1]. Dr Haramia considers the part of the Barn Door argument which claims that METI transmissions are morally defensible since we have already opened the metaphorical barn door and detectable transmissions have already taken place. First, we don't know that any particular METI transmission will be more or less detectable than all previous unintentional transmissions (causal inefficacy). Second, if both intentional and unintentional messages are received we don't know whether either or both will cause actions by the receiving ETI (causal overdetermination). Third, she argues that arguments for and against the Barn Door argument have been mostly been about interspecies effects (crudely - what they might do to us) but have largely ignored intraspecies effects (what we might do to each other). Finally she argues that there may be a moral justification in stopping intentional METI signals even though we are already signalling the cosmos in other detectable, unintentional ways since human transmissions are, intentionally or unintentionally, purporting to speak for our entire species and planet.				
Co-authors:	none			

D4,1,3,x83992	**Artificial Magnetic Field as Active Shield against Cosmic Radiation**	**Dr Alessandro Bartoloni**	**National Institute of Nuclear Physics**	**Italy**
IAF Abstract See also P46 report:	iafastro.directory/iac/proceedings/IAC-24/data/abstract.pdf/IAC-24,D4,1,3,x83992.brief.pdf			
IAF Cited Paper:	iafastro.directory/iac/proceedings/IAC-24/IAC-24/D4/1/manuscripts/IAC-24,D4,1,3,x83992.pdf			
IAF Presentation / Video:	-			
Open Paper:	none found.			
Reported By:	John I Davies			

Space, including the surface of all the rocky planets and satellites is "not a very nice place", as old folk in Lancashire used to say about "abroad". And many advocates of staying at home, including a good proportion of space scientists, maintain that we should leave machines to be the only visitors. But we are an ingenious species and have long looked for ways of making it "nicer". In this paper Dr Alessandro

[1] Messaging to an Extraterrestial Intelligence David Brin, *The"Barn Door" Argument, The Precautionary Principle, and METI as "Prayer"—an Appraisal of the Top Three Rationalizations for "Active SETI"*, Theology and Science - December 2018. No open publication.

Bartoloni and colleagues address the problem of ionizing cosmic radiation. They propose constructing an artificial magnetic shield using a series of electric cables strategically arranged to deflect particles away from inhabited spaces. On other planets we could live underground but the impact on health, both physical and psychological, can be imagined. Candidates for active shielding include electrostatic and magnetic fields. Actively directing high-energy particle beams toward incoming particles is another possible approach.
The team have come up with an Electromagnetic Active Moon Shielding (ELMET) project proposal. The team is drawn from a wide variety of organisations with multiple skills. Their proposal offers a transparent "roof" so the universe including the Earth would be visible to inhabitants. They propose an artificial magnetic field generated by a toroidal structure, half-buried, composed of superconducting electrical cables. The magnetic field lines generated will envelop the inhabited settlement, repelling cosmic rays with the structure itself providing some protection against micro-meteorites.
They see the technology as adaptable to Mars, to in-space vehicles/habitats and even to fusion power generation and space elevators. They outline a series of phases of work to develop their idea.

Co-authors: Dr Marco Peroni, Marco Peroni Ingegneria – Faenza, Dr Lidia Strigari, Alma Mater Studiorum - University of Bologna

D4,4,9,x81405	**Space Arks for the Nearest Stars: a Feasibility Evaluation**	**Prof Giancarlo Genta**	**Politecnico di Torino**	**Italy**
IAF Abstract See also P46 report:	iafastro.directory/iac/proceedings/IAC-24/data/abstract.pdf/IAC-24,D4,4,9,x81405.brief.pdf			
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IAF Cited Presentation/Video:	iafastro.directory/iac/proceedings/IAC-24/IAC-24/D4/4/presentations/IAC-24,D4,4,9,x81405.show.pptx			
Open Paper:	None Found			
Reported By:	Patrick Mahon			

The aim of this paper is to explore the feasibility of a crewed interstellar mission to Proxima Centauri B, based on a nuclear fusion-powered Space Ark, or Generation Ship, travelling at around 1% of the speed of light, which therefore reaches its destination around 450 years after departure.
Genta starts by defining what he sees as a realistic scenario for a crewed interstellar mission. He rules out Faster-Than-Light (FTL) travel as impossible, discounts as unethical ships carrying embryos or digital emulations of human minds, and also counts out ships carrying humans who hibernate for centuries, and ships travelling near the speed of light, as we don't even vaguely know how to do either. What remains is a mission carrying conscious humans at a speed around 1% the speed of light, so that even reaching the nearest potentially habitable exoplanet, Proxima Centauri B, some 4.3 light years away, would take something like 430 years. Such a mission, taking longer than a single human lifetime, requires a so-called World Ship.
Genta draws on the classification of World Ships in the 2020 paper by i4is Executive Director Andreas Hein and co-workers, published in the ESA house journal Acta Futura. A key issue with such World Ships is that their journeys will necessarily be a one-way affair. As a consequence, they need to carry enough humans to be able to create a self-sustaining colony at their destination. Estimates for the minimum viable size vary in the literature from 100 to 20,000.
The two key spacecraft subsystems that Genta focuses on in this paper are the habitat and the propulsion system, as he views these as most crucial to the success of the stated mission. He considers that the habitat for a centuries-long crewed journey must include artificial gravity, radiation protection, and a fully circular economy that is 100% self-sustaining in terms of materials and energy. Given these constraints, Genta calculates the minimum mass and surface area required for a world ship carrying 250, 500 and 1,000 people. For the rest of the paper, he focuses on the smallest viable mission, carrying 250 people.
Genta then moves on to a consideration of the propulsion system. He sees nuclear fusion as the only feasible option. On the basis of the proposed mission design, he calculates that the optimal solution is for the ship to spend roughly 107 days accelerating to 1% c, and the same time decelerating at the destination. This minimises the overall mass budget, and leads to a world ship with a total mass of 402,000 tonnes. Although this appears huge, Genta notes that the largest sea-going tankers currently in service are more massive than this.
Genta's overall conclusion is that a crewed mission to Proxima Centauri B is potentially feasible, subject to the achievement of high efficiency nuclear fusion propulsion systems, and the solution of such problems as artificial gravity, 100% regenerative life support systems, and radiation and dust protection.

Co-authors	None