

The Journals

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Here we list recent interstellar papers in the Journal of the British Interplanetary Society (JBIS), published since the 1930s and Acta Astronautica (ActaA), the commercial journal published by Elsevier, with the endorsement of the International Academy of Astronautics.

JBIS

Title (open publication)	Author	Affiliation
Abstract/Précis/Highlights		
JBIS VOLUME 74 NO.11 NOVEMBER 2021	General Interstellar Issue	
RELATIVISTIC BRAKING AND POWER GENERATION through stellar magnetic fields via Eddy Current forces	Colin Warn	Washington State University
<p>A highly conceptual method of braking a spacecraft moving at relativistic speeds by means of circulating Eddy Current forces in a metal is proposed. As an example calculation using a sail made from the ‘wonder-material’ graphene, it is hypothesized that an approximately 500 m², 1 g sail can be decelerated completely from 8% the speed of light in 127 seconds using a planetary system’s stellar magnetic fields, while generating around 26 W of power. This method, if experimentally shown to be feasible, can be improved by increasing the melting point of the spacecraft materials, as well as the maximum deceleration rating of spacecraft electronics and payloads.</p>		
SETI AND EVOLUTIONARY POPULATION DYNAMICS	Stephen Ashworth	
<p>The number of loci at which extraterrestrial intelligence might be found in the Milky Way Galaxy is conventionally thought to be roughly constant over time, having already arrived at a steady state some billions of years in the past. But the scenario of interstellar colonisation implies a radical transformation of the prevalence of intelligent activity in the Galaxy: an evolutionary big bang. Observations indicate that such a big bang has not yet happened, or is still at an early stage. Writers on the subject have hitherto shied away from this implication, preferring to conclude that it is possible to reconcile an already well populated Galaxy with the current lack of observed signs of intelligent activity in our immediate galactic neighbourhood. But whenever a radically new evolutionary innovation has appeared in the past history of life on Earth, it has spread as widely as it is physically possible for it to do in a brief period compared with the total time available. There are no grounds to believe that the evolution of technology-enabled life, if it goes through to its logical conclusion, will be different in this respect. Evolutionary population dynamics will therefore drive the occupation of the Galaxy by industrial species to saturation in a short period of time on the cosmic timescale.</p>		

AN EXAMINATION OF THE FERMI PARADOX by modelling the use of self-replicating probes	Alista Fow	University of Waikato, NZ
<p>The Fermi Paradox was first presented in 1933 and asks, “If extra-terrestrial space faring civilisations are common in our galaxy, why have we not observed them?” A common proposed expansion method is the use of self-replicating space probes. In ideal circumstances, if civilisations could send such probes, they would expand to cover our entire galaxy in less than ten million years. To test this hypothesis, a model was constructed and several possible failure modes that would affect such an expansion were examined. The results of the modelling demonstrates that expansion across the galaxy would not occur in all circumstances. This implies that one possible reason that humans have not observed such a probe could be because no civilisation has reached a technological level sufficient to overcome these failure modes.</p>		
THE SEARCH FOR DELIBERATE INTERSTELLAR SETI SIGNALS MAY BE FUTILE	John Gertz	Zorro Productions, Berkeley, California
<p>For more than 60 years, the predominant SETI search paradigm has entailed the observation of stars in an effort to detect alien electromagnetic signals that deliberately target Earth. However, this strategy is fraught with challenges when examined from ET’s perspective. Astronomical, physiological, psychological, and intellectual problems are enumerated. Consequently, ET is likely to attempt a different strategy in order to best establish communications. It will send physical AI robotic probes that would be linked together by a vast interstellar network of communications nodes. This strategy would solve most or all problems associated with interstellar signaling.</p>		
THE IMPACT OF NATURAL SELECTION ON CREW SIZE AND HUMAN EVOLUTION during interstellar travel	Sano Satoshi	Japan Aerospace Exploration Agency
<p>In this work the Monte Carlo code named EVOLVE has been updated to simulate the impact of natural selection on crew size and human evolution during multigenerational interstellar travel. Designing multigenerational interstellar ships requires defining the capacity of a spaceship, which includes many variables, including the space required for one person, food production, closed-ecosystem design and propulsion. EVOLVE version 1 (Sano, 2021) provided a critical crew size of 1,900-2,000 for interstellar travel and estimated the rate of human evolution, including population genetic parameters such as mutation and genetic drift, based on the neutral hypothesis (no natural selection). However, deleterious mutations reduce fitness (reproductive success) and could decrease population size. On the other hand, beneficial mutations, which may occur occasionally, would increase the rate of evolution. Thus, natural selection could be an important factor for multigenerational interstellar travel. Therefore, EVOLVE was updated to version 2, which includes the effect of natural selection on multigenerational interstellar travel. This paper shows that the impact of deleterious mutations on crew size is small and that a critical crew size to maintain a genetically healthy crew during interstellar travel is also approximately 2,000 even if there are deleterious mutations. Finally, this paper shows that human evolution during multigenerational interstellar travel can occur through beneficial mutations, which should be taken into consideration for the design of interstellar spaceships. The evolution rate of space flight is approximately 10 times higher than that of Earth.</p>		

COULD THE INTERSTELLAR OBJECT 'OUMUAMUA BE A SOLAR THERMAL PROPULSION VEHICLE?	Todd Sheerin & Abraham Loeb	The Aerospace Corporation, California
<p>The first interstellar object, 'Oumuamua, featured extreme geometry, excited rotation, and comet-like acceleration without detectable outgassing. Recent natural explanations contemplate objects that have never been observed before, including hydrogen and nitrogen icebergs, but these explanations are unlikely. Thus far, only a solar sail has been proposed as an alternative hypothesis, but there are other possibilities. This study investigates whether 'Oumuamua could have been a solar thermal propulsion vehicle. Given the constraints obtained by the Spitzer Space Telescope on infrared radiation emitted by 'Oumuamua, upper limits are derived for size and temperature of a notional exhaust hot spot, constraining its diameter to be smaller than one meter for temperatures above 800 K. These results may inform observational capability needs for future interstellar object transit events.</p>		

Acta Astronautica

Title	Number+date	Author	Affiliation
Abstract/Précis/Highlights			
Navigation and star identification for an interstellar mission	#192, March 2022	Paul McKee, Jacob Kowalski, John AChristian	Rensselaer Polytechnic Institute/Georgia Institute of Technology
<p>Interstellar missions are expected to rely on star observations as part of their navigation system. Interstellar missions require 3D star catalogs, which represents a departure from conventional star catalogs. If stars in the galaxy must be modeled as 3D points, there are no pose invariant descriptors that can be used to index star patterns. We may obtain star pattern invariants by constraining the allowable motion of the interstellar spacecraft.</p>			
Interstellar space biology via Project Starlight	#190, January 2022	Stephen Lantin et al	University of Florida/ University of California - Santa Barbara
<p>NASA Starlight program details a path to send small relativistic spacecraft to interstellar space. Relativistic spacecraft can transport seeds and live organisms to characterize and expand life. Biological and technological challenges of interstellar space biology are outlined. Guidelines for species selection based on research practicality and survivability are offered. Current planetary protection regulations cannot address ethics of extrasolar biology missions.</p>			

Navigation evaluation for fast interstellar object flybys	#191, February 2022	Declan Mages, Damon Landau, Benjamin Donitz, Shyam Bhaskaran	Jet Propulsion Laboratory
<p>Rapid response spacecraft to interstellar objects encounter high solar phase angles. High relative velocities severely limit ground-in-the-loop navigation accuracies. Autonomous navigation can enable successful close flybys and tracking. Autonomous navigation enables impactor guidance, though limited by high phase angles.</p>			
The Fishback ramjet revisited	#191, February 2022	Peter Schattschneider, Albert A Jackson	TU Wien Austria, Triton Systems, Houston, USA
<p>Fishback’s proposal of magnetic scooping for a Bussard ramjet is physically feasible. Absurdly long solenoids are needed. The cut-off speeds are orders of magnitude lower than thought before. Visiting the galactic center in a Bussard ramjet within a lifetime is unrealizable. NOTE: See also - Al Jackson: The Interstellar Ram Jet at 60 (Principium 29, May 2020) and IAC-20,D4,4,11,x58592, A Feasibility Analysis of Interstellar Ramjet Concepts, Gupta (P31, November 2020)</p>			
SETI in 2020	#190, January 2022	Jason T Wright	Pennsylvania State University
<p>A subjective survey of nearly all of the literature in SETI in 2020. A categorization of the kinds of papers in the field. A look ahead to 2021.</p>			



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