The Journals

John I Davies

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

JBIS

Five issues of JBIS have appeared online since our last issue, P51. They are – volume 78 issues #8 (August 2025) to #12 (December 2025). Of the twelve 2025 issues so far, seven were Interstellar issues.

Volume 78 #8 August 2025 Special Issue: Project Icarus: the final papers – 3

Project Icarus: the Pegasus Interstellar Spacecraft Propulsion Power Cycle	Kelvin F Long	UK

The use of fusion reactions within a propulsion engine involves enormous amounts of energy and power. In the design of any vehicle concept, it is important to attempt to quantify the gains and losses from the system to arrive at a reasonable estimate for the jet power and the jet efficiency as descriptive metrics for the engine performance. In this paper the power cycle is discussed for the Pegasus interstellar rendezvous spacecraft under the assumptions of minimal energy loss. This is described using a method developed by this author known as power cycle line maps. It is concluded that whilst the Daedalus flyby probe was able to assert a jet efficiency of ~91%, such an assumption is only feasible when one assumes no energy losses such as due to neutrons and x-rays. Instead, we adopt a more realistic model and do assume associated energy losses, so that the jet efficiency for Pegasus is determined to be of order ~85%. This implies that some degree of radiation shielding would be required to protect the spacecraft. It also comes with the implications of a requirement for highly efficient lasers and radiators to maintain a practical spacecraft mass to complete the mission. This paper is a final contribution to Project Icarus.

Project Icarus: The Pegasus Spacecraft Inertial Confinement Fusion Ignition Physics Design	Kelvin F Long	UK

The Pegasus is a theoretical spacecraft concept design for a mission to the nearest stars. It is powered by a fusion engine, where lasers are used to implode small mg scale capsules to high density and temperature so that thermonuclear ignition may occur. In this paper we describe the Representative Physics Model (RPM) that was developed for the Pegasus propulsion and ignition system, in terms of the capsule design. The method that was adopted is known as inertial confinement fusion via direct drive illumination.

We describe the key equations and how the designs were scaled up from recent experiments conducted at the National Ignition Facility whilst also being scaled down versions of the Daedalus second stage design. The analysis model that is developed is an approximation rather than exact solutions. The two capsule sizes adopted were 72 mg and 28.8 mg driven by an input energy of 145 MJ and 73 MJ respectively. Although still far from the existing state-of-art technological capability, the models developed were highly conservative and not overly optimistic in terms of the potential gain, but this was to remain as close as possible to the modern technological state of art. However, in the future, in terms of energy gain a capsule performance much higher than is shown in this work will likely be possible, which will also minimise the propulsion requirements. This paper is a final contribution to Project Icarus.

Vol 78 #11 November Interstellar issue

Ultimate Biosphere Survival: Interstellar Migration from the Post-Main Sequence Sun	Greg Matloff	USA

In approximately 5 billion years, our Sun will start its post main-sequence evolution. The initial stage of this process, the subgiant phase, has a duration of about 100 million years. The sub-giant Sun will have a luminosity about twice that of the present-day Sun. Its radius will be about 3X the current solar radius. A more suitable phase for interstellar migrations is the horizontal branch of 50 million year duration in which the Sun's luminosity will have increased by a factor of about 100X and its radius by about 10X. At intervals of 500,000 years or less, Sun-like stars approach within one light year of the solar system. This paper investigates the feasibility of using large space habitats accelerated by graphene solar-photon sails to enable interstellar migrations of ~1,000 year duration. This process could allow for the very-long-term survival of mini terrestrial biospheres onboard these habitats.

A Gamma Distribution Framework for Modelling Life's Emergence and Intelligence Across the Universe	Elio Quiroga Rodríguez	Spain

The search for extraterrestrial life and intelligence has long been hindered by the static, anthropocentric assumptions of classical models like the Drake equation. This paper introduces a paradigm-shifting approach by leveraging the Gamma distribution — a statistical tool adept at modelling time-dependent, sequential events — to reframe the emergence of life and intelligence as stochastic processes governed by cumulative rare events. We propose a dynamic, probabilistic model where evolutionary milestones are not fixed probabilities but temporal trajectories shaped by planetary habitability windows and evolutionary pacing. By parameterizing the Gamma distribution using Earth's timeline (eg ~700 Myr for abiogenesis, ~4 Gyr for intelligence), we distinguish between the steep initial slope of life's rapid emergence under early planetary conditions and the long-tailed decay reflecting intelligence's rarity. The model integrates Monte Carlo simulations to quantify uncertainties, revealing that while life may emerge relatively quickly on habitable worlds, intelligence demands vast temporal reservoirs to navigate sequential bottlenecks. A key innovation is the stochastic reformulation of the Drake equation, replacing static terms with Gamma-driven integrals that explicitly account for time constraints (Lh) and evolutionary dependencies.

For instance, the probability of intelligence emerging is conditioned on life's prior arrival, with habitable lifetimes acting as a cosmic stopwatch. Despite its speculative foundations, this framework bridges astrobiology, statistics, and planetary science, offering testable predictions for upcoming telescopes (eg JWST, ELT) and a mathematical language to interpret biosignature data. By grounding cosmic optimism in the sobering mathematics of rarity, this work challenges the field to prioritize temporal stochasticity in the search for life.

Abiogeneses in Light of the Cosmological Principle	Ian Von Hegner	-

A key question in astrobiology is whether the origin of life on Earth is an improbable or probable event. In the context of the Cosmological and Copernican Principles, it will also be a point of discussion whether life on Earth holds a privileged position in the universe. This paper argues that, regardless of whether the origin of life on Earth is deemed an improbable or probable event, Earth's life does not hold such a privileged position. Even if the emergence of life, or abiogenesis, is a deterministic process that unfolds in the same way and produces similar initial forms across worlds, the process on each world is inevitably and independently of each other influenced by contingent circumstances. Consequently, the probability of life's origin will have different numerical values that vary locally while remaining globally the rule. The Cosmological Principle predicts there will necessarily be an even or considerable distribution of these probabilities with no definitive numerical values that confer a privileged status. The fact that the numerical values are different each time is important for the estimation of the possibility of the emergence of life on other worlds. While certain types of worlds may produce life as we know it, the timing or certainty of its emergence cannot be predicted. If multiple forms of life exist, it cannot be said that a certain type of world can produce life either. Therefore, a revised trend for the probability will establish a trade-off between the likelihood of discovering life elsewhere with understanding its distribution across the universe.

On Perihelion Predictions for Visiting Interstellar Cometary Objects	Kelvin F Long	UK

In recent years three interstellar objects have entered our solar system and have been observed by long range detectors. These include 1I/'Oumuamua, 2I/Borisov and 3I/ATLAS. The mainstream consensus suggests these objects have a natural explanation, such as originating from beyond the outer Oort Cloud and interstellar space. However, certain peculiarities of their physical emissions and orbital characteristics at least suggest the controversial possibility that an artificial (and technological) origin may be considered as a potential hypothesis. We use the observed events and generate two additional hypothetical events and then predict when the next events might occur in late 2027 and 2029, whatever their nature. We suggest a minimum object clustering probability per year of order ~6.5%. This is performed as a method for validating or falsifying the artificial comet hypothesis which stands as an alternative to the mainstream accepted natural comet hypothesis. If the objects were indeed found to follow a periodic pattern that approximates this timing, we suggest this should be of high interest to scientists and the artificial comet hypothesis would require fair consideration as a candidate explanation. This is presented to facilitate an important discussion as to what might be possible, natural or otherwise.

Volume 78 #12 December Interstellar issue

Project Icarus: The Pegasus Spacecraft Concept Design ICF Propulsion for an Interstellar Rendezvous Mission – Part A	Kelvin F Long	UK

In the 1970s members of the British Interplanetary Society designed a spacecraft for an interstellar flyby mission to the nearest stars called Project Daedalus. In 2009 this author initiated a successor study called Project Icarus which set out to re-design the Daedalus spacecraft based on advances in science and technology. In this paper we describe a concept called Pegasus which is proposed as one of the potential improved solutions to the Daedalus. This is an inertial confinement fusion propelled spacecraft driven by laser beams, the technology for which is now supported by successful experiments at the National Ignition Facility. The Pegasus is a concept for an interstellar rendezvous mission carrying a 150 tonnes payload to 4.3 ly in a trip duration of order a century. It would be characterised by a thrust of 0.64 MN, a jet power of 2.85 TW and a specific power of 1.12 MW/kg. In this paper we discuss various physics and engineering issues relevant to the propulsion system. This paper is a final contribution to Project Icarus.

Project Icarus: The Pegasus Spacecraft Concept Design ICF Propulsion for an Interstellar Rendezvous Mission – Part B	Kelvin F Long	UK

This paper is a follow-up to an earlier one in relation to the design of an interstellar spacecraft called Pegasus, which set out to re-design the Daedalus spacecraft based on advances in science and technology. The Pegasus is an inertial confinement fusion propelled spacecraft driven by laser beams, the technology for which is now supported by successful experiments at the National Ignition Facility. The Pegasus is a concept for an interstellar rendezvous mission carrying a 150 tonnes payload to 4.3 ly in a trip duration of order a century. In this paper we discuss various physics and engineering issues relevant to the propulsion system, to include the reaction chamber, magnetic field control and charged particle jet collimation. This paper is a final contribution to Project Icarus.

Acta Astronautica

Acta Astronautica papers are announced online before print. The relevant papers below have appeared since our last issue, Principium P51, which reported announced papers up to the in-progress Volume 238 January 2026.

Speeding up slows down: A potential paradox of innovation curtailment in nomadic societies engaged in interstellar relativistic traffic	Volume 238 Jan 2026, Part A	Grzegorz Sadlok

An object moving through space with a relativistic speed, close to that of a photon in a vacuum, experiences time dilation – the flow of time slows down for objects in motion. This phenomenon makes traversing huge interstellar distances possible within a human lifetime. If not for engineering limitations, this could open up interstellar travel for humanity. However, time dilation makes sustaining a society's coherence challenging. A social transition toward a nomadic lifestyle has been offered as a potential solution to this problem. The paper further explores this idea and speculates on the impact that time dilation could have on the innovation rate of a theoretical society of interstellar nomads. The paper argues that a nomadic lifestyle would, in fact, curtail innovation, causing such a society to fall behind a stationary civilization.

Blink and you'll miss it - How technological acceleration shrinks SETI's narrow detection window	Volume 238 Jan 2026, Part B	Michael A Garrett

The search for extraterrestrial intelligence (SETI) has historically focused on detecting electromagnetic technosignatures, implicitly assuming that alien civilisations are biological and technologically analogous to ourselves. This paper challenges that paradigm, arguing that highly advanced, potentially post-biological civilisations may undergo rapid technological acceleration, quickly progressing beyond recognisable or detectable phases. We introduce a simple model showing that the technological acceleration rate (α) of such civilisations can compress their detectable phase to mere decades, dramatically narrowing the temporal "detection window" in which their technosignatures overlap with our current capabilities. This framework offers a plausible resolution to the "Great Silence": advanced civilisations may be abundant and long-lived, but effectively invisible to present-day SETI methods. Consequently, our efforts must include but also evolve beyond the search for narrow-band communication signals in the radio and optical domains. Instead, we require an expanded, technology-agnostic strategy focused on persistent, large-scale manifestations of intelligence, such as broadband electromagnetic leakage, waste heat from megastructures, and multi-dimensional anomaly detection across extensive, multi-wavelength and multi-messenger datasets. Leveraging advanced artificial intelligence for unsupervised anomaly discovery, recursive algorithm optimisation, and predictive modelling will be essential to uncover the subtle, non-anthropocentric traces of advanced civilisations whose technosignatures lie beyond our current technological and cognitive frameworks.