NEXT ISSUE

Back in 1984. Robert L Forward published a paper entitled *Roundtrip Interstellar Travel Using Laser-Pushed Light-sails'* (Vol 21, No.2, J. Spacecraft, March-April 1984) [1] including the equation deriving acceleration from photon power, sail reflectance and vehicle mass.

• **Two Equations to the Stars - Part Two: The Photon Sail Equation:** Even using fusion, the capabilities of rocket propulsion remain limited by Newton's second law and thus the Tsiolkovsky rocket equation. Our second equation shows how probes propelled by light are limited only by the capacities of the photon source and the sail - up to the limit set by Einstein's light speed barrier, John I Davies

• **Human Exploration of the Far Solar System and on to the Stars:** A report on our summer 2021 courses, delivered by i4is for the Limitless Systems Institute (LSI) - reporter, Patrick J Mahon (postponed from this issue)

• **73rd International Astronautical Congress 2022 - The Interstellar Papers:** Your guide to all that's interstellar at the biggest world space conference of the year

• **Book Review: Life in the Cosmos (Minasvi Lingam & Abraham Loeb):** by i4is Technical Director, Andreas Hein [2]

- plus, of course. *Interstellar News* and interstellar papers in *The Journals*.

[1] web.archive.org/web/20170808080011id_/http://interstellar-flight.ru/design/base_e/rit-1.pdf
[2] Associate Professor of Space Systems Engineering at SPASYS, Université du Luxembourg.

COVER IMAGES

Our cover images for this issue look near and far! A probe to 1i/'Oumuamua is a near term possibility, galactic warps and collisions are far far away.

FRONT COVER

Project Lyra probe and the Pale Blue Dot

i4is Project Lyra is an ongoing programme of work on the interception of interstellar objects (i4is.org/what-we-do/technical/project-lyra/). One major theme of this work is the use of gravitational slingshots to add velocity to a probe and a particularly effective way of doing this is a solar Oberth manoeuvre. Such a probe needs shielding close to the Sun and a rocket to add the perihelion kick required. The image depicts such a craft, with the Pale Blue Dot of the Earth in the middle of the misty band to the right, as it heads outwards to intercept the ISO 1I/'Oumuamua.

Credits: spacecraft: Malavika Patel (3D model), Adrian Mann (rendering). background: NASA (www.nasa.gov/feature/jpl/pale-blue-dot-revisited) composite: John I Davies

BACK COVER

We are not too close to the warp!
Credit: Stefan Payne-Wardenaar; Inset: NASA/JPL-Caltech; Layout: ESA.

Milky Way's warp caused by galactic collision, Gaia suggests

From ESA: Astronomers have pondered for years why our galaxy, the Milky Way, is warped. Data from ESA's star-mapping satellite Gaia suggest the distortion might be caused by an ongoing collision with another, smaller, galaxy, which sends ripples through the galactic disc like a rock thrown into water. www.esa.int/Science_Exploration/Space_Science/Gaia/Milky_Way_s_warp_caused_by_galactic_collision_Gaia_suggests

Image credit: Stefan Payne-Wardenaar; Magellanic Clouds: Robert Gendler/ESO

Paper: *Evidence of a dynamically evolving Galactic warp* - Poggio, E, Drimmel, R, Andrae, R et al. Evidence of a dynamically evolving Galactic warp. Nat Astron 4, 590–596 (2020). doi.org/10.1038/s41550-020-1017-3