

Project Lyra: A Mission to 1I/'Oumuamua without Solar Oberth Manoeuvre

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The Project Lyra team, noting the challenges involved in a close approach to the Sun to execute a Solar Oberth Manoeuvre, have now proposed a less challenging strategy using a Jupiter Oberth Manoeuvre in a paper available as open publication (arxiv.org/abs/2201.04240). Forbes magazine has featured its recommendations [1] and phy.org went into much more detail [2]. We also appeared in Interesting Engineering [3] and even The Sun newspaper - have they ever cited an arxiv.org publication before?

The proposed mission would launch in 2028 with a total time of flight of around 26 years implying an intercept around 2054. I would be 108 years old but it's still nearer to us in the future than the Voyager missions are in our past - they launched in 1977 - 45 years ago. The mission would slingshot around Venus then Earth, make a Deep Space Manoeuvre then again around Earth and out to Jupiter - firing a rocket around closest approach to exploit the Oberth effect (V-E-DSM-E-J). The intercept velocity would be only slightly more than half of that for an equivalent mission based on a Solar Oberth Manoeuvre - giving more time for examination of the 1I object. The mission can be achieved with a near term launcher, the NASA SLS Block 1B or a successor. The probe would reach its target at arrival speed relative to 1I/'Oumuamua of approximately 18 km/s, about 40% slower than for the Solar Oberth Manoeuvre with a consequent improvement in useful observation time.

Adam Hibberd's Optimum Interplanetary Trajectory Software (OITS) again proves it worth. Adam explains its application to a purely solar system mission elsewhere in this issue of Principium.

As the paper remarks, the possible scientific return

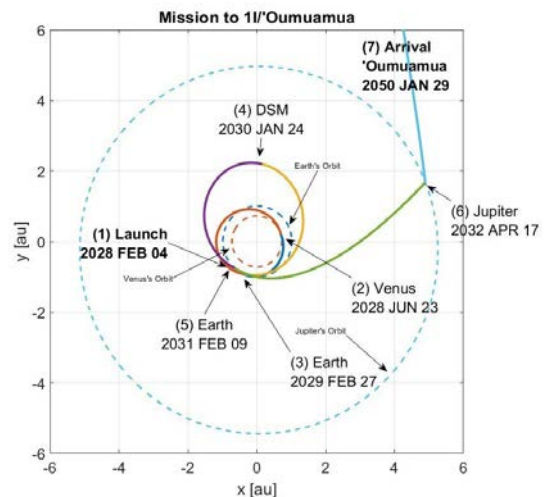


Figure 1. Trajectory, V-E-DSM-E-J (VEEGA)

Trajectory, V-E-DSM-E-J (VEEGA), Credit: Adam Hibberd

from such a venture makes this an unmissable opportunity. The 1I object remains unique and, though the strong scientific consensus is that it is a natural object, the possibilities for its composition remain numerous and all of them have significant objections which cannot now be resolved without an intercept mission. The mystery might be resolved soon if a similar object is found but it is now well over four years since 1I was discovered [4] and we cannot reason from a single instance to predict the frequency of such objects. Principium and the i4is Project Lyra team have been making this point since a few weeks after its discovery. We are well overdue for investment in detailed mission planning. As the Forbes story says "In short, we *must* take a closer look." More on the i4is Project Lyra page *Project Lyra – Exploring Interstellar Objects* (i4is.org/what-we-do/technical/project-lyra/).

Adam has set up a launch countdown to both ways of executing the Lyra mission - (adamhibberd.com/project-lyra-launch-countdown/). ■

[1] *NASA To 'Oumuamua? The New 22 Year Mission To The Extraordinary Object Said To Be An 'Alien Solar Sail'*, Jamie Carter, Jan 18 2022, www.forbes.com/sites/jamiecartereurope/2022/01/18/nasa-to-oumuamua-the-new-22-year-mission-to-the-extraordinary-object-said-to-be-an-alien-solar-sail/

[2] If launched by 2028, a spacecraft could catch up with 'Oumuamua in 26 years phys.org/news/2022-01-spacecraft-oumuamua-years.html

[3] interestingengineering.com/scientists-want-to-send-a-probe-to-catch-up-with-oumuamua-by-2054 - but beware their confusion about solar sails!

[4] 19 October 2017 by the Panoramic Survey Telescope and Rapid Response System (Pan-STARRS1), Hawaii