17th IAA SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FUTURE (D4)
Strategies for Rapid Implementation of Interstellar Missions: Precursors and Beyond (4)

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NEAR TERM INTERSTELLAR MISSIONS : FINDING AND REACHING INTERSTELLAR OBJECTS

Abstract

1I/'Oumuamua (or 1I) is the first InterStellar Object (ISO) known to pass through the Solar System. 1I was unfortunately found in October 2017, after its perihelion, and is now on its way out of the Solar System. On the opening day of the 2019 IAC, it will be 14 Astronomical Units (AU) distant, well beyond the orbit of Saturn, and proceeding away from the Sun at 28.6 km / second. Despite this, 1I is without question closest and easiest to reach Interstellar target for spacecraft exploration, by several orders of magnitude. Even in the 2060s it will still be 1000 times closer, and that much easier to reach, than the nearest stars.

1I remains mysterious, exhibiting characteristics that have never before been observed in a celestial body, providing ample motivation for *in situ* spacecraft exploration. In Project Lyra, we and our colleagues have explored possible mission scenarios, both in the near term, leaving Earth in the early 2020s [1], and in subsequent decades [2].

Of course, if there is one ISO passing through the Solar System, there should be others. 1I kinematically appears to be part of the Pleiades Dynamical Stream (or Moving Group); the dynamical streams being a major part of the organization of stellar (and presumably also ISO) trajectories in the Galaxy. If ISOs, like stars, are predominantly entrained in a dynamical stream, their incoming velocities (magnitude and radiants) can be predicted, which will enable deep surveys looking for ISOs well before perihelion. This will assist in the execution of rapid-response missions to future ISOs transiting the Solar System.

Whether a mission is send to 1I, or a mission is sent to a subsequent ISO (or both), it seems clear that the first interstellar mission will be to one of these objects.

[1] Hein, A. M., Perakis, N., Long, K. F., et al. 2017, ArXiv e-prints. https://arxiv.org/abs/1711.03155
[2] Hibberd, A., Hein, A. M., Eubanks, T. M. 2019, arXiv e-prints, arXiv:1902.04935. https://arxiv.org/abs/1902.04935
[3] Eubanks, T. M. 2019, in Lunar and Planetary Science Conference, Vol. 50, 3262