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INTERSTELLAR PROBE: REQUIREMENTS

Abstract

Due to its potential for scientific discovery and overall fascination, the science community has been focusing on a dedicated Interstellar Probe mission since 1971. While there has always been general concurrence on the science and measurement requirements, the details have changed with technologies and scientific understanding of near-interstellar space. That understanding has been enabled by the in situ measurements by the Voyager 1 and 2 spacecraft as the Voyager Interstellar Mission (VIM), and complementary remote imaging of energetic neutral atoms (ENAs) by the Ion Neutral CAmera (INCA) on Cassini, from its vantage point at Saturn, and from the Interstellar Boundary Explorer (IBEX) in Earth orbit. The remote observations are leading to a much improved understanding of the constraints on the overall global interaction of the solar wind with the very local interstellar medium (VLISM) and point to many discrepancies with our current models and our previous assumptions about the heliospheric boundary region. Thus, reaching large heliocentric distances rapidly is an even more compelling driver than heretofore for an Interstellar Probe, but reliance on advanced technologies, which have not matured or have fallen short of expectations, have hindered serious planning for a near-term mission. Regardless of the propulsive means, what has emerged is a requirement for a small, but extremely capable spacecraft, not unlike the New Horizons spacecraft (< 500 kg launch mass), which recently flew by Pluto. A consensus on the driving science, corresponding required measurements, and the best means for obtaining the requisite data are necessary to bound the solution space for a mission, which can be carried out in the “near-term” of the next two decades. Instrumentation, mass, and power must be accommodated on the spacecraft, which will also have a lifetime requirement of as much as 30 years, far in excess of previous mission requirements. The Committee on Space Research (COSPAR) has recently established a new Panel on Interstellar Research (PIR) to consider the next steps toward finally making such a dedicated Interstellar Probe mission a reality. Crucial tasks are to build consensus amongst the international scientific community for the appropriate scientific campaigns and measurements to be carried out for such a mission, taking into account the new and continuing findings from the outer solar system and beyond.