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STRATEGIES TO IMPLEMENT A PRECURSOR INTERSTELLAR MISSION: FROM MISSION
CONCEPTS TO FINANCING OPTIONS

Abstract

An interstellar precursor mission has been discussed as a priority for science for over 30 years. Such a mission would improve our knowledge of the interstellar environment and address fundamental questions of astrophysics, from the origin of matter to evolution in the Galaxy. As the interstellar Voyager mission's continues to progress, new observations keep raising more questions about the nature of the interaction between the heliosphere and the interstellar medium.

In this era of discovery of Earth-like exoplanets, the interstellar missions needed to reach those systems remain a major challenge. They are limited by factors such as cost, risk, and public support. The main difficulty of a precursor interstellar mission is the technology needed to reach significant penetration of the interstellar medium (1000 AU) in a timeline inferior to 50 years. There has been research on providing realistic extrapolations of current and near-current technology, feasibility studies on the propulsion alternatives (nuclear pulse propulsion, beamed power propulsion; laser pushed light sails; nuclear electric propulsion, etc.) but also analysis of the necessary cost considerations and research on the financial viability of such a mission. The financial possibilities are an important factor that needs to be tackled to further develop interstellar mission concepts.

Despite these technological and financial challenges, there have been recent studies to carry out smaller scale extrasolar missions. Low-cost space is a tempting solution for an interstellar precursor mission. Assuming a minimal interstellar mission, having enough escape velocity to reach the heliopause, the financial framework becomes more accessible. Recently, missions involving CubeSats have been very successful in paving the way for low cost space. For instance, LightSail, a CubeSat based project to use a solar sail as a method of propulsion, was funded through crowdsourcing and for simple escape from the Solar System, a similar financial approach was applied with the CubeSat Ambipolar Thruster (CAT) project. From private small funds, to public institutions and non-profit organizations, there are many possible strategies to fund a minimal interstellar mission.

In this paper, we will present the different mission concepts to implement a precursor interstellar mission with a focus on the needed analysis of the minimum financial needs and funding options for carrying out such a mission.