**The Interstellar Probe Mission: Humanity's First Explicit Step in Reaching Another Star.**

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As the Voyagers are crossing into the Interstellar Medium (ISM) and the Kepler Mission has uncovered an abundance of Earth-like planets, instead of simply sitting around, we are faced with the question of how humanity will venture out into the vast space between our star and other potentially habitable planetary systems. Such a venture requires new lines of voyages that each would expand our frontier of exploration. We discuss the concepts and phases of an Interstellar Probe Mission, NASA’s first step on the Path to Interstellar Missions, and the potential of such a mission.

### Interstellar Probe Science

**Undiscovered Worlds Beyond our Neighborhood**

- Largest known trans-Neptunian objects (TNOs)
  - Plutino
  - Haumea
  - Makemake
  - Eris
  - Quaoar

**Jupiter’s Outermost Moons**

Planetary systems are encircled by a gaseous disk, spanned by the natural outer limit of a planetary system. In the case of Jupiter-like planets, the disk is composed of gas and dust. The gaseous disk is thought to be composed of a wide range of materials, including water, ammonia, and methane. The dust component is thought to be composed of small particles, ranging from micrometers to millimeters in size.

### Interstellar Probe Mission Requirements

1. Launch the spacecraft to have an asymptotic trajectory within a 20° cone of the heliospheric nose
2. Collect data for 10 to 200 AU
3. Arrive at 200 AU at least as fast as possible
4. Collect data on a mission profile that spans the solar system
5. Launch when the Earth is in the most favorable position
6. Launch on the target launch date
7. Launch the spacecraft
8. Operate on a mission profile that spans the solar system
9. Be acceptable for launch and mission requirements

### Interstellar Probe Trajectories and Trade Offs

Two mission scenarios are considered: one that could be developed and flown today with today’s technology, direct injection to an active Jupiter Gravity Assist (JGA), and one using Solar Gravity Assist (SGA). The use of a space-probe environment including solar sails, nuclear-electric propulsion (NEP), and radioisotope propulsion (RPP) have all been considered. The problems these technologies produce are instrumental requirements, assembly, autonomy, and lifetime, and are therefore not consistent with these mission requirements.

### References