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# STELLA: EUROPE'S CONTRIBUTION TO A NASA INTERSTELLAR PROBE

**Abstract**

NASA is considering an Interstellar Probe (ISP) as a large strategic mission candidate. A recently completed concept study report (*Interstellar Probe: NASA Solar and Space Physics Mission Concept Study, 2021*) has shown that an ISP mission is realistic and can be designed, built, and launched by 2036. Traveling with a speed of 7.0 au/year ISP would reach 350 au during its nominal 50-year life-time but the system resources could allow traveling to, at least, 525 au.

ISP will explore never studied in-depth or visited domains and boundaries of our astrosphere and fully characterize very local interstellar medium (VLISM). Although anchored in heliophysics, ISP inevitably offers ground breaking discoveries across astrophysics and planetary science.

The exploration of the interstellar medium has been identified as a very compelling case for ESA in the ESA senior committee 's report Voyage 2050. ESA Call for M-class missions 2021 is the best and only currently available option for the European science community to contribute to ISP with the astronomically constrained launch window in 2036 – 2037.

Stella is an M-class mission proposal for a possible ESA's contribution to NASA's Interstellar Probe. Stella includes two core and two optional elements for the full complement:

- Core: Provision of European scientific instruments;
- Core: Provision of the European ISP communication system including the spacecraft's 5-m high gain antenna;
- Full complement: ESA deep space communication facility: an extension of ESA's DSA with a new antenna array;
- Full complement: Contribution to ISP operations to increase drastically the ISP and European payloads science return.

ISP's main goal is to understand our habitable astrosphere and its home in the galaxy. Stella contributes to achieving the ISP goal by answering five Stella-specific science questions:

- What is the composition of the local interstellar medium?
- How is our dynamical heliosphere upheld and how does it change from the Sun to the local interstellar medium?
- What is the origin and role of galactic cosmic rays in the solar system and beyond?
- How does the local interstellar medium become structured when it meets the heliosphere?
- Are there any deviations from the 1/r gravity law on the interstellar scale?

Stella assumes a model European ISP payload: a neutral gas mass spectrometer, plasma package, cosmic ray spectrometer, UV spectrograph, and radio science (utilizing the S/C radio for the fundamental physics question).