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# Interstellar Mapping and Acceleration Probe (IMAP)

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Our piece of cosmic real-estate, the heliosphere, is the domain of all human existence - an astrophysical case-history of the successful evolution of life in a habitable system. By exploring our global heliosphere and its myriad interactions, we develop key physical knowledge of the interstellar interactions that influence exoplanetary habitability as well as the distant history and destiny of our solar system and world. IBEX was the first mission to explore the global heliosphere and in concert with Voyager 1 and Voyager 2 is discovering a fundamentally new and uncharted physical domain of the outer heliosphere. In parallel, Cassini/INCA maps the global heliosphere at energies (∼5-55 KeV) above those measured by IBEX. The enigmatic IBEX ribbon and the INCA belt were unanticipated discoveries demonstrating that much of what we know or think we understand about the outer heliosphere needs to be revised. The next quantum leap enabled by IMAP will open new windows on the frontier of Heliophysics at a time when the space environment is rapidly evolving. IMAP with 100 times the combined resolution and sensitivity of IBEX and INCA will discover the substructure of the IBEX ribbon and will reveal in unprecedented resolution global maps of our heliosphere. The remarkable synergy between IMAP, Voyager 1 and Voyager 2 will remain for at least the next decade as Voyager 1 pushes further into the interstellar domain and Voyager 2 moves through the heliosheath. The “A” in IMAP refers to acceleration of energetic particles. With its combination of highly sensitive pickup and suprathermal ion sensors, IMAP will provide the species and spectral coverage as well as unprecedented temporal resolution to associate emerging suprathermal tails with interplanetary structures and discover underlying physical acceleration processes. These key measurements will provide what has been a critical missing piece of suprathermal seed particles in our understanding of particle acceleration to high energies in the solar-heliospheric system and by extension to other planetary and astrophysical paradigms. IMAP, like ACE before it, will be a keystone of the Heliophysics System Observatory by providing comprehensive cosmic ray, energetic particle, pickup ion, suprathermal ion, neutral atom, solar wind, solar wind heavy ion, and magnetic field observations to diagnose the changing space environment and understand the fundamental origins of particle acceleration.