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The Interstellar Boundary Explorer—IBEX

The Interstellar Boundary Explorer (IBEX) mission has been remotely observing the global interaction of our heliosphere with the local interstellar medium for five years. Initially, IBEX generated the first all-sky maps of Energetic Neutral Atoms (ENAs) emanating in from the boundaries of our heliosphere over the energy range from ~0.1-6 keV. Using these observations, the IBEX team discovered a smoothly varying, globally distributed ENA flux overlaid by a narrow "ribbon" of significantly enhanced ENA emissions. Since the initial publications of these results in a special issue of *Science* magazine (November 2009), IBEX has completed nine more energy-resolved sets of sky maps and discovered small but important time variations in the interaction, separated the ribbon from globally distributed ENA fluxes, measured the energy spectral shape and inferred ion source temperatures, and carried out many other observational and theoretical studies of the outer heliosphere. In addition to these heliospheric results, IBEX made the first observations of ENAs produced by backscatter and neutralization of the solar wind from the lunar regolith and provided the first energy and angle resolved ENA images of the subsolar magnetosheath, magnetospheric cusps, and terrestrial plasma sheet. Direct IBEX observations of Interstellar Neutral (ISN) He atoms show that the speed and direction (the motion of the heliosphere with respect to the interstellar medium) is slower and at a somewhat different angle than thought from prior Ulysses observations.

These results led to the unanticipated conclusions that 1) there is currently no bow shock in the interstellar medium ahead of the heliosphere, and 2) the local interstellar medium is rotating, possibly in a local turbulent cell, immediately around the heliosphere. In addition, IBEX is providing the first direct quantitative measurements of ISN H atoms and the first direct measurements of interstellar Ne and O. We find that O is depleted with respect to Ne compared to both the solar and average galactic abundances, possibly suggesting that significant O is tied up in interstellar dust. Collectively, the IBEX observations are providing revolutionary new information about the interstellar medium and its interaction with global heliosphere; this information is leading to the development of vastly improved understanding of the heliosphere…our home in the galaxy.

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