EGU22-6402
https://doi.org/10.5194/egusphere-egu22-6402
EGU General Assembly 2022
© Author(s) 2022. This work is distributed under
the Creative Commons Attribution 4.0 License.

Interstellar Neutral He Parameters from Crossing Parameter Tubes with the Interstellar Mapping and Acceleration Probe (IMAP) informed by 10 Years of Interstellar Boundary Explorer (IBEX) Observations

Nathan Schwadron[1,2], Eberhard Moebius[1], David McComas[2], Jon Bower[1], Maciek Bzowski[3], Stephen Fuselier[4], David Heirtzler[1], Marzena Kubiak[4], Marty Lee[1], Fatemeh Rahmanifard[1], Justyna Sokol[4], Pawel Swaczyna[2], and Reka Winslow[1]

[1]University of New Hampshire, Earth, Oceans and Space (EOS), Physics, Durham, United States of America (n.schwadron@unh.edu)

[2]Department of Astrophysical Sciences, Princeton University, Princeton, NJ, 08544

[3]Space Research Centre PAS (CBK PAN), Bartycka 18 A, 00-716 Warsaw, Poland

[4]Southwest Research Institute, San Antonio, TX, 78238

The Sun's motion relative to the surrounding interstellar medium leads to an interstellar neutral (ISN) wind through the heliosphere. For several species, including He, this wind is moderately depleted by ionization and can be analyzed in-situ with pickup ions and direct neutral atom imaging. Since 2009, observations of the wind at 1 AU with the Interstellar Boundary Explorer (IBEX) have returned a precise 4-dimensional parameter tube for the flow vector (speed V_{ISN}, longitude λ_{ISN}, and latitude β_{ISN}) and temperature T_{ISN} of interstellar He in the local cloud, which organizes V_{ISN}, λ_{ISN}, and T_{ISN} as a function of λ_{ISN}, and the local flow Mach number (V_{th-ISN}/V_{ISN}). We refer to this functional dependence as the 4D IBEX parameter tube. On IBEX, the limitation of measuring the ISN flow observations to nearly perpendicular to the Earth-Sun line limits the range of observations in ecliptic longitude to 30°. This limitation results in large uncertainties along the IBEX parameter tube and relatively small uncertainties across the parameter tube. Over the past three years, IBEX operations were modified to let the spin axis pointing of IBEX drift to the maximum offset (7°) west of the Sun, which is the limit for the IBEX spacecraft. This expansion of the IBEX viewing helps break the degeneracy of the ISN parameters along the 4D IBEX parameter tube. It complements the full χ-square-minimization to obtain the ISNs parameters through comparison with detailed models of the ISN flow. The next generation IBEX-Lo sensor on IMAP will be mounted on a pivot platform, enabling IMAP-Lo to follow the ISN flow over almost the entire spacecraft orbit around the Sun. A near-continuous set of 4D parameter tubes on IMAP will be observed for He, and for O, Ne, and H that cross at varying angles in the full ISN parameter space. This analysis substantially reduces the flow parameter uncertainties for these species and mitigating systematic uncertainties, such as those from ionization effects and the presence of secondary components. We discuss implications of these measurements for understanding our environment and its relationship to the structure of the local interstellar medium. Thus, we discuss

how IMAP will probe the interstellar neutral gas flow in detail to derive the precise parameters of the interstellar flow and relate these conditions to understand our place within the interstellar medium.