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Highlights of the combination of "Ground truth" >28 keV in-situ ions from the Voyagers and >5.2 keV ENAs from Cassini in the study of the global heliosphere

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The Voyager 1 and Voyager 2 (V1 & V2) crossings of the termination shock (TS; ~94 and ~84 AU, respectively), led to the first measurements of ions and electrons that constitute the heliosheath (HS). Their crossings of the heliopause (HP; ~122 AU and ~119 AU), pinpointed the extent of the upwind heliosphere's expansion into the Very Local Interstellar medium (VLISM). The Cassini/INCA >5.2 keV ENA images of the celestial sphere, have placed the local V1&2/LECP measurements in a global context and have led to the discovery of a high intensity and wide ENA region that encircles the celestial sphere, called "Belt" and corresponds to a "reservoir" of particles that exist within the HS. The heliosphere forms a time-dependent, roughly symmetric obstacle to the inward interstellar flow, responding within ~2-3 yrs, in both the nose and anti-nose directions to the outward propagating solar wind changes through the solar cycle. The shape of the ion energy spectra plays a critical role in determining the pressure balance and acceleration mechanisms inside the HS. Energy spectra from ~10 eV to 344 MeV show that the PUIs dominate the total pressure distribution inside the HS, but suprathermal ions provide a significant contribution that cannot be neglected, revealing that >5.2 keV ENAs serve as important indicators of the acceleration processes that the parent H^+ population undergoes inside the HS, thus imposing a key constraint on any future interpretation concerning the HS dynamics. The combination of ENAs and ions in the HS show that the plasma beta is >>1, the magnetic field upstream at the heliopause required to balance the pressure from the HS is >0.5 nT (V1 direction) and ~0.67 nT (V2 direction) and that the neutral Hydrogen density is ~0.12/cm^3. These inferred values are consistent with measurements from both V1 and V2 spacecraft. Energetic ion measurements from V1/LECP in and beyond the HP show an average radial inflow of 40-139 keV ions for ~10 AU inside the HS and an average radial outflow over a spatial range of ~28 AU past the HP. These particles correspond to an ion population leaking from the HS into interstellar space, most likely due to the flux tube interchange instability at the boundary and provide a direct observation of the communication between the HS and the VLISM. They may also provide an important constraint for future models that aim to explain the <6 keV ENA ribbon fluxes (measured from the IBEX mission), which are likely formed from the neutralization of energetic pickup ions gyrating in the IS magnetic field outside the HP, reflecting (in part) those ion distributions that are responsible for the formation of this unexpected structure.