**Introduction**

The Interstellar Boundary Explorer (IBEX) obtains a very precise relation between the interstellar neutral (ISM) flow longitudinal velocity \(v_{\text{ISN}}\) and speed \(V_{\text{ISN}}\) with substantially larger uncertainty separately for the interstellar magnetic field \(B_{\text{ISN}}\) which defines a parameter tube that connects ISN longitude, latitude, speed (velocity vector \(V_{\text{ISN}}\)) and temperature \([1, 2, 3, 4, 5]\), in agreement with Ulisses observations \([6, 7, 8]\) [1]. The isotropic distribution of \(v_{\text{ISN}}\) is reduced from the IBEX ribbon, consistent with the heliospheric asymmetry and TeV cosmic ray anisotropy \([9]\). The two vectors define the \(B_{\text{ISN}}\) plane, which determines the height of the \(v_{\text{ISN}}\) distribution upon injection at the combined solar wind and ISN velocity. The \(v_{\text{ISN}}\) distribution is modeled with a semi-analytical approach \([10, 11]\). An independent determination of \(v_{\text{ISN}}\) will tighten \(\lambda_{\text{ISN}}\), and obtaining \(\lambda_{\text{ISN}}\) over an extended time will resolve a current debate on possible temporary variations \([12, 13, 14]\).

**Pickup Ion Cut-Off Modelling**

- **Robust method to obtain \(\lambda_{\text{ISN}}\):** Pickup Ion (PUI) cut-off speed (high-energy edge of the PUI cut-off distribution) is a function of the ratio \(V_{\text{ISN}}/v_{\text{ISN}}\) (radial ISN flow component and solar wind speed) \([16]\).

**PUI Cut-Off with STEREO PLASTIC & ACE SWICS**

As shown in Fig. 2, the cut-off speed in the solar wind frame to a good approximation is given by \(V_{\text{ISN}} = V + v_{\text{ISN}}\) Normalized to \(V_{\text{ISN}}\) it is then:

\[ \frac{V_{\text{ISN}}}{v_{\text{ISN}}} = \frac{V}{v_{\text{ISN}}} + 1 \]

(2)

PUI distributions are gyrotropic and mostly scatter in pitch angle. As shown recently \([18]\), they largely maintain their initial torus distribution with some scattered values which induce a \(\lambda_{\text{ISN}}\) dependence on \(v_{\text{ISN}}\) bias in the rest frame. Fig. 3 shows a distribution obtained with PLASTIC after transformation into the solar wind frame \(w\) in the \(B_{\text{ISN}}\) plane. Accumulation along shells in constant \(w\) produces a cut-off that does not depend on initial torus \(\lambda_{\text{ISN}}\) angle.

- **Cut-off speed only minimally affected by PUI transport effects**

Produced by newborn ions and not altered by pitch angle scattering

**Results & Outlook**

- **ISTN Flow Direction from PLASTIC Data 2007-2014:** \(\lambda_{\text{ISN}} = 73.21\pm0.03\) - Consistent with previous studies & very small statistical uncertainty arising from systematic effects studied
- **PUI Cut-Off Method uses Newborn Ions:** Tornado Effect Minimized
- **Only pitch angle scattering** No effect in solar wind frame
- **18-Year Data Sets (STEREO, ACE & SOHO) for He, O & Ne**
- **Synchronous constraints on potential time variations in ISTN Flow**
- **Will provide constraints on secondary ISN Component on results and determine Secondary Flow direction for O**

**References**