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The downwind hemisphere of the heliosphere: what do IBEX observations at low energies tell us and which questions remain open?

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After eight years of observations with the Interstellar Boundary EXplorer (IBEX) we summarize what we learnt from imaging heliospheric hydrogen ENAs (Energetic Neutral Atoms) in the lowest energies accessible with IBEX (10 eV to 200 eV). For these low energies, we constrain ourselves to the globally distributed ENA flux from the downwind hemisphere of the heliosheath: Previous studies have established that the Ribbon of elevated ENA intensities fades into the globally distributed ENA flux between 100 and 200 eV. Moreover, the intense signal due to interstellar neutrals (ISN) from the nose region of the heliosphere prevents us from imaging the heliospheric signal from upwind direction. In the downwind direction, the energy spectrum of heliospheric ENAs begins to roll over around 100 eV and may completely drop to zero below 50 eV. This implies, due to the balance of plasma pressure, a minimum heliosheath thickness of 150 astronomical units for the downwind hemisphere.

We then present our ongoing work to address the outstanding questions about heliospheric ENAs at low energies: Can the ENA intensity from the downwind hemisphere be constrained to even lower values? Can we say more about the geometry of the downwind hemisphere if we combine ENA energy spectra from all available directions in addition to the selected regions in previous studies? Can we derive the radial velocity of the solar wind plasma in the heliosheath and thus infer jump conditions across the termination shock? Can we identify temporal trends (e.g. solar maximum versus solar minimum conditions) or do statistics and signal-to-background ratio introduce uncertainties too large at these low energies? Can we improve the analysis of heliospheric ENA signals by subtracting ISN hydrogen and the extended source of secondary ISN helium?