

EGU22-13535

<https://doi.org/10.5194/egusphere-egu22-13535>

EGU General Assembly 2022

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The primary and secondary populations of interstellar neutral gas as seen now by IBEX and in the future by IMAP

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As the Sun moves through its local galactic neighborhood, it disturbs the ionized component of interstellar matter, forming a complex bow-wave structure of a slowed and heated, magnetized plasma, flowing past the heliosphere. This region is called the outer heliosheath. The neutral component of interstellar matter is in equilibrium with the ionized component far ahead of the heliosphere, but within the outer heliosheath it decouples kinematically from the perturbed plasma. A complex interaction begins, mostly by charge exchange, between the ions and the neutral atoms, and as a result, a new population of neutral atoms is created, with kinematic parameters similar to that of the surrounding plasma. In addition, elastic collisions operate, additionally modifying both the original primary and the secondary population of neutral. Both the primary and the secondary populations penetrate inside the heliosphere and can be directly sampled at 1 au. We will review results of observations of these populations obtained from IBEX-Lo and results of modeling of the secondary populations of interstellar hydrogen, helium, and oxygen in the outer heliosheath. We will illustrate how these populations can be better observed owing to enhanced capabilities of the planned IMAP-Lo instrument and demonstrate how they can be leveraged to resolve the primary and secondary populations, and investigate the properties of local interstellar matter in the immediate neighborhood of the Sun.