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Interstellar neutral hydrogen: Eight years of IBEX-Lo observations

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The Interstellar Boundary Explorer (IBEX) is a NASA satellite in a highly elliptic Earth orbit. IBEX has been observing interstellar neutral material entering the heliosphere and energetic neutral atoms from the heliosheath for almost one full solar cycle, starting by the end of 2008.

In this presentation we discuss IBEX observations of interstellar neutral (ISN) hydrogen, measured between 10 and 40 eV from 2009 to 2016. Similar to the study of ISN helium and oxygen, ISN hydrogen data can provide information on the composition of the interstellar material and on the heliosphere that modifies the incoming ISN flow. The main challenge with ISN hydrogen data is how to discern the signal from the much more intense signal caused by ISN helium. Helium atoms generate hydrogen and oxygen counts in the IBEX-Lo instrument by sputtering off the water layers on the conversion surface. Whereas hydrogen is the dominant species in the unperturbed interstellar medium, most ISN particles that make it to the inner solar system without being re-ionized, are helium. In addition, a part of the ISN helium reaches Earth's orbit as a spatially extended secondary component with lower energies. A proper identification of ISN hydrogen therefore benefits the study of both ISN hydrogen and helium.

In years of weak solar activity, ISN hydrogen can clearly be identified at ecliptic longitudes between 260° and 310°, roughly one month after the signal of primary ISN helium has peaked. When the solar activity approached its most recent maximum in 2012, the ISN hydrogen signal weakened substantially. This reduction was expected because the increasing solar radiation pressure and re-ionization probabilities made it harder for ISN hydrogen to reach the inner solar system. However, the ISN hydrogen signal increased again in 2014, two years earlier than expected. The other puzzling aspect of the ISN hydrogen observations to be explained concerns the energy distribution: During the observations analysed so far, the ISN hydrogen count rates around 15 eV were much higher than at 29 eV, contrary to model predictions. We will discuss possible explanations for these discrepancies.