EGU22-13186
https://doi.org/10.5194/egusphere-egu22-13186
EGU General Assembly 2022

Differentiating the Ribbon and Globally Distributed ENA Flux in IBEX Observations

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The heliosphere surrounding our solar system is formed by the interaction between the solar wind and the local interstellar medium as the Sun moves through interstellar space. With dimensions on the order of hundreds to potentially thousands of au, it is extremely difficult to pinpoint the 3D structure of the heliosphere and its boundaries, and the properties of the plasma within it. However, we can remotely measure the properties of the heliosphere with energetic neutral atoms (ENAs) which are created as a product of charge exchange between interstellar neutrals and ions within the solar wind plasma. ENAs can propagate hundreds of au before ionizing, allowing us to remotely view the distant boundaries of the heliosphere.

The Interstellar Boundary Explorer (IBEX) mission, a NASA smaller explorer mission which has been measuring ENA fluxes at ~0.5-6 keV for more than a solar cycle, has revealed at least two separate sources of ENAs: the “ribbon” of enhanced ENA fluxes forming a narrow, circular band across the sky, and the “globally distributed flux” (GDF) that forms lower intensity, broad features near the nose and tail of the heliosphere. While it is believed that the ribbon is formed from secondary ENAs from outside the heliopause, and ENAs from the inner heliosheath inside the heliopause are a major contributor to the GDF, it is not clear exactly how much of the GDF may originate outside the heliopause, and how much of the flux observed in the Ribbon is from the GDF itself. To help solve this issue, we present recent developments in our understanding of the ribbon vs. GDF sources from both IBEX data analysis and modeling perspectives. Moreover, with the upcoming IMAP mission set to launch in 2025, we provide insight into how IMAP’s enhanced capabilities may improve our current understanding of the heliosphere.