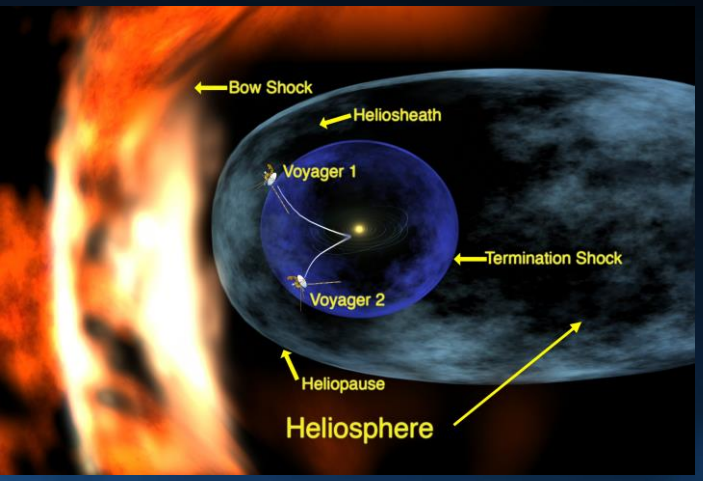
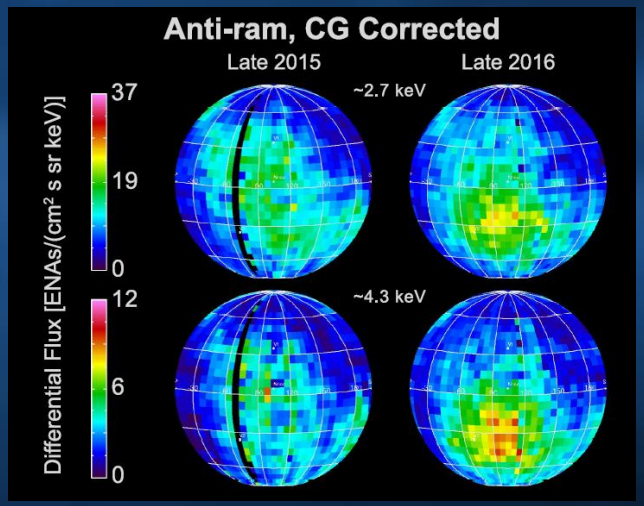
The Heliosphere Responds to Large Solar Wind Intensification



A diagram of the Heliosphere as it travels through the interstellar medium.



A comparison of ENA fluxes from late 2015 to late 2016 from CG correlated anti-ram data. The data shown is for the two highest energies, where a visible increase in ENA intensity is detected in late 2016.

By combining observations from NASA's Interstellar Boundary Explorer (IBEX) in 2016, near-Earth data of a large transient pressure enhancement in 2014, which passed Voyager 2 in the outer heliosphere in 2015, as well as computer simulations, a recent paper posits that the pressure is expanding our heliosphere, already pushing the termination shock and heliopause outward in locations closest to the Sun. Such large-scale reconfiguration of the global structure and properties of the heliosphere has implications for any of the various particles crossing the boundary into the heliosphere, including anomalous cosmic rays, galactic cosmic rays, interstellar neutral atoms, and the production of secondary neutral populations.

IBEX remotely monitors the outer edges of the heliosphere, by observing the energetic neutral atoms (ENAs) traversing from that region -- atoms created by charge exchange between cold neutral atoms that come from the interstellar medium, and solar wind ions and incorporated pickup ions that are heated as they pass through the termination shock at the front of the heliosphere.

IBEX observed a significant enhancement in higher energy ENAs starting in late 2016 which has become more elevated since. This enhancement in ENAs is thought to be the heliosphere's response to a large (~50%) increase in the solar wind dynamic pressure, as seen by near-Earth spacecraft in 2014 and Voyager 2 in 2015. The paper posits that the pressure increase propagated through the heliosheath, reflected off the heliopause -- and the enhanced density of the solar wind filled the heliosheath behind it -- before generating significantly enhanced ENA emissions.

If the next couple of years should show significant enhancement in the IBEX ENA ribbon fluxes and other ENA fluxes further from the front of the heliosphere. The details of the continuing IBEX observations provide important new information about the global structure of the three-dimensional heliosphere as well as properties of the nearby interstellar medium just beyond the heliopause.