

As Solar Wind Blows, Our Heliosphere Balloons

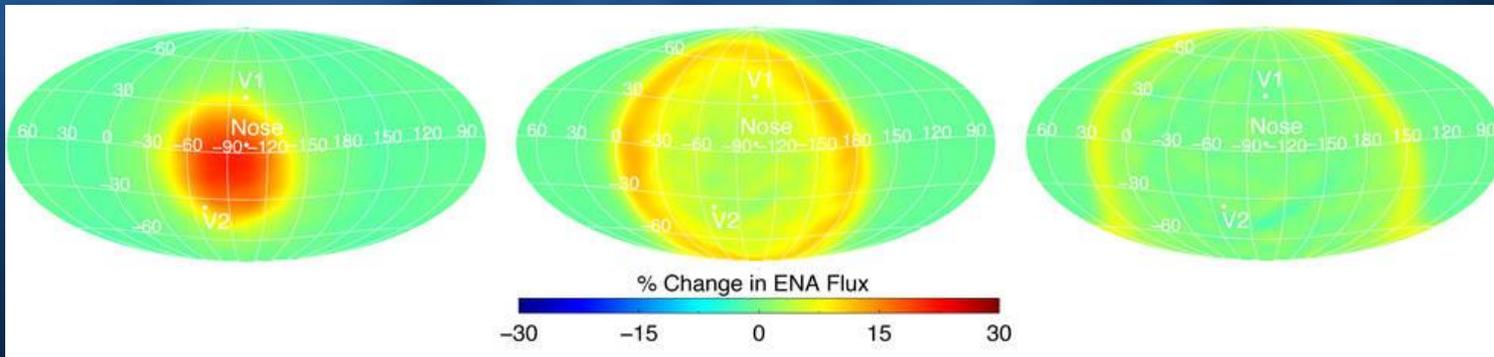
In late 2014, NASA spacecraft detected a substantial change, approximately a 50 percent increase, in the solar wind. Two years later, the Interstellar Boundary Explorer (IBEX), spacecraft detected the first sign of the aftermath, reaching the edge of the heliosphere, neutralizing themselves, and shooting all the way back to Earth. Using IBEX data along, with sophisticated numerical models, research published in *The Astrophysical Journal* ran the clock forward, modeling the heliosphere eight years after the 2014 solar wind pressure increase.

The initial signal detected by IBEX in 2016 was a solid circle, but it won't stay that way. As the 2014 solar wind reaches points of the heliopause further away, they take longer to bounce back, like an echo off of a far-away wall. The heliosphere's rounded shape causes this echo to reflect back in the form of a ring.

Researchers found that the precise rate at which the ring expands depended in part on the distances between the various layers of the heliosphere: the termination shock, the heliopause, and the part of the heliosheath where the energetic neutrals were produced. Zirnstein realized he had found a new way to measure the size and shape of the heliosphere.

Connecting the changes in the Sun with energetic neutral atom observations will help us understand long term changes in the hazardous conditions for space radiation environment — a sort of space climate as opposed to space weather. As the solar wind changes intensity and our solar bubble expands and contracts, that directly affects the amount of cosmic rays that can enter the heliosphere, potentially endangering astronauts on long duration spaceflights.

But the results also underscore the incredible power of our closest star. Changes on the Sun, including the solar wind, have significant consequences extending billions of miles into space -- with techniques like energetic neutral atom imaging, these far-off portions of the heliosphere can be precisely measured.



*After an initial spike, energetic neutral atoms should rain back down on IBEX, forming a ring that expands across the sky over time.
Credits: Eric Zirnstein*