

## The Heliosphere

Credit: NASA/IBEX/Adler Planetarium

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What do we mean when we say something has an edge or a boundary? Some things, like a table or a soccer field, have clear edges and boundaries. Other objects, like cities and towns, have boundaries that aren't as easy to see. It is hard to say where they end and something else begins. The Solar System is more like a city than a table or soccer field.

You could say that the Solar System extends as far as the influence of the Sun. That could mean the influence of the Sun's light, or the influence of the Sun's gravity, or the influence of the Sun's magnetic field and solar wind.

Could the reach of the Sun's light be a good way to decide how far the Solar System extends? The light from the Sun gets fainter as you move farther away, but there is no boundary where the light stops or where it suddenly gets weaker. How about gravity? Just like light, the influence of the Sun's gravity extends without limit, although it gets weaker farther away from the Sun. There is not a boundary at which it stops. Astronomers are still discovering objects in the outer Solar System beyond Pluto.

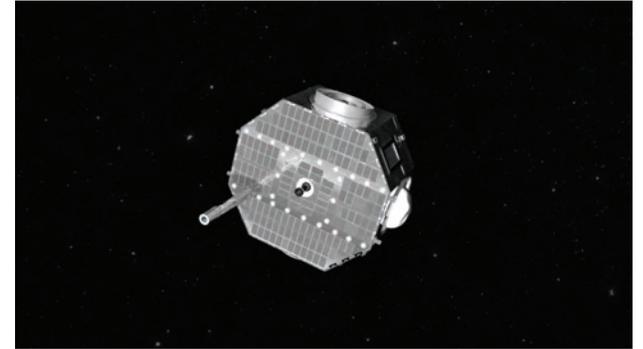
The solar wind is different from light or gravity. As it streams away from the Sun, it races out toward the space between the stars. We think of this space as "empty" but it contains traces of gas and dust, called the Interstellar Medium. The solar wind blows against this material and clears out a bubble-like region in this gas. This is not a bubble like a soap bubble, but more like a cloud of foggy breath that you breathe into chilly winter air.

The entire area, or bubble, inside the boundary of the Solar System is called the heliosphere. The place where the solar wind slows down and begins to interact with the interstellar medium is called the heliosheath. The heliosheath has a few parts: the termination shock (the innermost part of the boundary), the heliopause (the outermost part of the boundary), and the part in-between the inner and outer boundary.

The termination shock is more than twice as far away as the orbit of Pluto. The distances were measured in two places by NASA's Voyager spacecraft and found to be 94 and 84 times the distance between the Earth and the Sun.

NASA's Interstellar Boundary Explorer (IBEX) mission is making maps of the entire Solar System boundary.

To learn more, play games, and sign up for mission updates, visit <http://ibex.swri.edu>



Credit: NASA/Goddard Space Flight Center Conceptual Image Lab

### For you to try: Model the heliosphere using your kitchen sink

#### Materials

- Picture of the heliosphere (front of this lithograph)
- A sheet of cardboard\*
- Clear plastic wrap\*
- A sink with running water

\* This activity works better if you place the picture of the heliosphere under a sheet of plexiglass or laminate it instead of wrapping it in plastic wrap.

Place the picture of the heliosphere on top of the cardboard. Carefully wrap the plastic wrap around the picture and cardboard, like wrapping a present. Try not to have any wrinkles or bubbles. Make sure the entire picture is covered so no water can get in.

Turn on the faucet and adjust the stream of water so that it is about the thickness of a pencil.

Place the plastic wrapped picture of the heliosphere under the stream of water. Move the picture so that the water hits at the location of the Sun. Tip the image so that the water flows toward the right side of the picture.

Watch the stream of water flow quickly away from where it hits the paper. This represents the solar wind

streaming away from the Sun.

Look for the round edge where the water slows down and looks bumpy. This represents the termination shock.

Adjust the position of the picture up and down, or the amount of water coming out of the faucet, so that the water model matches up with the diagram of the solar wind and the termination shock on the picture.



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