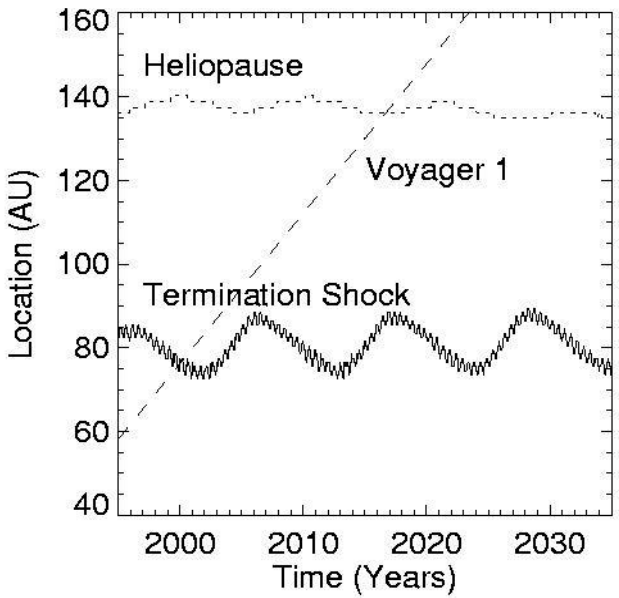
Voyager and the Motions of the Heliospheric Boundaries

- **The Voyager spacecraft are approaching the termination shock. The location of this boundary changes due to changes in the solar wind dynamic pressure. We model this change, including for the first time the effect of the pickup ions, to determine the magnitude of the boundary motion.**
- **Implications for Voyager**
  - **The results of this model predict that Voyager 1 will cross the termination shock in 2002 and the heliopause in 2019.**
  - **Note that these times are slightly later than shown in the figure because the distance shown is to the nose of the heliosphere and Voyager 1 is not headed directly at the nose**
  - **The solar cycle generated motion of the shock will cause up to 3 shock crossings**
    - **Shorter scale pressure variations may cause many more crossings to occur**



Termination shock and the heliopause motions in response to a superposition of 11 year (solar cycle) and 180 day sinusoidal variations in the solar wind ram pressure.

The amplitude of both pressure variations is a factor of 2. This model is the first to include the effect of pickup ions on the boundary location. The locations of the termination shock, the heliopause and Voyager 1 are labelled.

Submitted by John Richarson, PLS Team, MIT

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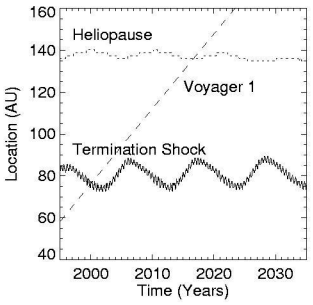

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Submitted by John Richarson, PLS Team, MIT
617-253-6112

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The Voyager spacecraft are approaching termination shock. The location of this boundary changes due to changes in the solar wind dynamic pressure. We model this change, including for the first time the effect of pickup ions, to determine the magnitude of the boundary motion.

We superpose the 11 year, factor of 2, solar cycle pressure variation and a 180-day variation of the same magnitude to simulate transient pressure changes.

The termination shock moves about 13 AU due to the solar cycle pressure change, but the high-frequency pressure change produces a motion of only a few AU. The heliopause motion is about 6 AU over the solar cycle. The pickup ions damp the motion of the boundaries by about 15%.

The motion of the shock is asymmetric, with the shock receding faster than it moves in.