

Space Science Seminar

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Voyager 1 Near the Heliopause

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Recent observations from the Voyager 1 spacecraft show that it is sampling the local interstellar medium (LISM). This is quite surprising because no realistic, steady-state model of the solar wind (SW) interaction with the LISM gives an inner heliosheath width as narrow as 30 AU. This includes models that assume a strong redistribution of the ion energy to the tails in the pickup ion distribution function. We show that the heliopause (HP), which separates the SW from the LISM, is not a smooth tangential discontinuity, but rather a surface subject to Rayleigh-Taylor-type instabilities which can result in LISM material penetration deep inside the SW. We also show that the HP flanks are always subject to a Kelvin-Helmholtz instability. The instabilities are considerably suppressed near the HP nose by the heliospheric magnetic field in steady-state models, but reveal themselves in the presence of solar cycle effects. We argue that Voyager 1 may be in one such instability region and is therefore observing plasma densities much higher than those in the pristine SW. These results may explain the early penetration of Voyager 1 into the LISM. They also show that there is a possibility that the spacecraft may start sampling the SW again before it finally leaves the heliosphere. It is predicted that Voyager 2 will cross the HP in 5-7 years.

<http://solarscience.msfc.nasa.gov/SpaceScienceSeminars.html>