INTERPLANETARY SCINTILLATION

John W. Armstrong
Mail Stop 238-737
Jet Propulsion Laboratory
Pasadena CA 91109

Interplanetary scintillation (IPS) has been used as a diagnostic of solar wind speed and interpl.anetary plasma turbulence, allowing inference of speed and electron density power spectrum close to the sun and out of the ecliptic. In that context, IPS is "signal" and provides scientifically interesting data. IPS is also of interest because amplitude and phase perturbations imposed on radio waves are "noise" for telemetry and precision Doppler tracking of deep space probes and for some radio astronomical observations.

In this talk I briefly review the connection between scattering observable and the electron density power spectrum. The main part of the talk emphasizes IPS-as-noise, with examples drawn from scintillation observations using the Galileo, Mars Observer, and Pioneer spacecraft. Interplanetary phase scintillation on time scales of 100-10,000 seconds is an important noise in mass determinations of small solar system bodies during space-probe flybys and in searches for low-frequency gravitational radiation. (Interplanetary phase scintillation at S-band limit the sensitivity of gravity wave experiments and are more than an order of magnitude higher than the precision of the hydrogen masers driving the Doppler system.) Amplitude scintillation, which degrades space probe telemetry performance for some tracking geometries, is also of practical interest. Examples of amplitude scintillation for near-sun tracking are given, along with the predicted scintillation environment for Galileo at Jupiter orbit insertion and for the proposed Solar Probe, which will pass to within 4 solar radii from the sun.