Solar Event Signatures Impressed Upon Spacecraft Radio Signals

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During the superior conjunctions of interplanetary spacecraft, the transmitted radio signals exhibit increased charged-particle effects including amplitude scintillation, phase scintillation and spectral broadening. The magnitudes of phase scintillation and spectral broadening are observed to increase as the angle between the spacecraft and the Sun decreases as seen by the tracking station on the Earth. The magnitude of amplitude scintillation increases as the solar elongation angle decreases until it saturates to unity. During the quiescent background periods, the scintillation and spectral broadening measurements follow well-defined trends of established models as a function of solar elongation angle and radio frequency. During periods of active solar events such as Coronal Mass Ejections (CMEs), the signatures of these effects are observed to increase predominately above the background levels. Several such events have been observed during the solar conjunctions of interplanetary deep spacecraft during the peak of the current solar cycle. Spectral broadening signatures, which rise above the quiescent background, appear to be associated with CMEs seen in white-light images and long duration events seen in X-ray data. Amplitude scintillation and phase variations, which rise above the quiet background, also appear to be correlated with such events. Measurements of scintillation and spectral broadening acquired during the superior solar conjunctions of the Cassini spacecraft in 2000 and 2001 will be presented at both X-band (8.4 GHz) and Ka-band (32 GHz) radio frequencies.