Ka-band and X-band Observations of the Solar Corona Acquired During Superior Conjunctions Using Interplanetary Spacecraft

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Simultaneous dual-frequency Ka-band (32 GHz) and X-band (8.4 GHz) signals have been recorded during the superior conjunctions of Mars Global Surveyor in May 1998, Cassini in May 2000 and Deep Space 1 in October-November 2000. The signals were acquired using the NASA Deep Space Network's facilities located in Goldstone, California. These conjunctions occurred during the rise in solar activity of the current solar cycle, but prior to the peak. The observed solar corona effects presented include spectral broadening, amplitude scintillation, and increased solar noise with reduction of received signal-to-noise ratio. For these measurements, the solar elongation angle varied from about 3 deg (~12 solar radii) to 0.5 deg (~2 solar radii). The measurements were generally consistent with solar models developed from theory and from earlier S-band and X-band solar conjunction observations of other spacecraft. There were several periods of elevated scintillation and spectral broadening above the 'quiet' background which appear to be related to solar transient events (such as coronal mass ejections) which occurred during the tracking passes. The high number of observed transient events is expected near the peak of an 11-year solar cycle.