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Global morphology of Saturn's magnetosphere from RPWS observations

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The Cassini radio and plasma wave science instrument provides a number of ways of studying the global morphology of Saturn's magnetosphere. The fact that Cassini is an orbiter which will survey a large volume of the three-dimensional magnetosphere over its four-year prime mission means that these measurements should provide an immensely useful view of the magnetosphere over time. While Cassini is only in its third orbit at the time this is written, it is already possible to begin to examine the data to foreshadow the view of at least the low-latitude, primarily dawnside magnetosphere. In this paper we discuss four techniques of studying the global aspects of Saturn's magnetosphere using radio and plasma waves. First, plasma waves provide a very clear signature of bow shock crossings. Magnetopause crossings are also evident, but the wave signatures are much less clear. These boundary observations allow for statistical studies of the location of these boundaries over local time, hence, the nominal size of the magnetosphere as well as its range of variability. Second, Cassini has found intense whistler-mode hiss in the outer magnetosphere at moderate latitudes. These emissions were not apparent in the Voyager flybys which were predominantly at lower latitudes. The early observations of these emissions suggest that they may be associated with either a plasma sheet boundary layer or the lobe of the magnetosphere. Third, the radio and plasma wave instrument can determine the electron plasma density via a number of techniques. In this paper, we concentrate on using the upper hybrid resonance and Bernstein wave emissions and associated quasi-thermal noise theory at radial distances inside of about 8 to 10 Saturn radii for which we can determine the electron density and a model for a two-component (core + halo) Maxwellian distribution. Even with the limited set of observations in hand, it is clear that there are radial and latitudinal

variations in the plasma density that can be used to investigate the three-dimensional structure of the inner and middle magnetosphere. Finally, Saturn kilometric radiation serves as an indicator of magnetospheric dynamics driven primarily by variations in the solar wind impinging on the magnetosphere and can help to identify morphological variations that may be temporal as opposed to spatial in nature.