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A comparison of the rotational modulation of three types of Saturnian radio emissions

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Three types of radio emissions occur in Saturn's magnetosphere that display very clear rotational modulation effects. These are (1) Saturn kilometric radiation (SKR), which is an intense radio emission generated along the high latitude auroral magnetic field lines at frequencies of about 50 to 500 kHz; (2) narrowband Saturn myriametric radiation (SMR), which is an intense narrowband radio emission thought to be generated in the inner to middle regions of the magnetosphere at frequencies of a few kHz; and (3) auroral hiss, which is a whistler-mode emission generated along the high latitude auroral field lines at frequencies of a few hundred Hz. Since these radio emissions originate from different regions of the magnetosphere, their modulation periods and relative phases can give potentially important information on rotational effects in widely different regions of the magnetosphere. Our initial studies show that over a two-year period, from July 1, 2004 to July 1, 2006, the modulation period of the narrowband SMR closely tracks the long-term variations in the period of the SKR, possibly with a slightly shorter period. On short time scales, of a week or less, the phase of the SMR modulation usually shows less variability than the phase of the SKR, consistent with the fact that these radio emissions are generated in the inner regions of the magnetosphere where the rotational control imposed by the planet is less subject to external solar wind effects, which are known to affect the intensity and phase of the SKR modulation. Since auroral hiss is known to be produced by auroral electron beams, the existence of a strong rotational modulation in the auroral hiss intensity provides clear evidence of a co-rotating auroral electron beams and associated

field aligned currents along the high latitude auroral field lines. The rotation period of auroral hiss source closely matches the SKR modulation period, and the relative phase is consistent with the generation of SKR as the magnetic field lines associated with the auroral hiss source rotate through the dayside of the magnetosphere, which is where the SKR is believed to be generated.