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Saturn kilometric Radiation Beaming. Observations and Interpretations

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Abstract

The SKR (Saturn Kilometric Radiation) is the main radio component at Saturn. Their auroral origin was discovered in the Voyager era and was confirmed and studied in detail with the Cassini/RPWS (Radio and Plasma Wave Science) experiment. The goniopolarimetric (GP) capabilities of the High Frequency Receiver (HFR) allows to instantaneously determine the flux, the polarization and the wave vector direction of any observed transverse electromagnetic wave. Provided a magnetic field model and assuming the emission to be emitted close to the local electron cyclotron frequency, one can then localize the SKR sources as well as the apparent beaming pattern of the source, which is the combination of the intrinsic source emission pattern and of propagation effects occurring along the wave path between the source and the obsever.

The Cyclotron Maser Instability (CMI) is considered to be the emission mechanism for planetary auroral radio emission. This has been confirmed with *in situ* measurements at Earth and was indirectly proven for the other magnetized planets. The CMI predicts that the emission pattern of the source is a thin hollow cone (a few degrees), whose axis is aligned with the direction of the local magnetic field and with an aperture that depends on the local electron distribution fonction in the source. This anisotropic emission pattern implies strong visibility effects. It is indeed not possible to see the source, if the observer is not within the thin hollow cone of emission. The arc-like structure of the radio bursts is directly linked to the anisotropy of the emission pattern. We propose here to analyze statistical properties of the emission beaming pattern of the SKR. We also interpret the results and provide possible constraints on the plasma parameters at (or close to) the SKR sources. We will also compare the presented results with the beaming properties of the terrestrial auroral kilometric radiation (AKR) and that of the jovian auroral radio emissions.