

MODEL OF A VARIABLE RADIO PERIOD FOR SATURN

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Abstract

We propose an explanation for the variations at the 1% level of Saturn’s radio rotation period measured at kilometer wavelengths. Because Saturn’s kilometric radiation (SKR) is strongly controlled by the Solar wind, we suggest that non-random variations of Solar wind characteristics (especially its velocity) at Saturn may result in systematic displacement of the auroral sources in local time, and finally in modifications of the apparent radio period. Alternatively, it may result in the superposition of two apparent periods, as also observed in Voyager data. We develop two simple models of local time variations of the SKR sources and analyze the conditions under which the measured radio period may be shifted by up to a few percent from the planet’s sidereal period. Our results provide a possible explanation for the 1% variation observed, and suggests that the dominant peak in the harmonic analysis of SKR variations seen by Voyager may be different from Saturn’s sidereal rotation period. We relate the limitation in the accuracy of planetary rotation period determination to long-term variations of “control” parameters (like the Solar wind velocity). 1.5–3 years of continuous SKR observations with Cassini will be required for deriving reliably and accurately Saturn’s true sidereal period.

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