



Periodicities in the magnetosphere of Saturn: making the distinctions

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A variety of phenomena observed in the magnetosphere of Saturn exhibit periodic time variations with a period essentially the same as that of the SKR radio emissions. Frequently such a periodicity is referred to as "rotational modulation" and is taken as direct evidence for a corotating spatial structure. One must, however, distinguish between two distinct types of periodicities; one is not rotational except by inference, and the other is not modulation. If the observed phenomenon is visualized as a flashing light, the two types correspond to a strobe and to a rotating beacon, respectively (there exists in addition a third type: the counter-rotating beacon). In the strobe type of periodicity, the modulation is purely temporal, with the same phase at all local times and hence no spatial variation; rotation is merely a hypothesis which can explain the periodicity provided there exists both a rotating and a stationary azimuthal asymmetry, but neither the rotation nor any of the azimuthal asymmetries are directly present in the signal. In the rotating-beacon type of periodicity, on the other hand, the phase of the apparent modulation varies directly with local time; the signal has a corotating, azimuthally asymmetric spatial variation but no true modulation (the temporal variation disappears in the corotating frame of reference), with the rotating azimuthal asymmetry directly present in the signal (and no stationary azimuthal asymmetry needed). Clearly, the type of periodicity for any particular phenomenon cannot be inferred from the mere existence of a periodic variation having the same period and a fixed phase relative to SKR; it is necessary to examine in addition the dependence of the phase on local time. The periodicity of the SKR emissions themselves is of the strobe type (in contrast to the periodic radio emissions at Jupiter, most of which are of the rotating-beacon type). The not infrequent presumption that any synchronism with SKR must constitute evidence for a rotating structure is thus unfounded. Recently reported results will be critically examined on the basis of these distinctions.