Differential Rotation as an Explanation for Saturn's B-Field Periodicity, Phase II

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It is understood that Saturn’s plasma sheet experiences periodic oscillations at a period extremely close to that of the rotation rate of the planet. This is unusual as the planet’s magnetic and spin axes are almost perfectly aligned, which would typically indicate a fairly stable plasma sheet. Additionally, it has been shown that Saturn and its rings undergo Keplerian rotation, a form of differential rotation in which further points, along the rings, will rotate more slowly than points on the planet. The sun also exhibits a form of differential rotation – the disparity occurs along the surface of the star from each pole to the equator – which leads to a scrambling and reconnection of its field lines. In a similar process, the field lines of Saturn may snap, drawing in ionized particles which will physically interact with the plasma sheet as the lines reconnect. Because the periodicity occurs so close to the rate of one planetary rotation, differential rotation is a valid hypothesis as to what the cause of the periodicity may be. The goal of this project is to develop a mathematical model taking into account: magnetic field line recombination, disparities in rotation rate, and ion interactions with the plasma sheet.