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# Global simulations of Saturn's magnetosphere

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We report the results of a set of MHD simulations of Saturn's magnetosphere with the University of Michigan's three-dimensional MHD code, BATS-R-US. In the simulations we used solar wind conditions corresponding to the observed plasma parameters during the July 2004 - March 2005 period and applied a magnetospheric source that was close to the observed $\sim$10ˆ28 particles/s. A significant result is the apparent control of the bow shock and magnetopause locations by the solar wind dynamic pressure as mentioned above. In addition, the results indicate that Saturn's magnetosphere exhibits a quasi-periodic behavior. Neutral gas primarily originating from the rings and the icy satellites is ionized in the inner magnetosphere and loads the closed magnetic field lines with an increasing mass of heavy ions. Centrifugal forces due to the rapid planetary rotation stretch the loaded magnetic field lines until the mass content reaches a critical value. Magnetic stresses cannot balance the centrifugal force and the field line pinches and reconnects with itself somewhere closer to the planet on the dawn side of the magnetotail. This process forms a short closed magnetic field line that is nearly empty of plasma, and a closed magnetic loop that contains a large amount of heavy ions. The heavy plasmoid moves down the tail and eventually leaves the Saturnian magnetosphere. According to a preliminary analysis of the simulation results the loading-unloading process exhibits a quasi-periodic behavior with plasmoids launching at multiples of Saturn's rotation period (a major period seems to be $\sim$45 hours or 4 rotations). This time period is likely controlled by the mass-loading rate and is modulated by the planetary rotation.