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How Does the Magnetosphere go to Sleep?

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An interesting question in magnetospheric research is related to the transition between magnetospheric configurations under substantial solar wind driving, and a putative relaxed state after the driving ceases. While it is conceivable that the latter state may be unique and only dependent on residual solar wind driving, a more likely scenario has magnetospheric memory playing a key role. Possible memory processes that could contribute include: constraints from conservation of flux tube entropy to neutral wind inertia in the upper atmosphere. In this presentation, we use high-resolution, global, MHD simulations to begin to shed light on this transition, as well as on the concept of a quiet state of the magnetosphere. We will discuss key elements of magnetospheric memory, and demonstrate their influence, through simulations and analytical estimates. We also show that the actual memory timescale obtained in the simulations is confirmed in observations. The time rate of change for the cessation of activity following northward turnings in the IMF was derived from the total field aligned currents measured by the AMPERE project and was found to be in amazing agreement with the model predictions.