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Reconnection onset in the magnetotail: Particle simulations with open boundary conditions

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Magnetic reconnection is one of the most universal energy conversion processes in space plasmas. It is believed to trigger substorms and bursty bulk flows in the tail of Earth‘s magnetosphere. However, the mechanism that triggers a burst of reconnection itself in the magnetotail remains unclear, because magnetized electrons trapped in the tail current sheet seem to fully stabilize the reconnection instability known as the ion tearing mode. Recent findings in the linear stability theory suggest the important role played in the onset mechanism by a population of electrons that are not trapped inside the tail current sheets. Modelling such passing electrons requires kinetic treatment of particles and either extremely large computational domains or open boundary conditions. In this work report on first results of the reconnection onset simulations in the magnetotail using the particle code P3D [Zeiler, 2002] with different sets of open boundary conditions. Initial geometry is similar to that of the GEM Reconnection Challenge [Birn et al., 2001]. The bursts of spontaneous reconnection and plasmoid formation are observed in the outflow regions. They resemble the onsets of reconnection in the magnetotail. In agreement with the linear theory, the onset is blocked if the open boundary conditions for particles are replaced by their re-introduction.