MHD simulation of relaxation transition to a flipped relaxed state in spherical torus

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The purpose of the present study is to investigate the plasma flows and the relevant MHD relaxation phenomena to elucidate this transition mechanism by using three-dimensional MHD simulations [2]. It is found from the numerical results that the magnetic reconnection between the open and closed field lines occurs due to the non-linear growth of the $n=1$ kink instability of the central open flux, generating the toroidal flow $\sim 60$ km/s in the direction of the toroidal current. The $n=1$ kink instability and the plasma flows driven by the magnetic reconnection are considered to be responsible for the self-reversal of the magnetic fields. [1] M. Nagata et al., Phys. Rev. Lett. 90, 225001 (2003). [2] Y. Kagei et al., Plasma. Phys. Control. Fusion 45, L17 (2003).