M27a Magnetic Reconnection in a Sheared Magnetic Flux Tube: Slippage versus Tearing

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It is widely accepted that the convective motions in the photosphere are the energy source to heat the solar corona to multi-million degree temperatures. The motions lead braiding and twisting of the coronal magnetic field lines, which have been proposed as the heating mechanism. According to Parker (1972, 1983), current sheets are formed in the braided magnetic field and energy dissipation occurs there. On the other hand, it may be possible that energy dissipation can also occur even in a single flux tube via magnetic reconnection. The process of magnetic reconnection in a flux tube can occur in a time-stationary fashion as slippage reconnection or in a time-dependent manner, for example, tearing instability. However, it is not well known how a system can be set up to sustain slippage reconnection, whether there is a competition between slippage reconnection and time-dependent reconnection. To investigate this question, using a 3D MHD simulation, we model a twisted flux tube, adding a spatially localized resistive region in the center of the simulation box. As a result, firstly, the Poynting flux injected at the boundary propagates to the resistive region and dissipates there. Secondly, tearing instability occurs with slippage reconnection in the resistive region when the cross section of the flux tube is elliptical enough, although only slippage reconnection occurs when it is circular. Finally, magnetic field generated by tearing instability propagates to the both ends of the flux tube.