[구SS-03] Numerical Study of the Dynamics Connecting a Solar Flare and a Coronal Mass Ejection

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We clarify the dynamics connecting a solar flare and a coronal mass ejection (CME) based on the results of a magnetohydrodynamic (MHD) simulation starting from a nonlinear force-free field (NLFFF) in Inoue et al. 2014. In previous studies, many authors proposed numerous candidates for triggering processes of a solar flare and the associated CME. Among them, the tether-cutting reconnection or the torus instability has been supported by recent simulations and observations. On the other hand, our MHD simulation in accordance with more realistic situations show that highly twisted field lines are first produced through a tether-cutting reconnection between the twisted field lines in the NLFFF, and then the newly formed, strongly twisted field erupts away from the solar surface because of a loss of equilibrium. This dynamics corresponds to the onset of a solar flare. Furthermore we have found that the strongly twisted erupting field reconnect with the weakly twisted ambient field during the eruption, creating a large flux tube, and then it rises over a critical height of the torus instability to trigger a CME. From these results, we conclude that the coupled process of tether-cutting reconnection and torus instability is important in the flare-CME relationship.

[구SS-05] Stability and Dynamics of a Magnetic Field Producing the M6.6 Class Solar Flare in NOAA Active Region 11158

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In this paper, we study the stability and dynamics of a magnetic field producing the M6.6 class solar flare taking place in NOAA active region (AR) 11158 on 2011 February 13th. Toriumi et. al. (2013) recently suggest that a fine scale magnetic structure on the photosphere gives a major possibility to produce the M6.6 class flare. On the other hand, they don't discuss the torus instability as a plausible mechanism even though Zhao et. al. (2014) and Janvier et. al. (2014) suspect it as the trigger mechanism of X2.2 class flare taking place later in the same AR. We are the first to investigate the stability of a nonlinear force-free field (NLFFF) prior to the M6.6 class flare against the torus instability by using analytical and numerical approaches. Consequently, we found that our NLFFF is quite stable against small perturbation. This result supports that the flare is triggered by the photospheric motion suggested by Toriumi et. al. (2013). We further perform another MHD simulation with an anomalous resistivity using the NLFFF as an initial condition. As a result, we found the eruption of strongly twisted lines. We compare our simulation results with observations and discuss relevant dynamics in detail.