Simulation study of the MHD instabilities for solar flares and coronal mass ejections

*石黒 直行[1]、草野 完也[1]
*Naoyuki Ishiguro[1], Kanya Kusano[1]

1. 名古屋大学 宇宙地球環境研究所 総合解析研究部
1. Division for Integrated Studies, Institute for Space-Earth Environmental Reserch, Nagoya University

Solar explosive phenomena, such as solar flares and coronal mass ejections, may disturb the whole heliosphere including the magnetosphere of the Earth. Many previous observations suggested that the eruption of twisted flux rope accompanies the solar explosive phenomena. Recently, we theoretically proposed the Double Arc Instability (DAI, Ishiguro & Kusano 2017) as an initial driver of the solar eruptions. This theory suggests that solar flare can be triggered by the DAI which destabilizes the concaved double arc flux rope with strong electric current which is formed through the magnetic reconnection of sheared magnetic loops. The critical condition of the DAI is determined by the parameter κ, which is defined as the product of the magnetic twist of a double arc loop and the ratio between magnetic flux contained in the double arc and the overlying flux. Since the DAI can stimulate the torus instability (TI) which can cause the full eruption of flux rope, the DAI might be responsible also for the formation of coronal mass ejection (CME). To exam how the DAI and the TI can work for the onset of flares and CMEs, we developed 3-dimensional zero-beta magnetohydrodynamics (MHD) simulation by parameterizing the length scales of magnetic gradient around the polarity inversion line (PIL) and the external magnetic field. We numerically form a sheared magnetic field around the PIL by imposing slow twisting motion and trigger the tether cutting reconnection by injecting a small magnetic bi-pole field on the PIL. As a consequence, we confirm the twisted flux rope of concaved structure is formed through magnetic reconnection of the sheared field. In this presentation, we report and discuss the relationship between the dynamics of flux rope and the instabilities.

キーワード：太陽フレア、コロナ質量放出、不安定性
Keywords: Solar flares, Coronal mass ejections, Instabilities

