R010-06
Zoom meeting B ：11/3 AM2 (10:45-12:30)
10:45〜11:00

What Condition is Necessary for the Large Solar Eruption of AR 12673 Before September 6 2017?

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The understanding of ”when”, ”where” and ”how” the solar flares take place is one of the long-standing issues in solar physics. The solar flares are widely considered as release phenomena of the free magnetic energy accumulated in the solar corona. Hence, sheared or twisted magnetic field lines are required but this is not a sufficient condition to produce solar flares. The understanding of how the sheared or twisted magnetic field lines before the flares destabilize or lose the equilibrium should be considered to clarify the trigger problem. If there are no any triggers, magnetic fields might stay in stable even though those accumulate enough free magnetic energy to cause flares.

Solar active region (AR) 12673, which appeared on September 2017, produced many M and C-class flares before the X-flares occurred. Yamasaki et al. found that highly twisted lines are already formed which have a potential to cause the X-flares as of September 4, but the magnetic field was stable for 2 days before the X-flares occurred. We conducted a hypothetical experiment by using a magnetohydrodynamic (MHD) simulation to explore a necessary condition for the eruption, as of September 4, in the region where the X-flares occurred on September 6th. We used a non-linear force-free field (NLFFF) as the initial condition of the simulation. The NLFFF was reconstructed from the photospheric magnetic field observed on September 4 which corresponds to 2 days before the first X-flare. As a result, although the NLFFF was stable to small disturbances where the residual force worked on the NLFFF, the eruption could be achieved if the strongly twisted lines with more than one-turn were formed through the reconnection and the magnetic flux reached more than about 7.0 x 10^{20} Maxwell. Moreover, we estimated a ratio of the magnetic flux of the highly twisted field lines and the overlying field lines which surround them. We found that when the flux ratio was approximately over 0.1, the twisted lines could be driven upward without depending on the decay index and eventually meet a condition of the torus instability.