## [초SE-01] Physics of Solar Flares

Tetsuya Magara
*Dept..of Astronomy and Space Science, Kyung Hee University*

In this talk we outline the current understanding of solar flares, mainly focusing on magnetohydrodynamic (MHD) processes. A flare causes plasma heating, mass ejection, and particle acceleration which generates high-energy particles. The key physical processes producing a flare are: the emergence of magnetic field from the solar interior to the solar atmosphere (flux emergence), formation of current-concentrated areas (current sheets) in the corona, and magnetic reconnection proceeding in a current sheet to cause shock heating, mass ejection, and particle acceleration. A flare starts with the dissipation of electric currents in the corona, followed by various dynamic processes that affect lower atmosphere such as the chromosphere and photosphere. In order to understand the physical mechanism for producing a flare, theoretical modeling has been develops, where numerical simulation is a strong tool in that it can reproduce the time-dependent, nonlinear evolution of a flare. In this talk we review various models of a flare proposed so far, explaining key features of individual models. We introduce the general properties of flares by referring observational results, then discuss the processes of energy build-up, release, and transport, all of which are responsible for a flare. We will come to a concluding viewpoint that flares are the manifestation of the recovering and ejecting processes of a global magnetic flux tube in the solar atmosphere, which has been disrupted via interaction with convective plasma while rising through the convection zone.

## [구SE-02] Intrusion of a Magnetic Field through the Overlying Field in the Solar Atmosphere Induced by Ballooning Instability

Hongda[1] Jun1,G.S.Choe[2]
[1]*Department of Astronomy and Space Science, Kyung Hee University*
[2]*SchoolofSpaceResearch,KyungHeeUniversity*

It has been a puzzle in solar physics how a low-lying magnetic structure such as a solar prominence surrounded by a strongly line-tied overlying field sometimes intrudes through the latter and goes into eruption. A numerical simulation study of the solar coronal plasma reveals that a ballooning instability can explain this type of eruptive process. We consider an idealized situation with two flux ropes merging. When magnetic field lines from different flux ropes reconnect, a new field line connecting farther footpoints is generated. Since the field line length abruptly increases, the field line expands outward. If the plasma beta is low, this expansion takes place more or less evenly over the whole field line. If, on the other hand, the plasma beta is high enough somewhere in this field line, the outward expansion is not even, but is localized as in a bulging balloon. This ballooning section of the magnetic field penetrates out of the overlying field, and eventually the originally underlying field and the overlying field come to interchange their apex positions. This process may explain how a field structure that has stably been confined by an overlying field can occasionally show a localized eruptive behavior.