**3D MHD Simulations of CME Initiations: a Review and a Case Study**

**Chaowei Jiang**

**Abstract:**

Solar eruptions are major factors in modulating the space weather, and the key of forecast of the space weather is to understand the eruption mechanism. Although manifested as different observational forms including the flares, filaments eruptions and coronal mass ejections (CMEs), it is commonly accepted that solar eruptions are resulted by the disruption of the coronal magnetic field, in which the magnetic free energy stored in the corona prior to the event is released. However, the mechanism of their initiations is still unclear. A variety of theoretical models have been proposed to explain the initiation of solar eruptions, e.g., the kink instability, the torus instability, the tether cutting model and breakout model, etc. However, solely by observation it is difficult to conclude which one accounts for a specific eruption event, and MHD simulation is usually required.

In this talk, I will first give a brief review of the current 3D MHD simulations of the CME initiations, which are commonly based on idealized magnetic field structures. Then we show a case study for a sigmoid eruption in AR 11283 on 2011 September 6, in which, we have for the first time simulated with the realistic coronal field extrapolated from photospheric vector magnetograms. We successfully reproduced the realistic initiation process of the eruption event, as is confirmed by a remarkable resemblance to the SDO/AIA observations.