Formation of a Quadrupolar Active Region Producing a Magnetic Flux Rope

*Yoshiaki Oi[1], Takaaki Yokoyama[1], Shin Toriumi[2]

1.Graduate School of Science, The University of Tokyo, 2.National Astronomical Observatory of Japan

It is suggested that most of the largest flares in the Sun are produced in active regions hosting delta-sunspots (Sammis et al., 2000). The formation process of delta-sunspots is not clearly understood but some of them may be formed by the merging of two beta-sunspots, which produces a quadrupolar active region. Toriumi et al. (2014) showed that the quadrupolar active region was successfully reproduced in their MHD simulation only when the two merging bipoles were magnetically connected with each other in the convection zone. Toriumi et al. (2014) aimed at reproducing an active region similar to an observed one, NOAA AR 11158, which had produced several flares including one X-class event. However, no flux ropes or eruptions were found in their simulation. Therefore, in this work, we aim to propose a theoretical model which produces not only the quadrupolar active region but also the magnetic flux rope. As a result of MHD simulation, we succeeded in reproducing a flux rope above the polarity inversion line as a consequence of an emergence of a flux tube from the convection zone. Also we found that the flux rope could reach the upper boundary when reconnection-favored coronal magnetic field was introduced above the developing active region. In this presentation, we will discuss the formation process of the flux rope and physical conditions for its ascent.

Keywords: Sun, Flares, Sunspots

