

## Magnetic Neutral Line Rotations in Flare-Productive Regions

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**Abstract.** We examined the evolution of active regions and found that rotational motions of the neutral line in the  $\delta$ -type magnetic configuration are common in the flare-productive active regions.

### 1. Introduction

What is the common magnetic field configuration among flare-productive active regions? In our previous studies, we have found that the magnetic neutral line shows a rotational motion in a  $\delta$ -type active region NOAA 9026, where three X-class flares successively occurred (Kurokawa et al. 2002). In this paper, we show other examples of magnetic neutral line rotations in flare-productive regions.

### 2. Results

During the current solar maximum (cycle 23), we studied the evolution of all the active regions that have produced at least one X-class flare and have been observed by the Solar and Heliospheric Observatory (*SOHO*) / Michelson Doppler Imager (MDI). We examined 35 active regions from 1996 through 2003 June, and found clear rotational motions of the neutral line in the  $\delta$ -type magnetic configuration in the following active regions; NOAA 9026, 9393, 9415, 9591, 9661, 9672, 0039, and 0314. The angular velocity is about 20 degree per day in each active region and the motion continues about four days. The clockwise motion dominates in the north-hemisphere regions (three in three), and the counter-clock-wise in the south-hemisphere (three in five, one region shows both rotations). These motions suggest the existence of magnetic flux knots and its relation to magnetic helicity. Such a magnetic knot should be the energy storage for major flares.

### References

Kurokawa, H., Wang, T.J., & Ishii, T.T. 2002, *ApJ*, 572, 598