Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PEM029-P10 Room: Convention Hall Time: May 26 17:15-18:45

Diagnostics of Magnetic and Velocity Structures in a Solar Active Region Filament

Yukio Katsukawa[1*], Andres Asensio Ramos[2], Javier Trujillo Bueno[2]

[1]National Astronomical Observatory, [2]Instituto de Astrofisica de Canarias

Dark filaments located along a polarity inversion line in an active region are one of the important structures in the solar atmosphere because they can be sources of mass and magnetic fields released to interplanetary spaces by solar flares and coronal mass ejections. In the dark filaments (or prominences when it is located over the solar limb), low temperature plasmas are confined in the upper atmosphere by magnetic fields. But it has been difficult to measure magnetic fields inside them observationally. The Zeeman effect provides the best diagnostic way for photospheric magnetic fields, but it does not make enough polarization signals in spectrum lines emerged from the upper atmospheres because of weak magnetic fields and broad spectrum lines.

One of promising approaches to resolve the issue is magnetic field diagnostic using the Hanle effect. The Hanle effect is a mechanism in which scattering polarization is modulated by presence of magnetic fields. It makes measurable polarization signals even in weak magnetic fields. Especially filaments and prominences are targets suitable to employ the Hanle effect because scattering radiation is significant in such structures suspended in the upper atmosphere. The Hanle diagnostics is becoming available for practical use because of development of high precision spectro-polarimetry and theoretical modeling including quantum effects.

In this paper, we report a study of magnetic and velocity fields in two dark filaments located in a delta sunspot. One of the filaments exhibited typical polarization profiles caused by the Zeeman effect, and it has strong and horizontal magnetic fields of 600 to 800 Gauss. The magnetic field configuration implies that the filaments is located low in the atmosphere and gradually emerging. The other one exhibited complex polarization profiles including both the Zeeman and Hanle effect. The magnetic fields are relatively weak and lower than 100 - 200 Gauss near the top while it has magnetic fields stronger than 1000 Gauss near the root of the filament. Supersonic downflows faster than 40 km/s are seen at the root, which are probably caused by free-falling material from the high altitude along the filament. Such strong downflows are often observed as a precursor of filament eruption.

The observation clearly shows that we can extend our coverage of magnetic field diagnostics in the solar atmosphere using the Zeeman and Hanle effect applied to spectro-polarimetric data with high sensitivities.

Keywords: the Sun, activity, filament, magnetic field, Hanle effect