Hinode-3: 3rd Hinode Science Meeting
Hitotsubashi Memorial Hall, Tokyo
1–4 December, 2009

Convective motions and net ciruclar polarization in sunspot penumbrae

Juan M. Borrero

Max Planck Institut for Solar System Research

Sami Solanki

Max Planck Institut for Solar System Research

Abstract. We have employed a penumbral model, that includes the Evershed flow and convective motions inside penumbral filaments, to reproduce the azimuthal variation of the net circular polarization (NCP) in sunspot penumbrae at different heliocentric angles for two different spectral lines. The theoretical net circular polarization fits the observations as satisfactorily as penumbral models based on flux-tubes. The reason for this is that the effect of convective motions in the NCP is very small compared to the effect of the Evershed flow. In addition, the NCP generated by convective upflows cancels out the NCP generated by the downflows. We have also found that, in order to fit the observed NCP, the strength of the magnetic field inside penumbral filaments must be very close to 1000 G. In particular, field-free or weak-field filaments fail to reproduce both the correct sign of the net circular polarization, as well as its dependence on the azimuthal and heliocentric angles.