Session 4

A fast approach to calibrate the vector magnetic field from the polarization measurement in Huairou Solar Observing Station

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A fast approximate method is proposed to calibrate the polarization measurement through Lyot filter. In this method, we only need the measurements at four wavelengths: Stokes parameters in the symmetry position around the line center, intensity at the line center and the continuum. Firstly, we use the synthesis stokes profile based on Milne-Eddington atmosphere model to obtain the fitting coefficients in the weak field approximation. Then we use the intensity at the four wavelength points to calculate the correction ratio caused by the bias of atmosphere model. We compared the polarization data of Huairou Solar Observing Station (HSOS) with the inversion data of HMI and Hinode/SP based on the heavy computation or time-consuming wavelength scanning. The linear correlation coefficient after calibration is better than 0.9 and the difference of mean current helicity(H c =< J z B z >) is even less than 3% (1%) than that of smoothed Hinode (SDO/HMI) data. Such method perfectly removes the so-called saturation effect of the sunspot's umbra measured through Lyot-type filter. The effectiveness reflects that the high order differentials of profile at the measured、wavelength probably play an important role to calibrate the vector magnetic field. Our method will tremendously reduce the difficulty of the design and control of Multiple-Channel Technique (MCT) of HSOS which obtain the polarization signal simultaneously at several wavelengths. The strong correlation between the correction ratio and the magnetic field strength shows a potential to improve the accuracy of stellar or cosmic magnetic field measurement as long as the Zeeman effect and polarized light transfer exists there