Session 1

Calibration and Data Analysis Pipeline of the Infrared Spectro-Polarimeter at NAOJ/Mitaka

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We have been operating the Infrared Spectro-Polarimeter (IRSP) since 2010 at the Mitaka campus of NAOJ. This instrument produces full-disk polarization maps at two wavelength bands (Fe 1564.8 nm and He 1083.0 nm/Si 1027.0 nm). The overview of the instrument and the derivation method of magnetic field parameters were described in Sakurai et al. (2018, DOI: 10.1093/pasj/psy050) and the data are open at https://solarwww.mtk.nao.ac.jp/en/db_cal.html#irmag.

Here we will describe more in detail the calibration procedure. The polarization modulator we are using is a rotating waveplate (taking eight frames per half rotation), and its retardation and the direction of the axis are determined by inserting a calibrator package made of a polarizer and a nearly achromatic quarter-waveplate. Both the calibration polarizer and the waveplate are rotatable, and by rotating them by 90 degrees and take extra measurements, we are able to eliminate errors caused by inaccurate setting of the polarizer and waveplate axes. The effects of the scattered light are estimated by using the data taken off the limb and are corrected by using the Moffat function as a model for the scattered light distribution (Chae et al. 1998, DOI: 10.1023/A:1005012509071). The conversion from the Stokes IQUV spectra to the magnetic field parameters is not by a full Stokes inversion but by adopting look-up tables (based on the Unno-Rachkovsky formula) that connect the magnetic field parameters and the observed QUV polarization degrees integrated over a wavelength range in the line wing. In the case of the Fe 1564.8 nm line, because of its large Zeeman splitting, we also use look-up tables to utilize the Zeeman splitting and the polarization degrees at the wavelength of the split Zeeman components.