Polarization Calibration of the Chromospheric Lyman-Alpha SpectroPolarimeter (CLASP) for a 0.1 % Polarization Sensitivity in the VUV Range

GIONO, G., ISHIKAWA, R., NARUKAGE, N., KANO, R., KATSUKAWA, Y., KUBO, M.
BANDO, T., HARA, H., SUEMATSU, Y.
(NAOJ)

WINEBARGER, A., KOBAYASHI, K., CIRTAIN, J.
(MSFC/NASA)

CHAMPEY, P.
(University of Alabama)

AUCHÈRE, F.
(CNRS)

TRUJILLO BUENO, J., ASENSIO RAMOS, A.
(IAC)

ŠTĚPÁN, J.
(ASCR)

BELLUZZI, L.
(IRSL&KIS)

MANSO SAINZ, R.
(MPS)

ISHIKAWA, S., TSUNETA, S., SHIMIZU, T., SAKAO, T.
(ISAS/JAXA)

De PONTIEU, B.
(LMSAL)

ICHIMOTO, K.
(Kyoto University)

CARLSSON, M.
(University of Oslo)

CASINI, R.
(HAO/NCAR)

GOTO, M.
(NIFS)

The Chromospheric Lyman-Alpha SpectroPolarimeter (CLASP) is a sounding rocket instrument designed to measure for the first time the linear polarization of the hydrogen Lyman-α line at 121.6 nm. The instrument was successfully launched on 3 September 2015 and observations were conducted at the solar disc center and close to the limb during the five-minutes flight. The disc center observations are used to provide an in-flight calibration of the instrumental polarization. The derived in-flight instrumental polarization is consistent with the spurious polarization levels determined during the pre-flight calibration (Giono et al., 2016) and a statistical analysis of the polarization fluctuations from solar origin is applied to ensure a 0.014 % precision on the instrumental polarization (Figure 1). The combination of the pre-flight with the in-flight polarization calibrations provides a complete picture of the instrument response matrix, and a proper error transfer method is used to confirm the achieved polarization accuracy. As a result, the unprecedented 0.1 % polarization accuracy of the instrument in the vacuum ultraviolet is ensured by the polarization calibration.

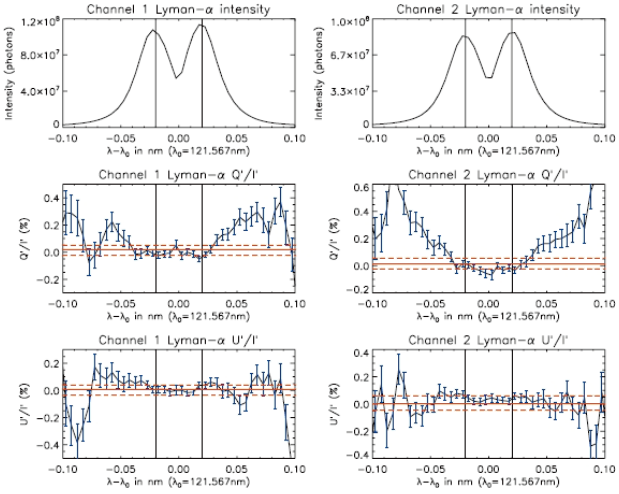

Figure 1: Stokes I', Q'/I' and U'/I' profiles obtained at disc center for a full slit spatially summed and three polarization-modulator rotations temporal summing, for both orthogonal polarization channels. Horizontal red solid lines show the expected spurious polarization offsets from the pre-flight calibration, with red dashed lines showing the $\pm 1\sigma$ error. Vertical black solid lines show the line core (i.e. ±0.02 nm around the line center). Error bars shown in blue on the polarization signals indicate the noise (1σ), including the photon noise, the read-out noise, and the error due to the residual polarization from the Sun for the full slit spatially summed. By applying a statistical analysis of the polarization fluctuations from solar origin, a 0.014 % precision on the instrumental polarization is ensured.

References

[1] Giono G., et al.: 2016, *Solar Phys.*, **291**, 3831-3867.
[2] Giono G., et al.: 2017, *Solar Phys.*, **292**, 57.