

The CoMP-S Instrument at the Lomnický Peak Observatory: Status Report

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Abstract. The Coronal Multi-channel Polarimeter for Slovakia (CoMP-S) has been installed at the high-altitude Lomnický Peak Observatory of the Astronomical Institute of SAS (2633 m a.s.l.) in 2011. The instrument was designed and manufactured by HAO/NCAR (Boulder, USA) with a tunable Lyot filter and polarimeter for visible and near IR spectral regions. This instrument is proposed for coronagraphic observations of magnetic and velocity fields in the solar corona and in prominences. A fundamental upgrade of this instrument has been prepared with pair of cameras sensitive in the near IR spectral region in a new camera module. This upgrade is being incorporated to the instrument in course of the year 2014. In this contribution the technical parameters of the final configuration of the CoMP-S instrument containing four cameras, covering both visible and near IR spectral regions, are described. We also present a potential of the CoMP-S instrument for coronagraphic spectro-polarimetric observations of the solar corona and prominences with a capability for sequential measurements of the spectral profiles of all prominent emission lines in spectral region from 500 to 1100 nm.

1. Introduction

Astronomical Institute of the Slovak Academy of Sciences has been equipped with high quality infrastructure with help of EU Structural funds. One of the major infrastructure is the Coronal Multi-channel Polarimeter for Slovakia (CoMP-S) which has been installed at the high-altitude Lomnický Peak Observatory 2633 m above sea level in High Tatras mountain in the North Slovakia. The observatory is one of a few sites still performing routine ground based observations of the solar corona. An astroclimate is rather good (120 days/year - observations of prominences, 70 days/year - observations of emission corona).

The CoMP-S serves as a post focus device at Zeiss 200/3000 coronagraph (Lexa 1963). There are two such coronagraphs installed in 1962 and 1970 as an optical twins with co-pointing precision of 2 arcsec, with diameter of the solar image in the focal plane of 4 cm, field-of-view 1.02 - 1.84 of the solar radius. They are diffraction limited from 530 nm to 1100 nm and focused by moving the objective lens along the optical axis ~80mm.

2. CoMP-S

The instrument was designed and manufactured by HAO/NCAR (Boulder, USA) with a tunable Lyot filter and polarimeter for visible and near IR spectral regions. Originally, the CoMP concept was described in (Tomczyk et al. 2008) and briefly introduced in (Schwartz et al. 2014).

This instrument is proposed for coronagraphic observations of magnetic and velocity fields in the solar corona and in prominences. Fundamental upgrade of this instrument was done in 2014. CoMP-S is mounted to coronagraph using an interface which allows to rotate both, tunable Lyot filter with polarimeter box and camera module box. The "Tunable Lyot filter and polarimeter box" contains key parts of the device. Namely, the four-stage Lyot filter, birefringent plates, and ferro-liquid crystal polarimetric modulators. There are in the box also prefilter carousel for selection of spectral lines and calibration carousel for polarimetric calibration.

The main features of the CoMP-S are the following:

- designated mainly for off-limb observations
- field of view: $14 \text{ arcmin} \times 11 \text{ arcmin}$
- 4-stage tunable Lyot filter with polarimeter (two ferro-liquid crystal polarizers), FWHM of transmission function $0.028 - 0.13 \text{ nm}$ for range $530 - 1083 \text{ nm}$
- sequential measurement of several VIS and near-IR lines
- deliverables: 2D full Stokes I, Q, U, V measurements
- actual observational output: linear combinations of $I \pm Q$ $I \pm U$ $I \pm V$, then, the four Stokes reconstructed from the combinations.

Actually are used the following emission lines selected by prefilters available in the prefilter carousel:

for solar prominences:

- He I 587.6 nm D3
- H α 656.3 nm
- Ca II 854.2 nm
- He I 1083.0 nm

for solar corona:

- Fe XIV 530.3 nm
- Ca XV 569.5 nm
- Fe X 637.5 nm
- Fe XI 789.2 nm
- Fe XIII 1074.7 nm
- Fe XIII 1079.8 nm

2.1. Post-focus Detectors for Solar Spectrograph

Originally, there was at CoMP-S so called "VIS camera module box" which contained two PCO edge CMOS cameras for registration of adjacent continuum and spectral line of the solar corona and several optical elements for light distribution.

Fundamental upgrade of this part has been made in 2014 with new Post-focus Detectors for Solar Spectrograph (PDSS). It consists of an optical system which focus light simultaneously onto two camera pairs. One camera pair is sensitive in the visible part of the spectrum, and the other camera pair is sensitive in the infrared (IR) part of the spectrum. Light is focused onto the cameras by an optical system which includes a dichroic beam-splitter to split the light between the visible (Andor Neo sCMOS) and IR (Goodrich GA1280J) cameras and two polarizing beamsplitters which split the light between the camera pairs to register adjacent continuum and spectral line. A rack-mounted computer system is included which operates the CoMP-S instrument and records images from the four cameras.

There was in 2015 installed a new instrument - Solar Chromospheric Detector (SCD) at the second coronagraph at the Lomnický Peak Observatory. This instrument is designed for observations of the solar chromosphere to provide information on magnetic and velocity fields. Both instruments the CoMP-S with PDSS and the new SCD will serve for complete tracking of an active events in the solar chromosphere and corona up to near solar limb.

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