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CoMP-S - the Coronal Multi-Channel Polarimeter for Slovakia

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Abstract. A new instrument *Coronal Multi-channel Polarimeter for Slovakia (CoMP-S)* is in the process of designing and constructing by the team of specialists from the High Altitude Observatory, National Center for Atmospheric Research, Boulder, USA (HAO/NCAR). It will be installed at the coronagraph at the Lomnický Štít Observatory of the Astronomical Institute of the Slovak Academy of Sciences (AISAS) at the beginning of the year 2011. We present here the technical parameters of the instrument, its observational potential and planed patrol and routine observations of the velocities and magnetic fields in the solar corona.

Key words: Sun: corona – Sun: filaments, prominences – Techniques: polarimetric

1. Introduction

Patrol observations at the AISAS and especially at the Lomnický Štít Observatory (LSO) have a long tradition. Such patrol observations have been performed there since the construction of the coronal station at Lomnický Štít (1957-1962) where a 20 cm coronagraph was installed (Lexa, 1963). Later, in 1970, an identical second telescope was installed. Today, the coronal station ranks among four existing stations worldwide which systematically observe emission spectral lines of the solar corona.

Two 20-cm Zeiss coronagraphs are presently used for observations of Hα prominences and coronal lines emissions. These observations provide two long-term data sets. 1) coronal green line data (since 1964) used for calculation of a daily Coronal index of solar activity (Rybanský, 1975, Rybanský et al., 2005) and 2) Hα prominence data from which the LSO Catalogue of Prominences for the epoch 1967 – 2009 is created (Rušin et al., 1988, 1994). The catalogue serves for a determination of a time-latitude long-term distribution of the prominence zones (e.g., Bumba et al., 1990, Dermendjiev et al., 1994, Minarovjech et al., 1998, Minarovjech, 2007, Rušin et al., 2000).

The actual trends in solar physics require direct measurements of velocities and magnetic fields in the solar corona. Unfortunately, there are no such data taken regularly and distributed to the community at a daily basis. There are neither ground based, nor space borne instruments at which long-lasting

polarimetric observations of the solar corona are planned for the near future, except the CoMP instrument (Tomczyk, et al. 2008). Thus we decided to equip the coronagraph at LSO with a multi-channel polarimeter. We applied for a grant in the frame of *Structural Funds to real convergence of the Recently Acceded Member States of EU, Operational Programme Research and Development - calls in 2008 and 2009*. We believe that the instrumentation at the LSO after significant improvements will be capable of bringing these important data.

The proposal was approved and we established the centre of excellence *Centre of space research: space weather influences*, where as members act: i) Astronomical Institute of the Slovak Academy of Sciences, Tatranská Lomnica; ii) Institute of Experimental Physics of the Slovak Academy of Sciences, Košice; iii) Pavol Jozef Šafárik University, Košice. In the frame of this Centre we build a new instrument CoMP-S. In this paper a brief description of the Instrument and its main goals are given.

2. Coronal Multi-Channel Polarimeter for Slovakia

New CoMP-S will not be a duplicate of the CoMP instrument developed at HAO/NCAR (Tomczyk et al., 2008). Several improvements and new technology will be used in the construction of the new Instrument.

Technical parameters: CoMP-S will reside behind one of the 20-cm Zeiss coronagraphs. The diameter of the main lens of the coronagraph, the focal length and the diameter of the resulted sun image are: D = 19.5 cm, f = 3 m, $D_\odot$ = 4 cm, respectively. The spatial resolutions of the coronagraph at wavelengths 530 nm, 656 nm and 1083 nm are 0.67 arcsec, 0.82 arcsec and 1.36 arcsec, respectively. The coronagraph is diffraction limited from 530 nm to 1083 nm by changing the focus of the objective lens only within a range of 80 mm. The coronagraph will have a photoelectric pointing.

CoMP-S itself will be a post-focus instrument with free rotation around the optical axis of the coronagraph. This instrument will measure the linear polarization (Hanle effect), circular polarization (Zeeman effect) and Doppler shift of spectral lines. Such measurements will be used for computation of the plane of sight magnetic field direction, the line of sight magnetic field strength and the line of sight velocity, respectively. The CoMP-S will operate in a wavelength range: 500-1100 nm (original CoMP operates in 1070-1090 nm only), thus we will have a possibility to observe spectral lines in the visible and infrared range of electromagnetic spectrum. This will allow us to register intensities of several important coronal spectral lines, namely: FeXIV 530.3 nm, CaXV 569.5 nm, FeX 637.5 nm, FeXI 789.2 nm, FeXIII 1074.7 nm, 1079.8 nm, and chromospheric spectral lines, HeI 587.6 nm, HI 656.3 nm, CaII 854.2 nm and HeI 1083.0 nm.

The CoMP-S will consists of these main parts: 1) the interface unit for connection of CoMP-S to the ZEISS coronagraph, 2) the filter unit in which the

Lyot filter, two filter wheels (see Fig. 1) with narrow band filters, polarization and calibration optics will be placed, 3) the detector unit containing division optics to split the beam into two perpendicular beams and two cameras, 4) cabling, computers and data storage (see Fig. 2)

The deliverables of the CoMP-S: Full Stokes I, Q, U, and V profiles, Field-of-View of about one diameter of the Sun, Diffraction Limited Sampling (0.326 arcsec/pixel at 656.3 nm).

3. Conclusion

We expect the final installation of the CoMP-S at the Lomnický Štít Observatory to take place in March 2011. The tests and first observations will be done in April 2011. A cooperation with the High Altitude Observatory, National Center for Atmospheric Research, Boulder, USA, will be established to utilize advantage of two instruments (CoMP, CoMP-S), to measure velocities and magnetic fields in the solar corona. The older CoMP is placed at the Mauna Loa Solar Observatory at Hawaii, USA, (MSLO). The longitude distance between LSO and MSLO is 175.80° which offers the possibility of coordinated observations with these two instruments.

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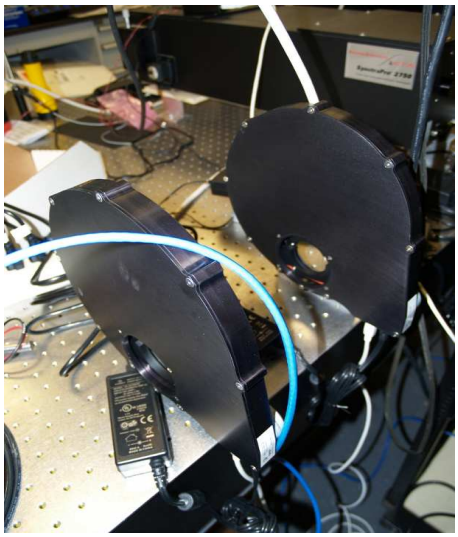

Figure 1. The filters wheels with narrow band filters and polarization optics tested at the National Center for Atmospheric Research, Boulder, USA.

Figure 2. The storage system for the CoMP-S tested at the National Center for Atmospheric Research, Boulder, USA.