The activities of ***the Astronomical Institute of the Slovak Academy of Sciences (AISAS)***, Tatranská Lomnica (*www.astro.sk*), related to COSPAR, were devoted to research in stellar, solar, and interplanetary physics using different satellite observations, mainly in the UV, XUV and X-ray spectral regions. Stellar data of the Swift, XMM-Newton, TESS, CHEOPS, and Kepler satellites, were used for research of various variable stars [1,3,4,5,8,10,18], stars hosting exoplanets and the exoplanets themselves [2,9,11,12,13,14,15,16,17]. Data of the current SDO, IRIS, STEREO, Hinode, and other satellites were used for solar research. In common, these data were used with the simultaneously acquired data by the ground-based solar telescopes [6,19,20,21,22,23]. Different topics of the solar system bodies have been addressed, in many articles from the laboratory phyics side [7,24,25,26,27,28,29,30]. Hereby we present some examples of the results obtained by the AISAS staff.

Accretion of mass onto a white dwarf (WD) in a binary system can lead to stellar explosions. If a WD accretes from stellar wind of a distant evolved giant in a symbiotic binary, it can undergo occasional outbursts in which it brightens by several magnitudes, produces a low- and high-velocity mass outflow, and, in some cases, ejects bipolar jets. In paper [1] the current picture of these outbursts is complemented by the transient emergence of a neutral region in the orbital plane of symbiotic binaries consisting of wind from the giant. Its presence was proved by determining H^0 column densities (N_H) in the direction of the WD and at any orbital phase of the binary by modeling the continuum depression around the Lyα line caused by Rayleigh scattering on atomic hydrogen for all suitable objects, i.e., eclipsing symbiotic binaries, for which a well-defined ultraviolet spectrum from an outburst is available. The N_H values follow a common course along the orbit with a minimum and maximum of a few times 10^{22} and 10^{24} cm^{-2} around the superior and inferior conjunction of the giant, respectively. Its asymmetry implies an asymmetric density distribution of the wind from the giant in the orbital plane with respect to the binary axis. The neutral wind is observable in the orbital plane owing to the formation of a dense disk-like structure around the WD during outbursts, which blocks ionizing radiation from the central burning WD in the orbital plane.

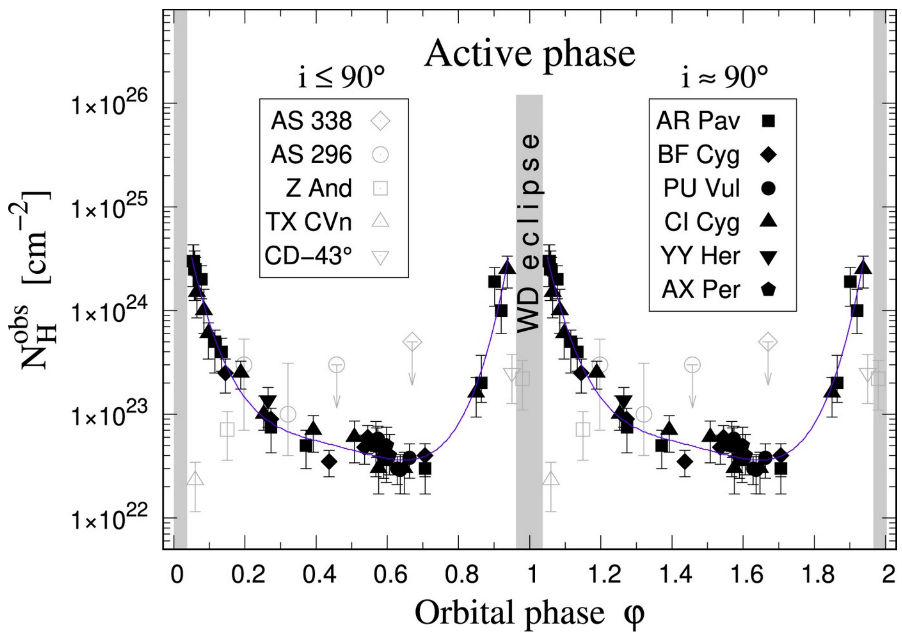

Figure 1. Column densities of atomic hydrogen, N_H^{obs}, between the observer and the WD, measured for our targets during active phases as a function of the orbital phase φ. For better visualization, the values are plotted over two orbital cycles. Eclipsing objects (black filled symbols) follow a common course. The blue line indicates their fit with a fourth-degree polynomial. Open gray symbols denote values for objects with poorly defined UV spectra (AS 338, AS 296) or not eclipsing, but with a high orbital inclination (Z And, TX CVn, CD −43°14304 (CD−43° in the legend)).

Based on the combined TESS and CHEOPS observations [2], the true orbital period of the planet d of the star HD 22946 (late F-type star) was successfully determinedt o be 47.42489 ± 0.00011 days, precise radii of the planets in the system were derived, namely 1.362 ± 0.040 $R_\oplus$, 2.328 ± 0.039 $R_\oplus$, and 2.607 ± 0.060 $R_\oplus$ for planets b, c, and d, respectively. Due to the low number of radial velocities, it was possible to determine only 3σ upper limits for these respective planet masses, which are 13.71 $M_\oplus$, 9.72 $M_\oplus$, and 26.57 $M_\oplus$. The stellar parameters for the host star were also derived. Planet c around the HD 22946 star appears to be a promising target for future atmospheric characterisation via transmission spectroscopy. We can also conclude that planet d, as a warm sub-Neptune, is very interesting because there are only a few similar confirmed exoplanets to date. Such objects are worth investigating in the near future, for example in terms of their composition and internal structure.

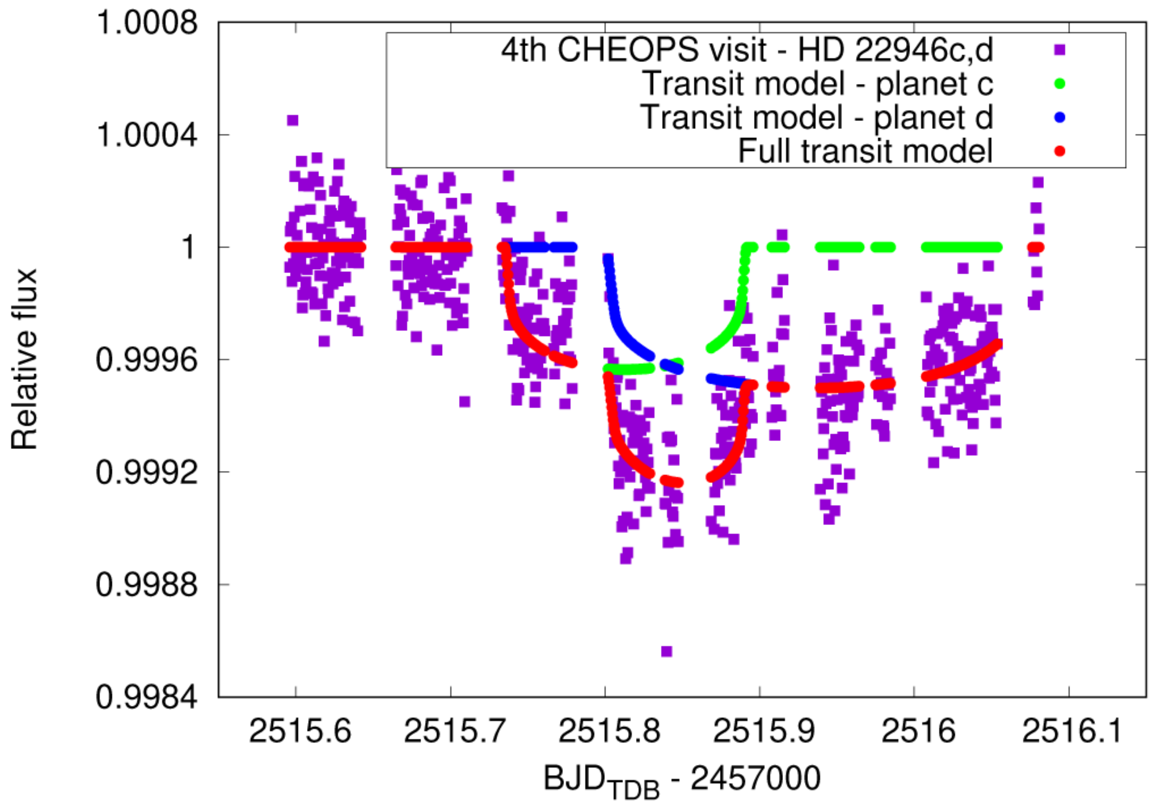

Figure 2. CHEOPS observations of the star HD 22946 on October 28, 2021. The observed light curve wad overplotted with the best fit model. Besides the summed model also the individual models of the planets c and d are displayed.

On 2021 February 12, two subsequent eruptions occurred above the western limb of the Sun, as seen along the Sun-Earth line. The first event was a typical slow coronal mass ejection (CME), followed ∼7 h later by a smaller and collimated prominence eruption, originating south of the CME, followed by a plasma blob. These events were observed not only by the SOHO and STEREO-A missions, but also by the suite of remote-sensing instruments on board Solar Orbiter [19]. It was shown how data acquired by the Full Sun Imager (FSI), the Metis coronagraph, and the Heliospheric Imager (HI) from the Solar Orbiter perspective can be combined to study the eruptions and different source regions. Images acquired by the two Metis channels in the visible light (VL) and H I Ly-α line (UV) were combined to derive physical information about the expanding plasma. The polarization ratio technique was also applied for the first time to Metis images acquired in the VL channel. The two eruptions were followed in 3D from their source region to their expansion in the intermediate corona. By combining VL and UV Metis data, the formation of a post-CME current sheet (CS) was followed for the first time in the intermediate corona. The plasma temperature gradient across a post-CME blob propagating along the CS was also measured for the first time.

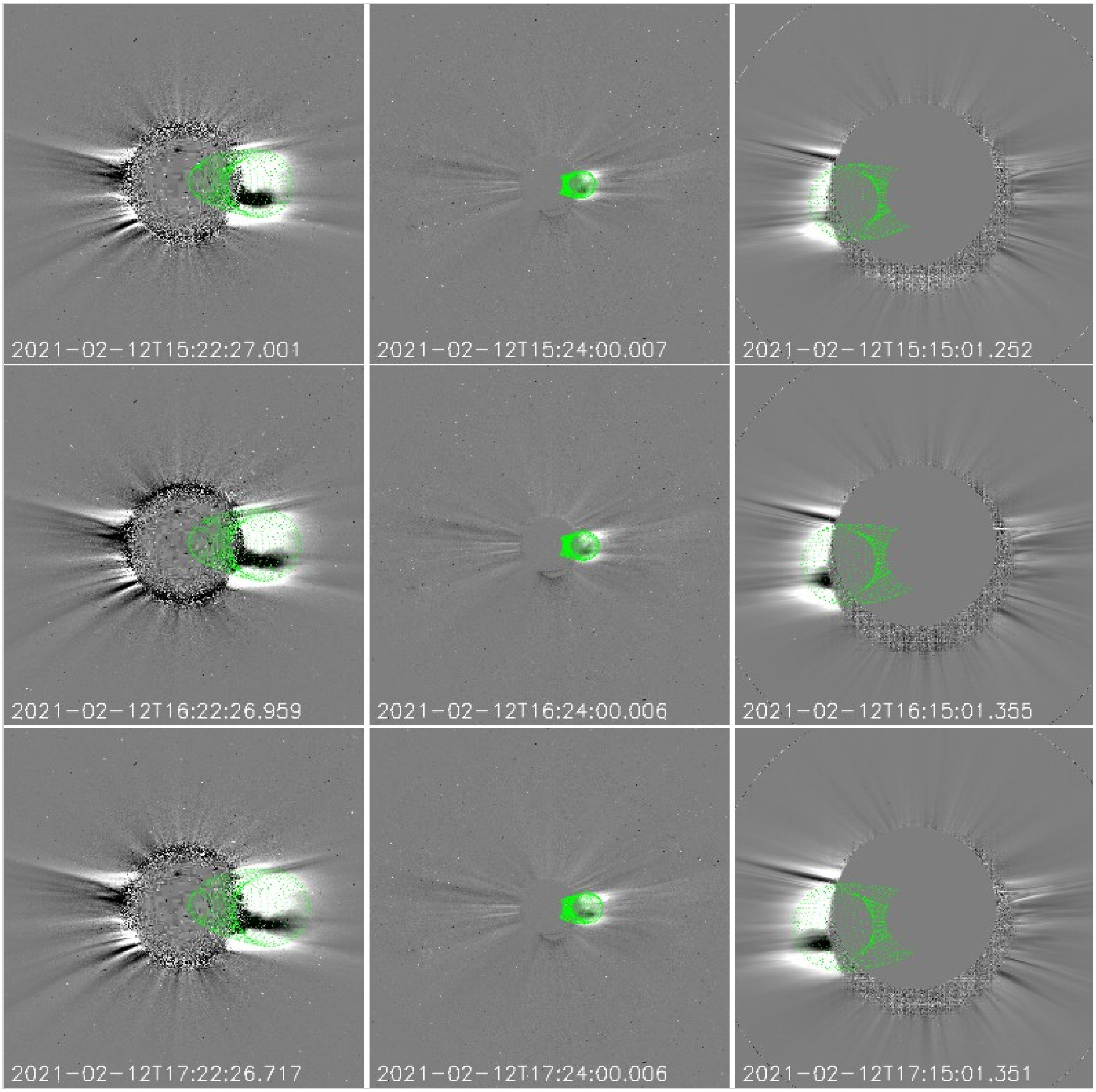

Figure 3. The February 12 CME as observed by coronagraphs on board different spacecraft at different times. *Upper row*: GCS reconstruction of the CME on February 12 observed by LASCO-C2 at 15:22–07:58 UT (*left panel*), by COR2-A at 15:24–08:24 UT (*middle panel*), and by Metis at 15:15–12:15 UT (*right panel*). *Middle row*: GCS reconstruction of the CME on February 12 observed by LASCO-C2 at 16:22–07:58 UT (*left panel*), by COR2-A at 16:24–08:24 UT (*middle panel*), and by Metis at 16:15–12:15 UT (*right panel*). *Lower row*: GCS reconstruction of the CME on February 12 observed by LASCO-C2 at 17:22–07:58 UT (*left panel*), by COR2-A at 17:24–08:24 UT (*middle panel*), and by Metis at 17:15–12:15 UT (*right panel*).

Water (H_2O) ice is a ubiquitous component of the universe, having been detected in a variety of interstellar and Solar System environments where radiation plays an important role in its physico-chemical transformations. Although the radiation chemistry of H_2O astrophysical ice analogues has been well studied, direct and systematic comparisons of different solid phases are scarce and are typically limited to just two phases. In the article [25] there are described the results of an in-depth study of the 2 keV electron irradiation of amorphous solid water (ASW), restrained amorphous ice (RAI) and the cubic (Ic) and hexagonal (Ih) crystalline phases at 20 K so as to further uncover any potential dependence of the radiation physics and chemistry on the solid phase of the ice. Mid-infrared spectroscopic analysis of the four investigated H_2O ice phases revealed that electron irradiation of the RAI, Ic, and Ih phases resulted in their amorphization (with the latter undergoing the process more slowly) while ASW underwent compaction. The abundance of hydrogen peroxide (H_2O_2) produced as a result of the irradiation was also found to vary between phases, with yields being highest in irradiated ASW. This observation is the cumulative result of several factors including the increased porosity and quantity of lattice defects in ASW, as well as its less extensive hydrogen-bonding network. Our results have astrophysical implications, particularly with regards to H_2O-rich icy interstellar and Solar System bodies exposed to both radiation fields and temperature gradients.

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