The activities of ***the Astronomical Institute of the Slovak Academy of Sciences (AISAS)***, Tatranská Lomnica (www.astro.sk), related to COSPAR, were devoted to the research in solar and stellar physics using different satellite observations, mainly in the UV, XUV and X-ray spectral regions. Stellar data of the IUE, FUSE, INTEGRAL, Kepler satellites, and the HST were used for research of various variable stars [1]. Data of the current SOHO mission, Hinode, SDO, TRACE and RHESSI satellites and previous satellites of the NOAA and GOES series were used for solar research [2, 3]. Hereby we present some examples of the results obtained by the AISAS staff, an information on an education activity of the AISAS and a information on the WAMIS project cooperation.

Within the research of the stellar astrophysics, the data carried out with the space observatories, the Far Ultraviolet Spectroscopic Explorer (FUSE) and International Ultraviolet Explorer (IUE) were used to model the very shallow and wide wings of the strongest emission lines OVI 1032, 1038 Å and HeII 1640 Å, observed in the spectra of symbiotic stars Z And, AG Dra and V1016 Cyg during different phases of activity. Theoretical profiles of these lines were calculated for the case of the light scattering on free electrons, the so-called Thomson scattering. By this way we determined mean values of electron optical depth and electron temperature, which characterize scattering region represented by symbiotic nebula. We found that physical properties of the nebula are directly connected with changes of the hot component of the binary, which results in relationship between these two parameters and phases of the activity. This relationship can be used to determine more precisely mass loss rate from the hot star, which is very important in understanding the nature of the symbiotic stars outbursts (see Figure 1). [1]

The light curve of KIC12557548b - an extrasolat planet with a comet like tail was analysed using long- and short-cadence Kepler observations from the first 14 quarters. The orbital period of the planet was improved. We prove that the peculiar light curve agrees with the idea of a planet with a comet-like tail. The light curve has a prominent pre-transit brightening (Figure 2) and a less prominent post-transit brightening. Both are caused by the forward scattering and are a strong function of the particle size. This feature enabled us to estimate a typical particle size (radius) in the dust tail of about 0.1-1 micron. However, there is an indication that the particle size changes (decreases) along the tail. The dust density in the tail is a steep decreasing function of the distance from the planet, which indicates a significant tail destruction caused by the star-planet interaction. We revealed interesting periodic long-term evolution of the tail on a time scale of about 1.3 years and also argue that the "planet" does not show a uniform behaviour, but may have at least two constituents. This exoplanet's tail evolution may find an analogy in the comet tail disconnection events caused by the magnetic/coronal activity of the Sun while the light curve with pre-transit brightening is analogous to the light curve of ε Aur and AZ Cas with mid-eclipse brightening and forward scattering playing a significant role in such eclipsing systems. [2]

We combined high-resolution SoHO/MDI magnetograms with TRACE observations taken in the 1216 Å channel to analyze the temporal evolution of an emerging small-scale magnetic loop and its traces in the chromosphere. We find signatures of flux emergence close to the edge of a supergranular network boundary located at disk center. The new emerging flux appeared first in the magnetograms in form of an asymmetric bipolar element, i.e., the patch with negative polarity is roughly twice as weak as the corresponding patch with opposite polarity (Figure 3). The average values of magnetic flux and magnetic flux densities reached 1.6×10^{18} Mx, -8.5×10^{17} Mx, and 55 Mx/cm^2, -30 Mx/cm^2, respectively. The spatial distance between the opposite polarity patches of the emerged feature increased from about 2.5 arcsec to 5.0 arcsec during the lifetime of the loop, which was 36 min. The chromospheric response to the emerged magnetic dipole occurred ~9 min later than in the photospheric magnetograms. It consisted of a quasi-periodic sequence of time-localized brightenings visible in the 1216 Å TRACE channel for ~14 min that were co-spatial with the axis connecting the two patches of opposite magnetic polarity. We identify the observed event as a small-scale magnetic loop emerging at photospheric layers that subsequently rose to the chromosphere. We discuss the possibility that the fluctuations detected in the chromospheric emission probably reflect magneticfield oscillations which propagate to the chromosphere in the form of waves. [3]

The Astronomical Institute organised in the year 2013 the lecture course – solar Spectro-polarimetry - given for the undergraduate and PhD students from Slovakia by Dr. Horst Balthasar of the AIP – Leibnitz Institute for Astrophysics Potrsdam (Germany) on June 3-7, 2013 at AISAS at Tatranska Lomnica. The course of lectures provided insights on the physical background, observational possibilities and numerical analysis of spectro-polarimetric measurements which provide a very important tool to study properties of solar magnetic fields. The course started with the theoretical background of polarized light and the magnetic sensitivity of spectral lines. In the second part, optical elements for polarimetry were presented, and it was demonstrated how they can be combined to a polarimeter. In the third part, we were dealing with spectro-polarimetric observations at modern solar telescopes. The numerical analysis of the data has been discussed in the last part. In total 15 students took part in the course. More details about the course of lectures can be found at the dedicated web page -

http://www.astro.sk/~gomory/SPECTRO/spectro.

In 2013 AISAS has become invlved also in the proposal which has been submitted for consideration of an award by NASA (Proposal Number: 13-HTIDS13_2-0018). The porsal called “Waves and Magnetism in the Solar Atmosphere (WAMIS)” is led by Yuan-Kuen Ko, Naval Research Lab, Washington, USA (PI), and its AISAS part by J. Rybak. The team is waiting for the agency decision. The project is a long duration balloon based 20cm aperture coronagraph designed to obtain continuous measurements over at least a week of the strength and direction of coronal magnetic fields within a large field-of-view at the spatial and temporal resolutions required to address several outstanding problems in coronal physics. The WAMIS investigation, comprising a balloon-borne infra-red coronagraph and polarimeter to observe forbidden transitions in Fe XIII and HeI, should enable breakthrough science and enhance the value of data collected by other observatories on the ground (e.g. ATST, FASR, SOLIS, COSMO) and in space (e.g. Hinode, STEREO, SDO, TRACE, GOES, SOHO and IRIS), and will advance the technology for a future orbital missions.

Besides of this, the AISAS staff was involved (or leading) in the last two years in total 5 coordinated observing campaigns focused on observations of several aspects of the solar activity. The integral part of the campaigns were also measurements performed by the space-born instruments on different satellites, e.g. SUMER/SoHO, EIS/Hinode. The measurements were coordinated with the ground-based instruments including the AISAS owned CoMP-S instrument at the Lomnicky Peak Observatory.

References:

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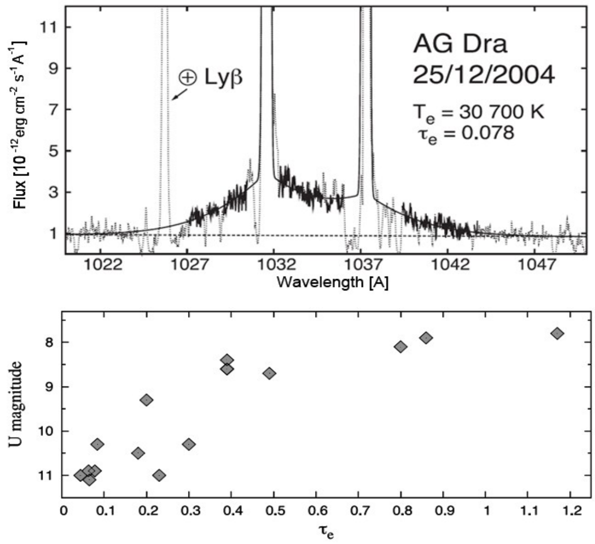

Figure 1. The top panel shows an example of the observed (dotted line) and modelled profile (thick line) of the wide wings of the line OVI 1032, 1038 Å in the symbiotic star AG Dra. The bottom panel depicts a relationship between the electron optical depth and the U magnitude as the indicator of the activity level in AG Dra.

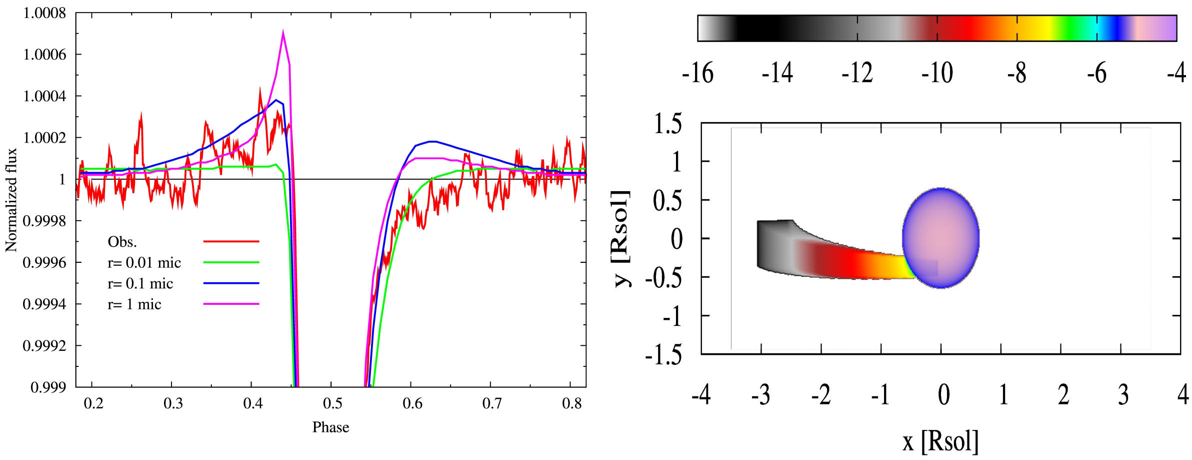

Figure 2. Left panel: Effect of the particle size on the light curve for the Kepler short-cadence observations calculated for pyroxene grains and A2 = −20. Right panel: 2D image (intensity logarithm, Iν , in erg cm−2 s−1 Hz−1) of the planet with a comet like tail during the transit. The intensity of the tail rapidly decreases because of a decrease in the dust density and forward scattering. Note also the optically thin absorption on the limb-darkened stellar disk.

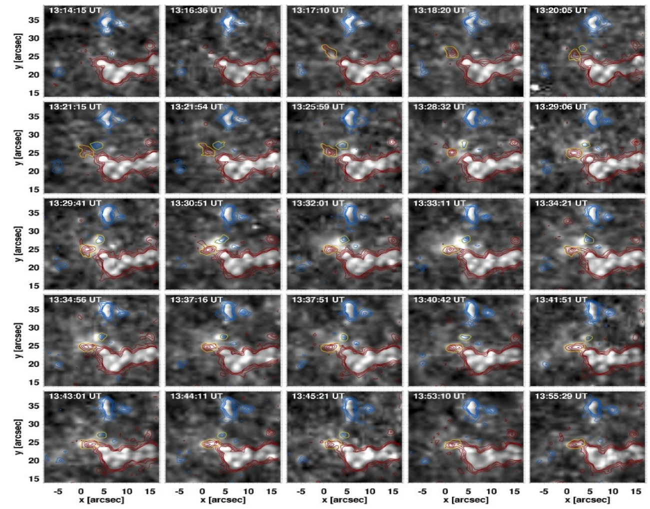

Figure 3. Temporal evolution of the emerging magnetic dipole. Background images have been taken in the TRACE 1216 Å channel. The superimposed contours represent the magnetic signal detected in the SoHO/MDI data with red (blue) contours referring to positive (negative) magnetic polarity. The yellow contours mark the emerging loop.