Biannual report
Astronomical Institute of the Slovak Academy of Sciences 2014 – 2015

Institute

Mission Statement of the Institute

[1] Astronomical Institute of the Slovak Academy of Sciences (AISAS) is focused on observations and basic research in the group of sciences “Natural sciences” sub-group “Physical sciences”, branches “Astronomy”, “Astrophysics”, “Plasma physics” and “Environmental Physics”, with emphasis on research of the Sun, interplanetary matter, stars and stellar systems.
[2] AISAS provides consulting and other expertise services relating to its main specialization.
[3] AISAS organizes the postgraduate (PhD) study in astronomy and astrophysics and ensures the participation of the staff of the Institute in teaching at universities.
[4] AISAS publishes the results of its scientific activity in journals as well as in non-periodical prints and popularizes the results in media.

Basic information on the Institute:

Legal name and address

Astronomical Institute of the Slovak Academy of Sciences
05960 Tatranská Lomnica, Slovakia

URL of the institute web site

https://www.astro.sk/

Executive body of the institute and its composition

Director:	RNDr. Aleš Kučera, CSc.
Deputy director:	Doc. RNDr. Ján Svoreň, DrSc.
Scientific secretary:	Mgr. Martin Vaňko, PhD.

Astronomical Institute of the Slovak Academy of Sciences (AISAS) consists of three scientific departments:

Stellar Department
Solar Physics Department
Department of interplanetary matter

Stellar department – research areas:

a) study and search of exoplanets, determination of basic parameters of exoplanets and development of theoretical tools for analysis, search for young exoplanets in open galactic clusters, search for circumbinary exoplanets,
b) study of binaries and multiple systems of stars, determination of the absolute parameters of the components of eclipsing binaries using ground-based and satellite photometric, spectroscopic, and interferometric data, study of close binaries focusing on the mass transfer and mass loss, study of cycles of stellar activity and spots,
c) study of pre-main-sequence (T Tauri) multiple and single stars to constrain models of stellar evolution,

d) study of the structure of active components in symbiotic stars, ionization, scattering and mass outflow by the stellar wind and jets, multifrequency observations of classical novae, determination of their orbital periods, study of the structure of their expanding envelopes

Solar department – research areas:

a) study of the solar photosphere and chromosphere and active events in them, using modern spectro-polarimetric, spectroscopic and photometric observations acquired with top level solar telescopes base at the Canary Islands (GREGOR, VTT, SST, THEMIS), and with space-borne satellites under own joint observing proposals,
b) study of the solar corona and structures in it (prominences, coronal holes, coronal condensations) and Sun-Earth relations using data acquired with modern infrastructure at our Lomnicky Peak Observatory, with space-borne satellites and from VSO – Virtual Solar Observatory (unique access to data from space- and ground-based observations of the Sun) and using data from solar total eclipses observations,
c) study of evolution of fast and very powerful events in the solar atmosphere (flares, coronal mass ejections, active prominences, jets) using multiple observations from ground based and space-borne instruments,

Department of interplanetary matter – research areas:

a) investigation of populations of small bodies in the Solar System, study of transfer orbits, interrelations and evolution among different populations regarding near-Earth objects, study of the structure of the outer part of the Oort cloud and the Edgeworth-Kuiper belt;
b) investigation of the activity of selected cometary nuclei and its influence on physical and dynamical evolution of these bodies, photometry of asteroids and comets;
c) study of structure and dynamics of meteoroid streams and evolution of their parent bodies, description of the distribution of meteoroid particles in the inner Solar System, search for meteoroid streams of asteroidal origin, search for hyperbolic and interstellar meteoroids, operation of the all-sky photographic cameras within the European Fireball Network; study of meteorite properties.
d) study of the physical and chemical properties of surfaces of small bodies in the Solar System and their relevant terrestrial analogs, simulation of effects of space weathering in laboratory conditions, formation of molecules due to ion irradiation of ices relevant to Solar System bodies.

Results 2014- 2015

Scientific achievements and results gained at (AISAS) have been published mostly in top high ranked international scientific journals, presented at prestigious international conferences and significantly cited by the scientific community

Computation and tabulation of fundamental parameters of exoplanets.

Calculations and analysis of non-isotropic phase functions, asymmetry parameter (mean cosine of the scattering angle), absorption and scattering opacities, single scattering albedos, equilibrium temperatures, and radiative accelerations of dust grains relevant for extrasolar planets are presented. We assume spherical grains, Deirmendjian particle size distribution, and Mie theory. Several species: corundum/alumina, perovskite, olivines with 0 and 50 %

iron content, pyroxenes with 0, 20, and 60 % iron content, pure iron, carbon at two different temperatures, water ice, liquid water, and ammonia are considered. The tables cover the wavelength range of 0.2-500 μm and modal particle radii from 0.01 to 100 μm. Equilibrium temperatures and radiative accelerations assume irradiation by a non-blackbody source of light with temperatures from 7000 to 700 K seen at solid angles from 2π to 10^{-6} sr.

BUDAJ, Ján- KOCIFAJ, Miroslav - SALMERON, Raquel - HUBENY, Ivan. Tables of phase functions, opacities, albedos, equilibrium temperatures, and radiative accelerations of dust grains in exoplanets.In Monthly Notices of the Royal Astronomical Society, 2015, vol. 454, p. 2-27.(**5.107 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0035-8711.

New parameters of G-band bright points introduced and analysed

So called G-band bright points (GBPs), derived from G-band images of solar photosphere represent locations of enhanced magnetic field. Our study of them is based on four diagnostics (effective velocity, change in the effective velocity, change in the direction angle, and centrifugal acceleration). Additionally, two new ones (rate of motion and time lag between recurrences of GBPs) were introduced by us. The results concerning the commonly used parameters showed the effective velocity of ≈0.9 km s^{-1}, whereas we found a deviation of the effective velocity distribution from the expected Rayleigh function for velocities in the range from 2 to 4 km s^{-1}. The change in the effective velocity distribution is consistent with a Gaussian one with FWHM=0.079 km s^{-2}. The distribution of the centrifugal acceleration exhibits a highly exponential nature. Two new parameters were defined by us: i) the real displacement between appearance and disappearance of GBPs (rate of motion) and the frequency of their recurrence at the same locations (time 7 lag). The locations of the tracked GBPs mainly cover the boundaries of supergranules representing the network, and there is no significant difference in the locations of GBPs with small (m<1) and large (m>2) values of the rate of motion. The time lags mostly lie within the interval of ≈ 2 - 3 min, with those up to ≈ 4 min being more abundant than longer ones. Results for both new parameters indicate that the locations of different dynamical types of GBPs (stable/farther traveling or with short/long lifetimes) are bound to the locations of more stable and long-living magnetic field concentrations. Thus, the disappearance/reappearance of the tracked GBPs cannot be perceived as the disappearance/reappearance of their corresponding magnetic field concentrations.

BODNÁROVÁ, Marcela - UTZ, Dominik - RYBÁK, Ján. On dynamics of G-band bright points. In *Solar Physics*, 2014, vol. 289, p. 1543-1556. (**3.805 - IF2013**). (2014 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0038-0938.

Impacts of stream meteoroids on the nuclei of comets

We attempt to answer two questions concerning the impacts of stream meteoroids on the nuclei of Comets 9P/Tempel 1 and 81P/Wild 2: firstly, how many streams cross the orbits of both comets and, secondly, what is the index of the differential mass distribution of impactors, s, when we assume that a prevailing number of the craters on the surfaces of cometary nuclei were created by stream meteoroids? We found that 110 and 129 potential streams originating from comets likely cross the orbits of 9P and 81P, respectively (and 103 potential streams cross the orbit of 1P/Halley, for comparison). If we consider the more compact streams originating from asteroids, the 9P and 81P pass through such streams 15 664 and 65 368 times. Neither these large numbers of passages imply, however, enough large impactors to excavate the whole observed variety of craters on studied comets. For all craters on 9P and 81P, s=2.09±0.01 and s=2.25±0.03, respectively. The craters on 81P seem to be, however, excavated by the impactors from four discernible sources. For two numerous enough sources we find s=5.6±0.2 and s=5.2±0.5. The difference between the indices for the set of all craters and the sets of their partial groups obviously implies an unknown cosmogonic consequence.

IVANOVA, Oleksandra - NESLUŠAN, Luboš - SVOREŇ, Ján - SEMAN KRIŠANDOVÁ, Zuzana. Crater-diameter distribution on Comets 9P and 81P and potential meteoroid streams crossing their orbits. In *Icarus*, 2015, vol. 254, p. 92-101. (**3.038 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0019-1035.

Asteroid surface space weathering investigated both observationally and experimentally

Surfaces of atmosphere-less small bodies in the Solar System, which are not protected by magnetic field, are continuously affected by processes of space wheathering.

Asteroid surface space weathering has been investigated both observationally and experimentally, mostly focusing on the effects on the visible–near infrared (VNIR, 0.4–2.5 μm) spectral range. Here we present laboratory near-ultraviolet (NUV, 200–400 nm) reflectance spectra of ion irradiated (30–400 keV) silicates and meteorites as a simulation of solar wind ion irradiation. These results show that the induced alteration can reproduce the spread observed in the VNIR vs. NUV slope diagram for S-type asteroids. In particular, the well-known spectral reddening effect induced in the VNIR range is accompanied by a less known but stronger bluing effect at NUV wavelengths. Such trend was previously identified by Hendrix and Vilas (Hendrix, A.R., Vilas, F. [2006]. Astron. J., 132, 1396–1404) but only based on the comparison between observations and laboratory spectra of lunar materials. We attribute the NUV bluing, analogously to the VNIR reddening, to the formation of iron nanoparticles accompanied by structural modifications (amorphization) of surface silicates. We expect the evidence of weathering processes in the NUV part of spectra before these effects become observable at longer wavelengths, thus searching for the space weathering effects in the NUV range would allow establishing the extent of space weathering for very young asteroidal families. It will be important to include in future studies the NUV range both in the observations of specific classes of objects (e.g., the Vestoids) and in the laboratory spectra of meteorites and terrestrial analogues before and after space weather processing.

KAŇUCHOVÁ, Zuzana - BRUNETTO, Rosario - FULVIO, Daniele - STRAZZULLA, Giovanni. Near-ultraviolet bluing after space weathering of silicates and meteorites. In *Icarus*, 2015, vol. 258, p. 289-296. (**3.038 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0019-1035.

Theoretical transmission profiles of the DOT Hα Lyot filter

Accurate knowledge of the spectral transmission profile of a Lyot filter is important, in particular in comparing observations of the solar chromosphere with simulated data. We summarized available facts about the transmission profile of the Dutch Open Telescope (DOT) Hα Lyot filter pointing to a discrepancy between sidelobe-free Gaussian-like profile measured spectroscopically and signatures of possible leakage of parasitic continuum light in DOT Hα images. We computed wing-to-center intensity ratios resulting from convolutions of Gaussian and square of the sinc function with the Hα atlas profile and compare them with the ratios derived from observations of the quiet Sun chromosphere at disk centre. We interpret discrepancies between the anticipated and observed ratios and the sharp limb visible in the DOT Hα image as an indication of possible leakage of parasitic continuum light. A method we suggested can be applied also to indirect testing of transmission profiles of other Lyot filters. We suggest two theoretical transmission profiles of the DOT Hα Lyot filter which should be considered as the best available approximations. Conclusive answer can only be given by spectroscopic re-measurement of the filter.

KOZA, Július - HAMMERSCHLAG, Robert H. - RYBÁK, Ján - GÖMÖRY, Peter - KUČERA, Aleš - SCHWARTZ, Pavol. Transmission profile of the Dutch Open Telescope H_alpha Lyot filter. In *Astronomische Nachrichten*, 2014, vol. 335, no. 4, p. 409-416. (**1.119 - IF2013**). (2014 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-6337.

Magnetoacoustic waves in solar flares.

Currently, there is a common endeavour to detect magnetoacoustic waves in solar flares. We contributed to this topic using an approach of numerical simulations. We studied a spatial and temporal evolution of impulsively generated fast and slow magnetoacoustic waves propagating along the dense slab and Harris current sheet using two-dimensional magnetohydrodynamic numerical models. Wave signals computed in numerical models were used for computations of the temporal and spatial wavelet spectra for their possible comparison with those obtained from observations. It is shown that these wavelet spectra allow us to estimate basic parameters of waveguides and perturbations. We found that the wavelet spectra of waves in the dense slab and current sheet differ in additional wavelet components that appear in association with the main tadpole structure. While in the dense slab this additional component is always delayed after the tadpole head, in the current sheet this component always precedes the tadpole head. It could help distinguish a type of the waveguide in observed data. We presented a technique based on wavelets that separates wave structures according to their spatial scales. This technique shows not only how to separate the magnetoacoustic waves and waveguide structure in observed data, where the waveguide structure is not known, but also how propagating magnetoacoustic waves would appear in observations with limited spatial resolutions. Thus, new possibilities to detect magnetoacoustic waves in observed data are open

MÉSZÁROSOVÁ, Hana - KARLICKÝ, Marian - JELÍNEK, Petr - RYBÁK, Ján. Magnetoacoustic waves propagating along a dense slab and Harris current sheet and their wavelet spectra. In The Astrophysical Journal, 2014, vol. 788, article no. 44, p. 1-10. (**6.280 - IF2013**). (2014 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-637X.

Mineralogy, petrology, and geochemistry of the Košice meteorite

The Košice meteorite was observed to fall on 28 February 2010 at 23:25 UT near the city of Košice in eastern Slovakia and its mineralogy, petrology, and geochemistry are described. The characteristic features of the meteorite fragments are fan-like, mosaic, lamellar, and granular chondrules, which were up to 1.2 mm in diameter. The fusion crust has a black-gray color with a thickness up to 0.6 mm. The matrix of the meteorite is formed mainly by forsterite (Fo80.6); diopside; enstatite (Fs16.7); albite; troilite; Fe-Ni metals such as iron and taenite; and some augite, chlorapatite, merrillite, chromite, and tetrataenite. Plagioclase-like glass was also identified. Relative uniform chemical composition of basic silicates, partially brecciated textures, as well as skeletal taenite crystals into troilite veinlets suggest monomict breccia formed at conditions of rapid cooling. The Košice meteorite is classified as ordinary chondrite of the H5 type which has been slightly weathered, and only short veinlets of Fe hydroxides are present. The textural relationships indicate an S3 degree of shock metamorphism and W0 weathering grade. Some fragments of the meteorite Košice are formed by monomict breccia of the petrological type H5. On the basis of REE content, we suggest the Košice chondrite is probably from the same parent body as H5 chondrite Morávka from Czech Republic. Electron-microprobe analysis (EMPA) with focused and defocused electron beam, whole-rock analysis (WRA), inductively coupled plasma mass and optical emission spectroscopy (ICP MS, ICP OES), and calibration-free laser induced breakdown spectroscopy (CF-LIBS) were used to characterize the Košice fragments. The results provide further evidence that whole-rock analysis gives the most accurate analyses, but this method is completely destructive. Two other proposed methods are partially destructive (EMPA) or nondestructive (CF-LIBS), but only major and minor elements can be evaluated due to the significantly lower sample consumption.

OZDÍN, Daniel - PLAVČAN, Jozef - HORŇÁČKOVÁ, Michaela - UHER, Pavel - PORUBČAN, Vladimír - VEIS, Pavel - RAKOVSKÝ, Jozef - TÓTH, Juraj - KONEČNÝ, Patrik - SVOREŇ, Ján. Mineralogy, petrography, geochemistry, and classification of the Košice Meteorite. In *Meteoritics and Planetary Science*, 2015, vol. 50, no. 5, p. 864-879. (**3.104 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 1086-9379.

Coronal motion and dynamics over the solar-activity cycle,

Continuing our series of observations of coronal motion and dynamics over the solar-activity cycle, we observed from sites in Queensland, Australia, during the 2012 November 13 (UT)/14 (local time) total solar eclipse. The corona took the low-ellipticity shape typical of solar maximum (flattening index ε = 0.01), a change from the composite coronal images we observed and analyzed here and elsewhere for the 2006 and 2008-2010 eclipses. Our results include velocities of a coronal mass ejection (CME; during the 36 minutes of passage from the Queensland coast to a ship north of New Zealand, we measured 413 km s^{-1}) and we analyzed its dynamics. We analyzed the shapes and positions of several types of coronal features seen on our higher-resolution composite coronal images, including many helmet streamers, very faint bright and dark loops at the bases of helmet streamers, voids, and radially oriented thin streamers. We compared our eclipse observations with models of the magnetic field, confirming the validity of the predictions, and relate the eclipse phenomenology seen with the near-simultaneous images from NASA's Solar Dynamics Observatory (SDO/AIA), NASA's Extreme Ultraviolet Imager on Solar Terrestrial Relations Observatory, ESA/Royal Observatory of Belgium's Sun Watcher with Active Pixels and Image Processing (SWAP) on PROBA2, and Naval Research Laboratory's Large Angle and Spectrometric Coronagraph Experiment on ESA's Solar and Heliospheric Observatory.

PASACHOFF, Jay M. - RUŠIN, Vojtech - SANIGA, Metod - BABCOCK, Bryce A. - LU, Muzhou - DAVIS, Allen B. - DANTOWITZ, Ronald - GAINTATZIS, Pavlos - SEIRADAKIS, John H. - VOULGARIS, Aris - SEATON, Daniel B. - SHIOTA, Kazuo. Structure and dynamics of the 2012 November 13/14 eclipse white-light corona. In *The Astrophysical Journal*, 2015, vol. 800, article no. 90, p. 1-19. (**5.993 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-637X.

New multiwavelength analysis and modelling of physical parameters of solar prominences

i) Total masses of six solar prominences were estimated using prominence multi-spectral observations (in EUV, X-rays, Hα, and Ca II H). The observations were made during the observing campaign from April through June 2011. We applied a complex method for the prominence mass estimations that can be used later for other prominences observed during the observing campaign. Our method is based on the fact that intensity of the EUV solar corona at wavelengths below 912 Å is reduced by the absorption in resonance continua of hydrogen and helium (photoionisation) and at the same time also by a deficit of the coronal emissivity in volume occupied by the cool prominence plasma. Both mechanisms contribute to intensity decrease simultaneously. The observations in X-rays allow us to separate these mechanisms from each other. Coronal emission behind a prominence is not estimated by any temporal or spatial interpolation, but by using a new method based on comparing the ratio of the optical thickness at 193 Å and 211 Å determined from the observations with the theoretical ratio. Values of the total mass estimated for six prominences are between $2.9 \times 10_{11}$ and 1.7×10^{12} kg. The column density of hydrogen is of the order of 10^{18}-10^{19} cm^{-2}. The method is now ready to be used for all 30 prominences observed during the campaign. Thus, it will be possible to obtain a statistics of the total mass of quiescent solar prominences. [1]

ii) We performed a detailed statistical analysis of the spectral Lyman-line observations of the quiescent prominence observed on May 18, 2005. We used a profile-to-profile comparison of the synthetic Lyman spectra obtained by 2D single-thread prominence fine-structure model as a starting point for a full statistical analysis of the observed Lyman spectra. We employed 2D multi-thread fine-structure models with random positions and line-of-sight velocities of each thread to obtain a statistically significant set of synthetic Lyman-line profiles. We used for the first time multi-thread models composed of non-identical threads and viewed at line-of-sight angles different from perpendicular to the magnetic field. We investigated the plasma properties of the prominence observed with the SoHO/SUMER spectrograph on May 18, 2005 by comparing the histograms of three statistical parameters characterizing the properties of the synthetic and observed line profiles. In this way, the integrated intensity, Lyman decrement ratio, and the ratio of intensity at the central reversal to the average intensity of peaks provided insight into the column mass and the central temperature of the prominence fine structures. [2]

iii) We investigated the soft X-ray (SXR) signatures of a prominence. The X-ray observations were obtained by the satellite Hinode/X-Ray Telescope using two different filters. Both of them have a pronounced peak of the response function around 10 Å. The observed darkening in both of these filters has a very large vertical extension. The position and shape of the darkening correspond nicely with the prominence structure seen in satellite SDO/AIA images. Detailed calculations of the optical thickness in this spectral range show clearly that the darkening is not caused by X-ray absorption. Therefore, we suggested that presence of an extended region with a large emissivity deficit, which can be caused by the presence of cool prominence plasmas within an otherwise hot corona. To reproduce the observed darkening, one needs a very large extension along the line of sight of the region amounting to around 10_5 km. We interpret this region as the prominence spine, which is also consistent with SDO/AIA observations in EUV. [3]

[1] SCHWARTZ, Pavol - HEINZEL, Petr - KOTRČ, Pavel - FÁRNÍK, František - KUPRYAKOV, Yurij Alexejevič - DELUCA, Edward E. - GOLUB, Leon. Total mass of six quiescent prominences estimated from their multi-spectral observations. In Astronomy and Astrophysics, 2015, vol. 574, article no. A62, p. 1-18. (**4.378 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-6361.

[2] SCHWARTZ, Pavol - GUNÁR, Stanislav - CURDT, Werner. Non-LTE modelling of prominence fine structures using hydrogen Lyman-line profiles. In Astronomy and Astrophysics, 2015, vol. 577, article no. A92, p. 1-10. (**4.378 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-6361.

[3] SCHWARTZ, Pavol - JEJČIČ, S. - HEINZEL, Petr - ANZER, Ulrich - JIBBEN, Patricia R. Prominence visibility in HINODE/XRT images. In The Astrophysical Journal, 2015, vol. 807, article no. 97, p. 1-9. (**5.993 - IF2014**). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-637X.

Introducing of a new method for determining the mass-loss rate from symbiotic binaries via the Raman scattering on atomic hydrogen

The mass-loss rate from Mira variables represents a key parameter in our understanding of their evolutionary tracks. We introduce a method for determining the mass-loss rate from the Mira component in D-type symbiotic binaries via the Raman scattering on atomic hydrogen in the wind from the giant. Using our method, we investigated Raman HeII λ1025 → λ6545 conversion in the spectrum of the symbiotic Mira V1016 Cyg. We determined its efficiency to 10.2 and 14.8% and using the ionization model of symbiotic stars we determined the corresponding mass-loss rate of $2.0(+0.1/-0.2)\times10^{-6}$ and $2.7(+0.2/-0.1)\times10^{-6}$ $M_\odot$ per year from our spectra on 2006 April and 2007 July, respectively. Our values of the mass-loss rate that we derived from Raman scattering are comparable with those obtained independently by other methods. Applying the method to other Mira–white dwarf binary systems can help us in modelling evolutionary tracks of the cool giants during their late stages of evolution at the asymptotic branch of the H-R diagram.

SEKERÁŠ, Matej - SKOPAL, Augustin. Mass-loss rate by the Mira in the symbiotic binary V1016 Cygni from Raman scattering. In The Astrophysical Journal, 2015, vol. 812, article no. 162, p. 1-8. (**5,993 – IF2014**). (2015 – Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-637X.

First time evidence of rotational motions in a tornado-like prominence.

Su et al. proposed a new explanation for filament formation and eruption, where filament barbs are rotating magnetic structures driven by underlying vortices on the surface. Such structures have been noticed as tornado-like prominences when they appear above the limb. They may play a key role as the source of plasma and twist in filaments. However, no observations have successfully distinguished rotational motion of the magnetic structures in tornado-like prominences from other motions such as oscillation and counter-streaming plasma flows. Here we report firs time evidence of rotational motions in a tornado-like prominence. The spectroscopic observations in two coronal lines were obtained from a specifically designed Hinode/EIS observing program. The data revealed the existence of both cold and million-degree-hot plasma in the prominence leg, supporting the so-called prominence-corona transition region. The opposite velocities at the two sides of the prominence and their persistent time evolution, together with the periodic motions evident in SDO/AIA dark structures, indicate a rotational motion of both cold and hot plasma with a speed of ~5 km s^{-1}

SU, Yang - GÖMÖRY, Peter - VERONIG, Astrid - TEMMER, Manuela - WANG, Tongjiang - VANNINATHAN, Kamalam - GAN, Weiqun - LI, YouPing. Solar magnetized tornadoes: rotational motion in a tornado-like prominence. In *The Astrophysical Journal Letters*, 2014, vol. 785, article no. L2, p. 1-6. (**5.602 - IF2013)**. (2014 - Current Contents, SCOPUS, WOS, NASA ADS). ISSN 2041-8205.

International projects - grants: 2014- 2015

Project title: Polarization as a tool to study the Solar System and beyond
Type/ Project number: MPNS COST Action MP1104
Duration: 11/2012-11/2015
Responsible person: Partner - Coordinator for Slovakia/ A. Kučera - scientist in charge

Project title: SOLARNET- High-Resolution Solar Physics Network
Type/ Project number: 7 RP/FP7-INFRA-312495
Duration: 04/2013-03/2017
Responsible person: Partner/ A. Kučera - scientist in charge

Project title: Topology and physical parameter of the magnetic fields in solar filaments.
Type/ Project number: 7 RP SOLARNET Trans-nat. access programe: VTT - Ref. nr.: 14-08
Duration: 09/2014-09/2014
Responsible person: Coordinator / P. Gömöry

Project title: Coordinated three-site observations of quiescent prominencess
Type/ Project number: 7 RP SOLARNET Trans-nat. access programe: Ref. nr.: 14-07
Duration: 07/2014-08/2014
Responsible person: Coordinator / J. Koza

Project title: Origins and evolution of life on Earth and in the Universe
Type/ Project number: COST Action TD 1308
Duration: 05/2014- 05/2018
Responsible person: Partner- Coordinator for Slovakia/ Z. Kaňuchová - scientist in charge

Project title: Mapping the fireball stage of the Nova Del 2013 (V339 Del) by the method of multi-wavelength modelling its SED
Type/ Project number: Alexander von Humboldt Foundation SLA/1039115
Duration: 03/2014-04/2014
Responsible person: Coordinator A. Skopal

Project title: Topology and physical parameter of the magnetic fields in solar filaments.
Type/ Project number: 7 RP SOLARNET Trans-nat. access programe: GREGOR - Ref. nr.: 15-07
Duration: 051/2015-05/2015
Responsible person: Coordinator / P. Gömöry

Project title: Two suns in the sky: search for circumbinary planets with the TEST telescope
Type/ Project number: DFG/DFGHA 3279/9-1
Duration: 01/2015- 12/2017
Responsible person: Partner/ T. Pribulla

Project title: Exploring the accretion process in the symbiotic system CH Cygni during its transition from quiescence to the present (2014-15) active phase
Type/ Project number: Alexander von Humboldt Foundation SLA/1039115
Duration: 03/2015-04/2015
Responsible person: Coordinator A. Skopal

Project title: Impulsively generated waves in radio and X-ray ranges of the electromagnetic spectrum detected in the solar corona
Type/ Project number: MAD SK-CZ
Duration: 01/2012-12/2014
Responsible person: Coordinator / J. Rybák

Project title: Plasma diagnostics of EIT waves and flares on the Sun
Type/ Project number: MVD APVV SK-AT-0003-12 SK 16/2013
Duration: 01/2013-12/2014
Responsible person: Coordinator / P. Gömöry

Project title: Study of stellar explosions in interacting binaries
Type/ Project number: MAD SK-UA Č:1/2014
Duration: 10/2014-12/2016
Responsible person: Coordinator / D. Chochol

Project title: The magnetic vector field in solar filaments
Type/ Project number: MAD - DAAD 57065721
Duration: 01/2014-12/2015
Responsible person: Partner / P.Schwartz

Project title: The Dwarf project: Eclipsing binaries – precise clocks to discover exoplanets
Type/ Project number: MAD SK-UA Č: 2/2014
Duration: 01/2014-12/2015
Responsible person: Coordinator / M. Vaňko

Project title: The study of interplanetary matter in the Earth's vicinity
Type/ Project number: MAD SAV-AV ČR 15-17
Duration: 01/2015-12/2017
Responsible person: Coordinator / M. Husárik

Project title: Observing Coronal Eruptions and Spectra at the 2015 Arctic Solar Eclipse
Type/ Project number: Bilateral/Nat. Geographic's Committee on Research and Exploration, USA 9616-14
Duration: 06/2014-12/2015
Responsible person: Partner/ V. Rušin

Project title: Finite-Geometrical Aspects of Quantum Theory
Type/ Project number: Bilateral/FWF-M1564-N27l
Duration: 03/2014-06/2015
Responsible person: Coordinator / M. Saniga

Project title: Exploring the Geometry of Generalized Pauli Groups
Type/ Project number: Bilateral RECH-MOB15-000007
Duration: 09/2015-06/2016
Responsible person: Coordinator / M. Saniga

International visits of the institute
YEAR-2015

Country	Type of visits					
	Projects		Bilateral		Other	
	Name	**Days**	**Name**	**Days**	**Name**	**Days**
Czech republic	Koten Pavel	5			Mikulášek Zdeněk	14
	Meszárosova Hana	14			Mikulášek Zdeněk	18
	Shrbený Lukáš	5				
	Vojáček Vlastimil	5				
Estonia					Leedjarv Laurits	4
Germany	Balthasar Horst	19				
	Denker Carsten	12				
	Gonzáles Sergio Javier	20				
	Kuckein Christoph	13				
	Verma Meetu	12				
Poland					Berlicky Arkadius	12
					Zapior Maciej	13
Russia					Kravtsova Alexandra	90

Italy					Capobianco Gerardo	8
					Capobianco Gerardo	8
					Romoli Marco	8
Ukraine					Ivanova Oleksandra	184
					Krushevska Viktoria	90
USA					Getman Konstantin	17
Total	**9**	**105**			**12**	**466**

YEAR 2014

Country	**Type of visits**					
	Projects		**Bilateral**		**Other**	
	Name	**Days**	**Name**	**Days**	**Name**	**Days**
Czech Republic	Mészarosová Hana	15			Heinzel Petr	10
					Jelínek Petr	13
					Mikulášek Zdenek	13
					Wolf Marek	5
France					Holweck Fréderic	8
Germany	Balthasar Horst	15				
	Denker Carsten	18				
	Diercke Andrea	18				
	Kuckein Christoph	15				
	Manrique Sergio	5				
	Manrique Sergio	15				
Poland					Berlicki Arkadiusz	7
					Galan Cezary	4
Austria					Utz Dominik	6
					Vanninathan Kamalam	4
Russia					Gladilina Natalia	21
					Golysheva Polina	20

					Kravtseva Alexandra	92
					Zemko Polina	79
Slovenia					Jejčič Sonja	10
Italy					Capobianco Gerardo	8
					Fineschi Silvano	8
					Massone Giussepe	8
Ukraine					Breus Vitalii	8
					Ivanova Alexandra	92
Total	**7**	**101**			**19**	**416**

List of publications
YEAR 2015
ADCA Scientific papers in international scientific journals with impact factor

ADCA01 BARSUNOVA, Olga Yu. - GRININ, Vladimir P. - SERGEEV, Sergey G. - SEMENOV, A.O. - SHUGAROV, Sergey Yu.. UX Ori variables in the cluster IC 348. In Astrophysics, 2015, vol. 58, no. 2, p. 193-203. (0.707 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0571-7256.

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ADCA07 JAKŠOVÁ, Ivana - PORUBČAN, Vladimír - KLAČKA, Jozef. Structure and sources of the sporadic meteor background from video observations. In Publications of the Astronomical Society of Japan, 2015, vol. 67, no. 5, article no. 99, p. 1-7. (2.066 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0004-6264.

ADCA08 JAKUBÍK, Marián - NESLUŠAN, Luboš. Meteor complex of asteroid 3200 Phaethon: its features derived from theory and updated meteor data bases. In Monthly Notices of the Royal Astronomical Society, 2015, vol. 453, p. 1186-1200. (5.107 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0035-8711.

ADCA09 KAŇUCHOVÁ, Zuzana - BRUNETTO, Rosario - FULVIO, Daniele - STRAZZULLA, Giovanni. Near-ultraviolet bluing after space weathering of silicates and meteorites. In Icarus, 2015, vol. 258, p. 289-296. (3.038 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0019-1035.

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ADCA12 MELITA, Mario - KAŇUCHOVÁ, Zuzana - BRUNETTO, Rosario - STRAZZULLA, Giovanni. Space weathering and the color–color diagram of

Plutinos and Jupiter Trojans. In Icarus, 2015, vol. 248, p. 222-229. (3.038 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0019-1035.

ADCA13 OZDÍN, Daniel - PLAVČAN, Jozef - HORŇÁČKOVÁ, Michaela - UHER, Pavel - PORUBČAN, Vladimír - VEIS, Pavel - RAKOVSKÝ, Jozef - TÓTH, Juraj - KONEČNÝ, Patrik - SVOREŇ, Ján. Mineralogy, petrography, geochemistry, and classification of the Košice Meteorite. In Meteoritics and Planetary Science, 2015, vol. 50, no. 5, p. 864-879. (3.104 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 1086-9379.

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ADCA18 PERNA, Davide - BARUCCI, Maria Antonella - DRUBE, Line - FALKE, Albert - FULCHIGNONI, Marcello - HARRIS, Alan W. - HARRIS, Alan W. - KAŇUCHOVÁ, Zuzana. A global response roadmap to the asteroid impact threat: The NEOShield perspective. In Planetary and Space Science, 2015, vol. 118, p. 311-317. (1.875 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0032-0633.

ADCA19 PLANAT, Michel - GIORGETTI, Alain - HOLWECK, Frédéric - SANIGA, Metod. Quantum contextual finite geometries from dessins d'enfants. In International Journal of Geometric Methods in Modern Physics, 2015, vol. 12, article no. 1550067, p. 1-18. (0.437 - IF2014). (2015 - Current Contents, WOS, SCOPUS, NASA ADS). ISSN 0219-8878.

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