XV Bulgarian-Serbian Astronomical Conference

Book of Abstracts

13 – 18 September 2026
Varna, Bulgaria

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A Retrospective Analysis of CCD Photometry of Asteroids: A Quarter-Century at BNAO Rozhen and Nearly a Decade at AS Vidojevica (invited talk)

Gordana Apostolovska (1), Violeta Ivanova (2), Nataša Todorović (3), Galin Borisov (2), Elena Vchkova Bebekovska (1), Zahary Donchev (2), and Andon Kostov (2)

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The collaboration between Bulgarian and Serbian astronomers can be traced back to 1998, when initial contacts were established during the First Serbian–Bulgarian Conference in Belogradchik, Bulgaria. These contacts led to a joint effort involving the Bulgarian Academy of Sciences, the Institute of Physics at Ss. Cyril and Methodius University in Skopje, and a Space Frontier Foundation grant, through which an SBIG ST-8E CCD camera was purchased in 2000 and installed on the Schmidt telescope at BNAO Rozhen. The cooperation with the Solar System Group initially focused on astrometric observations of Near-Earth Objects (NEOs), followed by photometric observations of Near-Earth and Main-Belt asteroids. The collaboration with Serbian astronomers was initiated during the Second BELISSIMA Workshop, First Light of the Milanković Telescope, held at Vidojevica in June 2016. In 2017, regular asteroid photometric observations began with the 1.4 m Milanković and 60 cm Nedeljković telescopes at the Astronomical Station Vidojevica.

A statistical overview of more than two decades of asteroid observations will be presented, including the number and diversity of observed objects, observing runs, derived rotational periods, and spin-state and shape models. Selected results will illustrate the development of the observational program, from classical CCD lightcurve analysis to modern approaches combining dense ground-based photometry with sparse and survey data. In the era of space missions such as Gaia and large-scale surveys such as the

Vera C. Rubin Observatory, targeted ground-based observations remain an essential complement, providing follow-up, long-term monitoring, and detailed characterization of individual asteroids.

Massive Contact Close Binary Systems and Their Stability (talk)

Bojan Arbutina

University of Belgrade, Serbia

There is a growing interest of astronomical community in stellar mergers, primarily due to the detection of gravitational waves associated with mergers of black holes and neutron stars, but merger can also occur in contact close binary systems long before stars reach the end points of their evolution. Such mergers can lead to the formation of fast-rotating single stars, possibly blues stragglers and red novae. Most of the contact binaries are low-mass systems of W Ursae Majoris type with common convective envelope, but there is also a handful of massive O-B contact binaries with radiative envelope. We discuss the latter systems, their properties, the similarities and important differences in their stability analysis in comparison to their lower mass counterparts, and possible merger outcomes, such as luminous red novae.

Investigating cosmic structure with quasars from Gaia and red galaxies from DESI LS (talk)

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The presented work is a continuation of a previous one, providing one of the largest catalogs of cosmic voids, clusters and quasar densities in the range $0.8<z<2.2$. Using luminous red galaxies (LRGs) from the DESI Legacy Survey, we overlap with the previous work in $0.4<z<1$ and analyze how well the densities measured around ~6M LRGs in this range match the quasar densities from the Gaia mission's "Quaia" catalog. To this end, we

analyze the 2D Pearson correlation of projected LRGs against quasar densities, as well as the 3D profiles of LRG density around voids/clusters detected using Quaia quasars. The work is in the process of development, but preliminary results show a strong Pearson correlation of the 2D projections and a weaker correlation of the 3D LRG densities around quasar voids. This may be due to the high completeness of Quaia and DESI in measuring quasars and LRGs at 0.6<z<1, respectively, but suboptimal redshift accuracy for both photometric surveys. Nevertheless, the results indicate that the upcoming publication of DESI DR2 and Gaia DR4, both containing spectroscopic redshifts, should significantly improve the consistency of cosmological density measurements between LRGs and quasars and significantly expand our mapping of cosmological voids and clusters, which is essential for cosmological tests.

Photometric and Spectroscopic Investigation of Active G-, K-, and M-type Stars Using TESS and Ground-based Observations (talk)

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We present selected results from an ongoing investigation of magnetically active G-, K-, and M-type stars combining high-cadence TESS photometry with ground-based spectroscopic observations. TESS light curves are analysed to identify and characterise stellar flares and rotational variability, while particular attention is paid to flux contamination and source blending using Gaia information and TESS pixel-level data.

The photometric analysis is complemented by time-resolved spectroscopy, with the Hα line used as a diagnostic of chromospheric activity.

Dynamic spectra are employed to trace short-term variations in the line profiles and to investigate their relation to enhanced stellar activity.

We present representative objects exhibiting different levels of activity and photometric contamination and discuss the benefits of combining space-based photometry with ground-based spectroscopy. These results are part of a broader study of active late-type stars that is currently being finalised for publication.

Blazars as the most extreme and violent multi-wavelength and multi-messenger sources in the Universe (talk)

Rumen Bachev

IA-NAO, BAS

Blazars are among the most powerful and enigmatic sources in the Universe. Powered by accretion onto a supermassive black hole, their main feature is a relativistic jet that happens to be pointed almost directly toward the observer. A number of processes in this jet are responsible for producing not only the Doppler-boosted electromagnetic emission that cover practically the entire electromagnetic spectrum, but also information carriers (messengers) from all other known fundamental interactions in Physics, such as gravitational waves, high-energy particles and neutrinos. Therefore, blazars are not only powerful multi-wavelength, but also multi-messenger sources. As such, and taking into account their other unique features (high luminosity, rapid variability, high polarization, etc.) blazars can successfully serve as a testing ground for the "new physics" beyond the standard model. Some aspects of the blazar studies performed at Belogradchik and Rozhen observatories are also briefly discussed in this review.

Combining the Dense Ground-Based Photometry from NAO Rozhen and AS Vidojevica with Sparse Data for Asteroid Modeling (invited talk)

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Asteroids have a wide range of shapes, from nearly spherical to top-shaped and highly irregular, and span a broad range of sizes, from objects only a few meters in diameter to objects with diameters close to 1000 km. To construct a reliable asteroid model, including its shape, spin-axis orientation, and sense of rotation, observations obtained over several decades are often required. This extended observational coverage is necessary to ensure that different regions of the asteroid's surface are observed under varying viewing geometries.

In this work, we investigate how sparse photometric observations from space missions, such as GAIA, or from ground-based observations available in databases such as AstDys, can be used to reduce the observational time on the ground-based telescopes. We present a comparison between asteroid models derived from dense photometric observations, collected from NAO Rozhen and AS Vidojevica, and those obtained using a combination of dense and sparse data. In addition, for each asteroid, its spectral class is determined using GAIA DR3 data.

Multicolor observations of V777 Peg in quiescence (talk)

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$UBVR_cI_c$ photometry was obtained of the WZ Sge-type dwarf nova V777 Peg (ASASSN-14cl or TIC 2001466142) during eight nights between 2014 and 2026. We studied its variability at quiescence state after the 2014 outburst. A photometric period with duration ~ 20 % longer than the orbital one was discussed.

We present a preliminary B-band light curve of the new detected from TESS data and our observations eclipsing binary star (probably β Lyrae-type), located in the field of V777 Peg.

Photometric variations and accretion processes of the EM UMa type dwarf novae IX Draconis (poster)

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We present results of photometric variabilities of the dwarf nova, cataclysmic variable (CV) star IX Draconis (Dra). IX Dra also belongs to the EM UMa type stars. These stars are characterized with their short orbital periods, and they typically undergo regular normal outbursts and cyclic superoutbursts. We use our photometric observational data, obtained with

the 2.0 m telescope at the National Astronomical Observatory (NAO) Rozhen, Bulgaria. In the light curves from the 2 m telescope Rozhen, a non-periodic intranight variability in brightness with low amplitudes is observed.

The data from the Transiting Exoplanet Survey Satellite (TESS) are also applied in this survey, where the cyclic outbursts activity within 3-4 days is clearly seen.

The created periodograms show an existence of periodicity in the signal of the highest peak during the regular outburst.

We also focus on the accretion processes in the binary system, as it is confirmed in advance that the primary component is a white dwarf. The accretion efficiency is estimated, using the maximum values of luminosity measured during observational times from the two facilities.

We discuss the type of interactions between the components, assuming the mass transfer rate of IX Dra is relatively high, as it is already defined. It is suggested a possible tidal influence on the disc activity, which could be related to the emerging outbursts.

Exploring the Relationship Between Outburst Intervals in RS Ophiuchi (talk)

Borislav Borisov

Konstantin Preslavsky University of Shumen, Bulgaria

The recurrent nova RS Ophiuchi displays semi-regular thermonuclear outbursts with inter-eruption intervals historically ranging between 9 and 26 years. This paper presents a mathematical framework that models outburst timing as a quasiperiodic process. By evaluating primary inter-outburst durations against the known orbital period P = 453.6 days, we derive an underlying long-term cycle matching the pulsation period of the red giant companion of about 700 days. We demonstrate that outburst occurrences are strongly shaped by phase geometry and ratio alignments between these two periods. The ratios between major inter-outburst intervals are closely

bounded by the corresponding proportions of orbital revolutions and giant pulsation cycles.

Outbursts organize into two distinct geometric classes relative to the 1933 baseline epoch: events occurring at aligned orbital and pulsation cycle completions (such as 1958 and 2021), and events occurring at half-orbital alignments accompanied by a constant phase lag of approximately 0.89 of the pulsation cycle (such as 1967, 1985, and 2006). Finally, an attempt is made to forecast future outbursts.

Investigation of the Colour Distribution in the Coma of the Disintegrating Comet C/2025K1 (ATLAS) (talk)

Galin Borisov (1), Andon Kostov (1), Milen Minev (1), Tanyu Bonev (1)

(1) Institute of Astronomy and NAO, Bulgarian Academy of Sciences

The comet C/2025 K1 (ATLAS) is a long-period Oort Cloud comet discovered in May 2025 by the ATLAS (Asteroid Terrestrial-impact Last Alert System) survey. It fragmented into at least four pieces after its close perihelion passage in late 2025. We observed the comet during its disintegration for 5 consecutive nights in November 2025 (12-16 Nov 2025) in the standard BVRI filters with the new 1.5 m AZ1500 telescope at NAO Rozhen. The images were calibrated using field stars from the Pan-STARRS catalogue. Furthermore, we measure the comet magnitude in two different-sized apertures. The first one was 1000 km and covered only the main nucleus, and the second one was 20000 km, covering the bright coma around it. Then we computed the true colours (B-V) 0, (V-R) 0, and (R-I) 0, and constructed colour maps of the near-nucleus region, spanning 50000 km, as well. Interestingly, the colour maps show a butterfly-like structure from both sides of the nucleus along the Sun-tail direction, similar to the coma arclets, also called “coma wings”, described in Boehnhardt (2004). It is best visible in the (B-V) 0 colour and widens over time (see Figure 1 for details). The (B-V) 0 colour decreased by one magnitude with time from its highest value to almost a solar-like colour, while the other two colours, (V-R)_0 and (R-I)_0, stayed almost unchanged (see Figure 2 for details). Our interpretation is that this unusual colour and its distribution in the coma are due to very faint, almost missing, C 2 emission and a comet spectrum

dominated by NH 2 lines, hence the high (B-V) 0 colour, observed with the Hanle Faint Object Spectrograph and Camera (HFOSC) on the 2-m Himalayan Chandra Telescope at Hanle, India (Ganesh 2025).

Stability of the Rozhen echelle spectrograph (poster)

M. D. Christova (1), S. Kandzichka, R. Zamanov, K. Stoyanov, M. Dechev, V. Marchev

(1) Technical University of Sofia, Bulgaria

We observe spectroscopically a few types binary stars (high mass X-ray binaries, symbiotic stars and recurrent novae) with the ESpeRo (Echelle Spectrograph Rozhen). Here we perform a check of its stability using (1) ThAr spectrum and (2) telluric lines imprinted in the stellar spectra. We find that the stability of the spectrograph is better than 3 km/s.

Application of Stark broadening of Sn III spectral lines in astrophysics (poster)

M. D. Christova (1), M. S. Dimitrijević, S. Sahal-Bréchot and K. Stoyanov

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Stark broadening calculated data for Sn III spectral lines are proposed for astrophysical application. The temperatures of interest are 10 000; 20 000; 30 000; 50 000; 100 000 and 150 000 K. The electron density is 1.10e15 cme-3. The obtained results for examined spectral lines are suitable and could be used for plasma diagnostics and other astrophysical purposes.

Temporal and spatial distribution of Galactic supernovae from supernova remnants statistics (poster)

Vinka Dakić (1), Bojan Arbutina (2)

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Supernova remnants (SNRs) are essential cosmic laboratories that play an important role in cosmic ray acceleration and magnetic field amplification, as well as galaxy chemical enrichment. Born from stellar explosions, they also provide information about supernova (SN) and, indirectly, star formation rate. However, the majority of SNRs do not have reliable age and distance determined. In this contribution, we analyze the temporal and spatial distribution of Galactic SNRs, focusing on estimating their ages and explosion times. Using a dynamical formula that incorporates explosion energy, mass of the ejecta, interstellar density, wind velocity and mass loss, we calculate SNR ages and compare them with those found in the literature. Based on SNRs statistics, we estimate the Galactic Type Ia SN and core-collapse SN rates. Furthermore, we discuss the problem of distance determination, selection effects and estimate the distribution and the expected number of SNRs in the Galaxy and compare these with the observational data.

Results of SANU-BAN project Gaia astrometry and fast variable astronomical objects (2023-2025) (talk)

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We established the Serbian-Bulgarian mini-network telescopes from 2013 in line with our local cooperation; there are 8 instruments: 5 in Bulgaria (at Rozhen and Belogradchik sites) and 3 in Serbia (at Astronomical Station Vidojevica - ASV site). At the end of last year We finished our SANU-BAN bilateral joint research project "Gaia astrometry and fast variable astronomical objects (2023-2025). The new one is "Astrometric and astrophysical research of variable astronomical objects" for the period 2026-2028. During 2025 we observed 15 Gaia Alerts objects: AT2021aeuk (1 time), AT2024kwu (1), TCrB (20), ZTF18aarippg (2), SN2015ap (1),

Gaia22dwj (1), Gaia23crp (4), Gaia24acn (5), Gaia24aup (8), Gaia24azc (4), Gaia23cer (6), Gaia24bux (1), Gaia24bnd (1), Gaia24axc (1) and Gaia23axx (1). Also, we did some objects in line with the international Whole Earth Blazar Telescope (WEBT) project: 0235+164, 0735+178, 0716+714, 1553+113, 1641+399, 1652+398, 1807+698, 2200+420, 2230+114, 2251+158, 2344+514, etc. Some results of our activities are presented, here.

Stark broadening data for N III spectral lines for white dwarfs and hot stars investigations (talk)

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Nitrogen atoms and ions in various ionisation stages are present in cosmic plasma. This chemical element belongs to the CNO peak of elemental abundances, so that the data on the Stark broadening of the corresponding spectral lines are important for analysis, investigation and modelling of stellar plasma, especially for white dwarfs and hot stars of A and late B spectral type. Such data are of interest for example for analysis and synthesis of stellar spectra, abundance determinations and radiative transfer calculations. In order to provide the needed Stark broadening parameters, missing in the literature, calculations have been performed for a number of N III spectral lines broadened by electron-, proton-, and helium ion-impacts, main charged particles in stellar atmospheres, by using the semiclassical perturbation theory. The obtained new Stark broadening data will be also implemented in the STARK-B database (http://stark-b.obspm.fr), a part of Virtual Atomic and Molecular Data Center (VAMDC - http://www.vamdc.org). In this contribution, we will present the obtained results and the theoretical method for their determination, as well as the possibilities of their applications in stellar physics.

Binary Companions from SDSS DR17 (talk)

Abolfazl Elsaghi (1), A. Niedzielski (2), D. Srivastava (3)

(1) Atatürk University
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We present an ongoing search for Doppler signals consistent with stellar or brown dwarf companions among a promising sample of target stars. The primary objective of this work is to produce a comprehensive catalog of both known and previously unpublished binary systems within our broader planet-search sample.

To identify and characterize these systems, we utilize combined radial velocity (RV) measurements, leveraging visit-level RVs from APOGEE-1 and APOGEE-2 in SDSS DR17. Target confirmation and extensive cross-referencing of the literature are performed using the SIMBAD database to ensure a robust sample selection. For our radial velocity and orbital analysis, we employ the Data Analysis Center for Exoplanets (DACE) platform to conduct extensive period searches and Keplerian orbital modeling of the observed RV variations. Furthermore, to break observational degeneracies and further constrain the systems, we integrate astrometric data from the Gaia mission whenever available.

Currently, our sample includes approximately 30 of the most promising RV-variable systems, including systems with supporting Gaia DR3 non-single-star (NSS) solutions. We will discuss our preliminary Keplerian analysis, the integration of Gaia DR3 NSS astrometry, and the current status of our binary star catalog.

Estimation of star's physical parameters, based on three-dimensional maps of the extinction in the Milky Way (talk)

Hristo Georgiev

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The subject of this study is the determination of the physical parameters of stars (temperature, surface gravity, metallicity, etc.), with a focus on the influence of interstellar extinction – the absorption and reddening of starlight as it passes through interstellar dust. Two sources of data for interstellar extinction were used: three-dimensional extinction maps – digital models that show the distribution of dust in the Milky Way (dustmaps: A Python interface for maps of interstellar dust, Green (2018)), and template libraries – X-shooter Spectral Library (XSL) (The X-shooter Spectral Library (XSL): Data Release 3, Verro et. al (2022)) and MUSE Library of Stellar Spectra (MUSE library of stellar spectra, Ivanov et. al (2019)) – databases of spectra of various astronomical objects used for the analysis and classification of new observations. The modeling of extinction is carried out through empirical curves (e.g., Cardelli-Clayton-Mathis (The relationship between infrared, optical, and ultraviolet extinction, Cardelli et. al (1989))) or physical models of dust grains (Mie theory, discrete dipole approximation). The Python package dust_extinction (https://dust-extinction.readthedocs.io/) is used.

Information from SIMBAD, Gaia, as well as the Bayestar19 (northern sky) (Green, Schlafly, Finkbeiner et al. (2019)) and DECaPS (southern sky) (Zucker, Saydjari, & Speagle et al. (2025)) maps was used to construct a complete three-dimensional map of extinction in the Milky Way.

It is shown how, through a combination of observations, spectral libraries, and extinction modeling, the physical parameters of stars can be determined more accurately.

Flickering of MWC 560 in 2011: Prominent quasi-periods of about 21, 40 and 50 minutes (poster)

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We analyzed again 13 pairs of *BV* archive observations. We perform our method of Structure Eminence Function (SEF). The method reveals and characterizes repetitive structures (patterns) responsible for quasi periods (QPs). The SEF method gives also QP profiles which may recognize kind of the QP – basic or or false (artificial). It also hints of the QP reason, roughly "flash" or "obscure" (Georgiev, 2023, BlgAJ 38, 120).

Now we exhibit 38 temporary QPs that lasts 15–91 min. Most prominent QP mode occurs at 21 min. Two other modes fall on 40 am 50 min. So, we confirm the main modes found by us early (Georgiev et al., 2022, BlgAJ 37, 62) through structure functions and auto-correlation functions. The flickering QPs of MWC 560 are associated with QPs of mass accretion rate on the hot component.

Re-aluminization of the Primary Mirror of the 2-m Telescope at Rozhen National Astronomical Observatory (talk)

Viktor Gerasimov (1)(2) and Milen Minev (2)

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The performance of optical observations with large telescopes is directly related to the quality of the reflective coating of the primary mirror. As a result of prolonged operation and the specific environmental conditions at the Rozhen National Astronomical Observatory, the reflective properties of the mirror gradually deteriorate, leading to reduced light-gathering power and, consequently, lower telescope sensitivity.

We present the procedure for the periodic maintenance of the primary mirror of the 2-m telescope, including its disassembly, transportation to a specialized facility for cleaning and re-aluminization, and subsequent reinstallation and restoration of the telescope's optical configuration.

We also present observational data obtained before and after the procedure in order to assess the impact of the renewed reflective coating on the telescope's observational performance.

The search for optical counterparts to isolated FASHI HI sources (talk)

Marko Grozdanović (1), Ana Lalović, Ana Mitrašinović

(1) Astronomical Observatory Belgrade

The standard ΛCDM cosmological model successfully describes the universe on large scales but faces challenges on smaller scales, notably the "missing satellite problem" where simulations predict significantly more low-mass dark matter halos than we actually observe (Klypin et al. 1999; Moore et al. 1999). A widely discussed solution to this discrepancy is the existence of "dark galaxies", dark matter halos that contain neutral hydrogen (HI) gas but have either failed to form a visible stellar population or have very few stars (Simon & Geha 2007; Sawala et al. 2016). Consequently, deep HI surveys have become the primary method for detecting these starless gas clouds (Haynes et al. 2018). However, many initial dark galaxy candidates identified in these surveys are reclassified after detailed follow-up observations. Some candidates are eventually shown to be tidal debris rather than self-gravitating halos (Davies et al. 2004; Haynes et al. 2007). Others, initially thought to be entirely dark, are later revealed to harbor extremely faint stellar components when observed with deeper optical imaging, reclassifying them as extreme low-surface-brightness (LSB) dwarf galaxies (e.g., Leisman et al. 2021; Du et al. 2024).

A prime example of this is the recently discovered HI cloud FAST J0139+4328, which was initially proposed as the first isolated dark galaxy in the local universe. However, our recent deep optical observations

unambiguously revealed an LSB optical counterpart, demonstrating that its stellar component was simply below the detection limit of previous medium-depth surveys like Pan-STARRS1 (Mitrašinović, Grozdanović, et al. 2026). To minimize the likelihood of observing tidal debris, the most promising candidates for true dark galaxies are highly isolated HI clouds located far from dense environments or massive galaxies. Nevertheless, verifying their "dark" nature requires optical imaging capable of surpassing the limits of standard wide-field surveys (which typically reach ~24-25 mag arcsec^{-2}), in order to definitively rule out ultra-faint stellar populations (O'Beirne et al. 2025; Sola et al. 2022).

Cyclic variations in the circumstellar environment of the Be/shell star 28 Tau (Pleione) (talk)

Lubomir Iliev

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28 Tau (Pleione) is a prototype of a group of Be/shell stars. It was proven that the star is binary system with a 218 days period. New evidences of variations in the circumstellar environment connected with the orbital period will be discussed.

Scientific Observations of the Total Solar Eclipse of 12 August 2026 (talk)

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Although modern ground-based and space-based observatories continuously monitor the Sun with unprecedented spatial and temporal resolution, total solar eclipses remain the only opportunity to investigate the white-light corona from the immediate vicinity of the solar limb out to several solar

radii under natural occultation conditions. Such observations provide unique diagnostics of the coronal structure and its physical properties that cannot be fully achieved by conventional instrumentation.

To take advantage of these conditions, our research team organized a scientific expedition to Spain to observe the total solar eclipse of 12 August 2026. The primary objective was to obtain high-quality observations of the solar corona and determine its structure, brightness, polarization degree, and electron density distribution of its K-coronal component. Complementary experiments were carried out to investigate eclipse-related atmospheric phenomena, including shadow bands and variations in local meteorological parameters during the different eclipse phases.

The presented report summarizes the observational campaign, instrumentation, and experimental methodology, and includes the first results obtained during the expedition. It will also contribute to a long-term database of eclipse measurements, enabling comparative studies of coronal morphology and polarization over different phases of the solar activity cycle.

Study of possible hierarchical quadruple stellar system (poster)

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In this project we will present a study of the stellar system Gaia DR3 2207132810943329536, which we observed at the "Beli Brezi" summer school in July 2025. During these observations, discrepancies with the VSX database were found. In the light curve from the TESS space telescope, we noticed two pairs of periodic eclipses. We found the orbital periods of both pairs of eclipses and, using the PHOEBE software platform, we created a model of the systems, from which we obtained the main physical parameters of the stars and their orbits.

Spectral analysis of ZTF J191814.28+010850.2 (poster)

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The binary system ZTF J191814.28+010850.2, discovered by the ZTF survey, is classified as an eclipsing binary. However, our analysis of TESS photometry, suggests that the system has been misclassified. In this poster, we present spectroscopic observations of the system showing strong emissions of the Balmer series, suggesting the system is a cataclysmic variable. Moreover, the presence of HeII λ4686 and the Bowen blend C III/ N III further indicate accretion processes. The comparable strength of HeII λ4686 and Hβ lines suggest that the system is an intermediate polar or an SW Sex type binary. Further observations are needed to clarify the exact nature of this system.

Physical properties of planetary nebulae (poster)

Alexander Jeliazkov

SU "Saint Kliment Ohridski", Bulgaria

This project presents a spectroscopic study in the optical region of NGC 6720, NGC 6826 and NGC 6543. Both low-resolution and high-resolution spectra were used. Results were obtained for 4 regions of NGC 6720 because of its large angular diameter. From the low-resolution spectra we obtained electron temperature results using the [O III](λ5007+λ4989)/λ4363 and [N II](λ6584+λ6548)/λ5755 lines, electron densities from the [S II]λ6717/λ6731, [Ar IV]λ4711/λ4740 and [Cl III]λ5517/λ5537 ratios and ionic abundances from O, N, S, Ar and Cl ions for the three nebulae, where NGC 6720 has results from the 4 regions. Using the high-resolution spectra we measured the expansion velocities of NGC 6720 and NGC 6543 and using reference radii from Gonzalez-Santamaria et al. (2021), we calculated the kinematical ages of the nebulae.

Flux variability of AGNs important for the Gaia CRF and ICRF link (poster)

Miljana D. Jovanovic (1), Goran Damljanovic (1), Oliver Vince (1), Yanko Nikolov (2), Rumen Bachev (2), and Georgi Latev (2)

(1) Astronomical Observatory, Belgrade, Serbia
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One of the main scientific goals of the European Space Agency's Gaia mission is to establish a celestial reference frame in the optical domain, the Gaia Celestial Reference Frame (Gaia CRF). This reference frame needs to be linked to the International Celestial Reference Frame (ICRF), which is defined in the radio domain using distant extragalactic objects (quasars). For this purpose, it is necessary to identify sources that can be observed in both the optical and radio domains. A sample of 47 such sources has been selected, all of which are Active Galactic Nuclei (AGNs) without detected extended emission in the radio domain. Variability of these sources in optical domain needs to be studied in detail.

AGNs are variable sources whose brightness can change on different timescales, from variations occurring during a single night to changes observed over several years. We have therefore been monitoring the brightness of these 47 objects since 2013 at the Astronomical Observatory in Belgrade, Serbia, and at the National Astronomical Observatory Rozhen, Bulgaria. The results of this long-term observational program were presented in the doctoral dissertation of M. D. Jovanović. Since the selected AGNs can exhibit variability on different timescales, continued observations are important for obtaining well-sampled light curves and for a better understanding of their intra-day, short-term and long-term behaviour.

Gaia DR4 will provide an important opportunity to further investigation, as it will contain both epoch photometry and epoch astrometry data. By combining the Gaia measurements with the ground-based observations obtained by our team, we will investigate whether changes in the optical brightness of these sources are accompanied by changes in their optical

photocenters. This comparison will help us select suitable sources for the link between the Gaia CRF and the ICRF.

The observations will be carried out within the bilateral project “Optical flux stability of 47 Active Galactic Nuclei important for the link between the Gaia CRF and ICRF systems” (MD Jovanovic-Serbian side, Y. Nikolov-Bulgarian side), as part of the cooperation between the Serbian Academy of Sciences and Arts and the Bulgarian Academy of Sciences for the period 2026–2028.

Galaxy Evolution from Multi-wavelength Observations (invited talk)

Veselina Kalinova (1)(2)

(1) Max Planck Institute for Radio Astronomy (MPIfR)
(2) Institute of Astronomy with NAO, Bulgaria Academy of Sciencec

The mechanisms that lead galaxies to strongly reduce their star formation activity (star- formation quenching) are complex and still poorly understood. To address this challenge, we developed a new star-formation quenching classification scheme based on the ionised gas distribution in galaxies. The classification suggests a more detailed understanding of the galaxy quenching process by focusing on transitional phases, rather than relying on a binary categorisation of galaxies as either quenching or star-forming. Studying the molecular and hydrogen gas within these transitional phases is fundamental to understanding how star formation is suppressed—whether due to the absence of gas or dynamical effects.

Our results from molecular gas surveys (such as CARMA-EDGE and APEX-EDGE) indicate a strong correlation between the molecular gas distribution and the quenching stage of galaxies. Complementary atomic gas data (from GBT and VLA/GMRT instruments) show that neutral hydrogen gas is much more extended than molecular gas. Galaxies below the Main Sequence of star-formation—those beginning to quench or already quenched—show patchy or ring-like HI distributions, in contrast to the well-defined, fast-rotating disks of star-forming galaxies on the Main Sequence.

We also investigate the connection between the dynamics - taking the circular velocity curves (CVCs) as a proxy for the inner gravitational potential - and star formation quenching in the galaxies. Our results show that both the amplitude of the CVC - driven by the mass of the galaxies - and its shape - which reflects the internal structure of the galaxies - play an important role in the quenching history of a galaxy.

Therefore, galaxies with different quenching patterns have likely been shaped by different—and possibly multiple—quenching or dynamical mechanisms. Further multi-wavelength investigations and a closer look at the transformation of the baryon cycle in galaxies will shed more light on the quenching process and help answer how galaxies evolve.

Contemporary Cosmological Puzzles and their possible solutions (plenary talk)

Daniela Kirilova (1), Emanuil Chizhov (1), Mariana Panayotova (1)

(1) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

During the last decades the main cosmological parameters have been determined with high accuracy. A good accordance between the contemporary cosmological model and the observational data have been found. Nevertheless, there still remain numerous puzzles, connected with inflationary stage of the Universe and the following reheating, baryon and lepton asymmetry of the Universe, Universe dark sector: dark matter, dark energy and dark radiation, Hubble tension, etc. In this talk several cosmological puzzles will be discussed and possibilities for their solutions will be presented.

Chiral Tensor Particles in the Universe (poster)

Daniela Kirilova (1), Emanuil Chizhov (1)

(1) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

We present an extended model with chiral tensor particles in the early Universe. We discuss their direct influence on the dynamics of the Universe, and their interactions: creation, scattering, annihilation and decay during the hot Universe epoch. Cosmological constraints on chiral tensor particles coupling are derived from BBN considerations.

Magnetism in single stars after the main sequence - the present picture (plenary talk)

R. Konstantinova-Antova (1), S. Georgiev (1), S. Tsvetkova (1)

(1) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

We present a review on the global picture of stellar magnetism in stars evolved after the main sequence. We consider the surface magnetic fields and the new findings of the internal magnetic fields. Future prospects of these studies are also discussed.

Astronomical seeing and meteorological conditions at Astronomical Station Vidojevica (talk)

Petar Kostić (1), Branislav Vukotić (1)

(1) Astronomical Observatory, Belgrade, Serbia

The performance of astronomical observations relies heavily on meteorological conditions, making numerous monitoring instruments a standard feature at observatories. Limited angular resolution—known as astronomical seeing-depends on atmospheric (thermal) turbulence, which typically originates from local weather factors like temperature gradients, wind speed, and surrounding terrain. In this study, we analyze test-phase data from the Astronomical Station Vidojevica seeing monitor to evaluate site-specific astronomical seeing. Furthermore, by combining this with data from the site's meteorological station, we investigate any existing

correlations between astronomical seeing and prevailing meteorological conditions.

Broadband monitoring of two comets (poster)

A. Kostov (1), M. Minev (1), G. Borisov, T. Bonev (1)

(1) Institute of Astronomy and National Astronomical Observatory, Bulgaria

Two significant cometary events happened in the year 2025: the discovery of the third interstellar comet, 3I/ATLAS, and the fragmentation of the dynamically new comet C/2025 K1 (ATLAS). The interstellar comets, predicted long ago, were still not observationally confirmed till 18-Oct-2017, when the first such object was discovered. C/2017 U1 (PANSTARRS), discovered by The Panoramic Survey Telescope and Rapid Response System (Pan-STARRS1), later became the first confirmed small body with an origin outside the Solar System - 1I/‘Oumuamua. The second one, 2I/Borisov, was discovered two years later - on 30-Aug-2019, by Gennadiy Borisov, a russian astronomer. And the third was discovered on 01-Jul-2025 by The Asteroid Terrestrial-impact Last Alert System (ATLAS). The population of these unique objects is still meager, but with the advance of observational techniques and instruments, and with the start of more new all sky programs, like PANSTARRS and ATLAS, the population of these comets will grow significantly. Studying them gives us a unique opportunity to understand the evolution of other systems, as well as our own. The second object of our present work is C/2025 K1 (ATLAS) - an Oort cloud comet, discovered 24-May-2025 by the ATLAS project. It was observed to fragment on 10-Nov-2025, soon after it passed perihelion on 08-Oct-2025. Fragmenting comets reveal significant information about the chemical composition of the early years of formation of our system. As such, they are objects of particular interest, attracting the comet community's attention.

In this work, we present our observations of these two comets. The observations were carried out with two of the telescopes of the National Astronomical Observatory Rozhen, Bulgaria - 1.5m ASA AZ1500 telescope, and 50/70cm Schmidt telescope. Three main campaigns were performed: 2025-Jul-04, 13-16-Nov-2026, and 15-17-Dec-2026. Our results are presented in the form of isophote brightness maps, giving us the

opportunity to study the evolution of these two comets. Measurements of the broadband magnitudes, along with the parameter afrho, a proxy for the dust production, are also presented.

Alternatives to the Neural Networks in the Physics Informed Neural Networks (PINNs) in some problems of Astrophysics (talk)

Ognyan Kounchev and Georgi Simeonov

Institute of Mathematics and Informatics, Bulgarian Academy of Sciences

We present the results of research devoted to the analysis of Arcade/Ribbon structures (sun flares) related to the Helmholtz equation by means of the modern approach of PINN.

Arcade structures play an important role in solar flare physics; we refer to the works of T. Wiegelmann, in 1998 and later, where Solar magnetic fields demonstrate triple arcade structures; in particular we refer to the observations of the LASCO telescope in 1996 on board of the SOHO spacecraft of Corona helmet streamers.

More recently, the Atmospheric Imaging Assembly (AIA) onboard NASA's Solar Dynamics Observatory captured a supra-arcade downflow within a solar flare that occurred on Nov. 29, 2020. In an Astrophysical context, the Helmholtz equation represents an equilibrium magnetic structure, which is the case of the magnetic arcades (ribbons) observed in the solar corona. We study the scalar flux function u allowing to deduce the magnetic field vector component in the (x, z) plane and magnetic field lines, via isocontour values of u.

We follow a recent research of Baty, and Baty-Vigon (2024), who consider the Helmholtz problem, the related triple arcade structure, and analyze it by means of the very modern approach of PINNs. This approach is characterized with extremely high computational price – they need about 50-60,000 iterations to obtain the solution in the form of Neural Network.

We present an alternative approach based on Radial Basis Functions which need about 200 iterations (with parallelization via GPU).

On the other hand the approch of Multivariate polysplines needs just 1 iteration with parallelization via GPU.

The work of GS was partially supported by a project with Bulgarian NSF within the Multilateral competition for scientific and technological collaboration in the Danube region –2024: Application of novel AI methods in analyzing Big data in Astrophysics and Physics: multidisciplinary and multilateral effort, entry number BG-175467353-2024-18-0018/FNI-238 of 17.01.2025. The work of OK was partially supported by project with Bulgarian NSF, KP-06-RILA.

Interferometric Radio Imaging and Modeling of Type II Solar Bursts (talk)

Kamen Kozarev (1), Vergil Yotov, Puja Majee, Pietro Zucca

(1) Institute of Astronomy and National Astronomical Observatory, Bulgaria

The Sun is a constant source of plasma, electromagnetic radiation and energetic particles. Solar radio bursts give us valuable information about the dynamics of magnetic fields and eruptive processes in the solar corona. Modern ground-based low-frequency radio interferometers such as the Low Frequency Array (LOFAR) allow us to probe in great detail the sources and locations of energetic electron acceleration and release. We present here our latest results of solar activity observations with low-frequency radio telescopes, including LOFAR. We also report on the progress of the development of LOFAR-BG, the Bulgarian LOFAR observing station.

The new ASA800RC telescope at Rozhen National Astronomical Observatory (talk)

Georgi Latev (1), Milen Minev (1), Dimitar Slavov (2), Anna Dikovska (2), Pencho Markishki (1)

(1) Institute of Astronomy and NAO - BAS

(2) Institute of Electronics - BAS

We present technical data from the analysis of the images, the reduction frames (bias, dark and flat), the photometric (UBVRI) filter profiles in combination with the quantum efficiency of the new C5A-150M CMOS camera attached to ASA800RC telescope of Rozhen NAO. The camera is equipped with a 5-position external filter wheel EFW-5 XL. The filter profiles were measured in July 2026 at the Institute of Electronics of the Bulgarian Academy of Sciences. The filter profiles and how they change when taking into account the quantum efficiency of the SONY IMX 411 image sensor are discussed. The report presents some recommendations and useful tips regarding the need of binning the images, the signal and noise level in dark and bias frames and the size of the fits frames itself. The RBI tests performed on August 14 and 22, 29,026 are also described and discussed. The ASA800RC telescope will be included in the new application form for upcoming observing session (2027A) and all colleagues are kindly invited to apply scientific proposals for visiting mode observations.

Multicolor photometry of the cataclysmic variable SS Cyg (talk)

D. Marchev (1), G. Yordanova (1), **A.** Georgiev (1), T. Atanasova (1)

(1) Department of Physics and Astronomy, University of Shumen, Shumen, Bulgaria

This work presents photometry in UBVRI filters of the cataclysmic SS Cyg, obtained in the interval 2024-2026 with the telescopes of the Astronomical Observatory of the University of Shumen (Kjurkchieva, D. et al. 2020; Marchev, et al. 2025). The star was observed on 20 nights, which encompass periods of both normal brightness and outburst states. The importance of SS Cyg in modern astrophysics stems from the possibility, through observations in multiple wavelengths (optical, ultraviolet and X-ray), to follow the evolution of the disk or accretion columns and to test the theory of accretion in compact objects. This makes it a valuable model for comparison with other binary systems, including X-ray milky stars and active galactic nuclei. The work presents the results of a periodogram analysis of the observations. A period with a slightly larger value than that

known in the literature so far was obtained. One possible explanation for this fact is the assumption that SS Cyg is an intermediate polar (Giovannelli et al. 1985; Marchev et al. 1999) in which full synchronization has not yet occurred.

A comparative analysis of two methods for determining the temperature of the flickering source of the star by Bruch (Bruch, A. 1992) and Nelson (Nelson et al. 2011) has been made. In fact, the Bruch method estimates the average brightness of the flickering source, while the Nelson method estimates the maximum brightness. From the obtained results, we conclude that the Nelson method gives slightly higher values, which could be expected from the initial assumption in the method. It is noticeable that the error in the Bruch method is much larger. The average value of the results from the two nights gives us a disk temperature of T=13809 ± 530 [K] in the low state and T=10939 ± 155.639 [K] in the high state. It is concluded that in the future it is better to use the Nelson method, as a method giving a smaller error and good repeatability of the results.

As future plans, we set the goal of making synchronous photometric and spectral observations for simultaneous determination of the temperature and radius of the disk.

On the Origin of Power-Law Tails of the Column-density Distribution in Galactic Star-forming Clouds (talk)

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Column-density probability distribution functions (N-PDFs) of interstellar molecular clouds is a key statistical characteristics which bears information about their physics, structure and evolutionary status. Recent observations in different tracers of star-forming regions in the Milky Way reveal that most N-PDFs display one or two power-law tails (PLTs) at their high-density end - this is usually attributed to gravitational contraction and

collapse. Double PLTs have been extracted by Schneider et al. (2022) from Herschel data of regions with various star-forming activity. Using their maps, we aim to trace the emergence of PLT at small spatial scales (<0.1 pc) where the effects of self-gravity are expected to be significant. To this end, we apply the decomposition method of Li (2022) which accounts for the contribution of structures of different sizes to a map of an arbitrary astrophysical quantity.

Not all N-PDFs exhibit a PLT. When a (single) PLT is present, it appears at scales between 0.02 pc (typical for pre-/protostellar cores) and 0.2 pc; about the upper limit, the slopes are very similar which might be an effect of low resolution.

A rational method for studying the orientation of archaeoastronomical objects (talk)

P. Markishki (1), L. Tsonev

(1) Institute of Astronomy and NAO, Bulgaria

The most important task in the study of an archaeological site, which is assumed to have had an astronomical purpose in antiquity, is to determine precisely the direction in which its system of viziers points. The report presents a photographic method by which the orientation of such an object can be determined quickly, easily and with high accuracy, with a minimum amount of equipment.

Gravitational Potential as Cumulative Relativistic Interaction Delay: Evidence from Planets, Galaxies, and Galaxy Clusters (talk)

Nikolay Markov

(1) Bulgarian Academy of Sciences, Bulgaria

Gravity is traditionally described through the curvature of spacetime or, in the Newtonian limit, through the gravitational potential generated by mass. In this work, we explore the possibility that gravitational phenomena may

be interpreted as manifestations of cumulative relativistic interaction delays associated with finite-speed propagation within self-gravitating systems. Rather than modifying established gravitational laws, the approach seeks to provide a causal interpretation of gravitational potential and spacetime curvature in terms of accumulated propagation delays between source and observer.

The proposed interpretation is examined across three distinct astrophysical regimes. First, self-gravitating planetary and stellar bodies are considered. The framework implies a connection between characteristic internal propagation speeds and escape velocities through the equivalence of the associated relativistic time-dilation factors. Comparison with observational data reveals a close correspondence between these quantities in gravity-shaped bodies possessing coherent internal propagation paths.

Second, the framework is extended to galaxies, where gravitational and kinematic time-dilation effects coexist. In this mixed regime, orbital motion contributes significantly to the cumulative delay, providing a natural interpretation of the observed connection between characteristic velocities and gravitational dynamics.

Third, galaxy clusters are examined as systems in which collective kinematic effects become increasingly important relative to gravitational time-dilation contributions. Observed relations among velocity dispersion, gravitational redshift, and lensing mass are shown to be consistent with the hypothesis that these observables probe a common underlying delay structure. In this interpretation, planetary interiors, galaxies, and galaxy clusters probe cumulative interaction delays through internal material propagation, mixed material–gravitational interactions, and large-scale gravitational dynamics, respectively.

The results suggest that cumulative relativistic interaction delay provides a unified phenomenological interpretation of gravitational behavior across multiple astrophysical scales. The proposed framework preserves the observed gravitational phenomenology described by General Relativity while offering a possible physical explanation for the origin of the associated spacetime curvature. This interpretation motivates further investigation of finite-speed interaction effects in self-gravitating systems.

Column-density distribution in gravitationally coherent regions of star-forming clouds (talk)

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(2) Department of Applied Physics, Faculty of Applied Mathematics, Technical University-Sofia, 8 Kliment Ohridski Blvd., Sofia 1000, Bulgaria

We present an analysis of structures delineated on two kinds of maps of the star-forming clouds Perseus and Orion A: i) integrated-intensity 13CO(1-0) maps from the COMPLETE survey (Ridge et al., 2006) and Bell Laboratories (Bally et al., 1987); and, ii) maps of the gravitational boundedness as measured by the quantity G-virial (Guang-Xing Li et al. 2015). We derive the probability distribution functions (PDFs) of column density and of G-virial and gauge the contribution of gravitationally coherent regions to the power-law tails of the column-density PDFs. The work is a continuation of the ongoing exploration of the G-virial method and its possible applications.

Modelling the evolution of density distribution in starf-forming clouds as a Markov process (poster)

H. Mihaylov (1), T. Veltchev (1), S. Donkov (2)

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(2) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, 72 Tsarigradsko Chausee Blvd., 1784 Sofia, Bulgaria

The analysis of the probability distribution function of mass density (rho-PDF) is an often used tool for study of star formation in turbulent interstellar medium. We reproduce the evolution of the rho-PDF in turbulent, self-gravitating clouds prior to the formation of first stars through a continuous Markov process. The latter is run by use of Monte Carlo simulations following the approach of Scannapieco & Safarzadeh (2018) but varying the virial parameter as a function of turbulent crossing time.

Power-law tails of the rho-PDF emerge at later stages, as expected from numerous hydrodynamic simulations.

Комплекс Астрономске опсерваторије у Београду као аутентична амбијентална целина: спој науке, културе и уметности (talk)

Весна Мијатовић, Ненад Миловановић

Астрономска опсерваторија, Београд, Србија

Промена културног пејзажа на некадашњем брду Велики Врачар, на локацији 'кота 253' на Лаудановом шанцу, била је условљена потребама науке тридесетих година 20. века. Она је одражавала настојања да се кроз модернистички пројекат комплекса Астрономске опсерваторије представи модернизација новонастале југословенске државе, и то кроз специфичну визуелну и функционалну естетику. Овај рад се пре свега односи на приказ синкретичког споја науке, културе, архитектуре и природе који је на овом простору настао протоком времена. Поменути процес трансформације одвијао се постепено током скоро сто година — од изградње грађевинског комплекса Јана Дубовија 1932. године, па све до савременог доба.

Technical performance and first results of new 80cm telescope at Rozhen NAO (talk)

Milen Minev (1), Nikola Petrov (1), Georgi Latev (1)

(1) Institute of Astronomy and National Astronomical Observatory, Bulgaria

The RC800 telescope is designed with modern optical and mechanical components and aims to enhance the observation capabilities of the Rozhen National Astronomical Observatory. Here we present the initial tests, setup procedures, and results from the conducted observations. The tests include checking the performance of the instrument itself and photometric observations of various types of objects. The results of these initial tests

provide us with valuable insights into the capabilities of the telescope and help us to improve the observations at Rozhen NAO.

Disc properties of the gamma Cas analogue MWC 1023 (talk)

Miroslav Moyseev

Institute of Astronomy and National Astronomical Observatory, Bulgaria

MWC 1023 is a Be/X-ray binary with a possible white dwarf companion, placing it within the unusual and still poorly understood family of gamma Cas-type systems. The main component is a Be star of class B0.5V-IIIe. Using high-resolution spectroscopy from the 2-m RCC telescope of Rozhen NAO, Bulgaria and archive data from SOPHIE, we study its circumstellar disc properties and interstellar extinction towards the object. Balmer emission signatures reveal a disc in optically thick regime. The asymmetric profiles of the Balmer, He II and Fe II emission lines evolve on long timescales with low-amplitude variability in their equivalent width. We also find variability in the degree of polarization of MWC 1023, using spectropolarimetric data obtained with the 2-m telescope. The observed variability in both the emission-line properties and the degree of polarization suggests ongoing structural changes in the circumstellar disc around the Be star, affecting both its emission and scattering properties.

New *BVRI* photometry of the young star GM Cep (talk)

Asen Mutafov (1), Evgeni Semkov (1), Stoyanka Peneva (1), Sunay Ibryamov (2)

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The report presents the results of new four-color photometric observations of the young star GM Cep, obtained between November 2020 and June 2026. These observations are a continuation of our photometric monitoring of the star, which began in 2008. The analysis of the new observational data

shows that the star continues to exhibit strong, large-amplitude photometric variability. Several deep declines in brightness were observed, showing different shapes, while no evidence of periodicity was detected. The collected photometric data reveal the color reversal typical of UXor variables during brightness minima, providing evidence for variable extinction caused by the circumstellar environment. It is very likely that the variability of GM Cep is dominated by fading events rather than bursting events.

Spectropolarimetric Observations with FoReRo2: Instrument Overview and Scientific Applications (poster)

Янко Николов

Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

This talk presents the capabilities of the FoReRo2 (2-Channel Focal Reducer Rozhen) instrument mounted on the 2-m RCC telescope at the Rozhen National Astronomical Observatory, with a focus on its spectropolarimetric observing modes. The main characteristics of the instrument are reviewed, together with the calibration methods based on observations of standard stars.

The results of a ten-year monitoring program of highly polarized standard stars are discussed, including cases of detected variability that have direct implications for their suitability as calibration standards.

The scientific potential of FoReRo2 is demonstrated through observations of various classes of objects, including the recurrent nova RS Oph, and the symbiotic stars SU Lyn and Z And. Particular emphasis is placed on the role of spectropolarimetry as a tool for investigating the geometry of ejected material, dust formation processes, and the connections between different classes of astrophysical objects.

Ellipticities of the Central Regions of Old Galactic Globular Clusters (talk)

Maria Petkova (1), Georgi Petrov (1), Orlin Stanchev (1), Nikolay Tikhonov (2), Petko Nedialkov (1)

(1) Department of Astronomy, Faculty of Physics, Sofia University 'St. Kliment Ohridski'
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Our study focuses on the globular clusters M2 (NGC 7089) and M15 (NGC 7078), which represent two particularly interesting and contrasting cases. Both systems are old, metal-poor clusters with ages of approximately 13 Gyr, yet they represent different stages of dynamical evolution. M2 is considered a complex system and is likely associated with the remnant core of a former dwarf galaxy. In contrast, M15 is a dynamically evolved globular cluster that has undergone core collapse. Its steep central density profile and high central concentration are indicative of advanced dynamical evolution. The comparison between M2 and M15 is therefore particularly valuable. By analyzing elliptical isodensity profiles measured from the cluster centers out to a radius of 9 arcmin, we aim to investigate how their different dynamical evolutionary stages are reflected in the observed structural parameters, including ellipticity, position angle, and cluster-center coordinates.

Ground-Based Full-Disk Observations of the Solar Chromosphere in Hα and Ca II K (poster)

N. Petrov (1), Ts. Tsvetkov, M. Minev, M. Andjelic, D. Urosevic

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The observations of the solar chromosphere provide essential information on the evolution of active phenomena associated with space weather. We present the capabilities and observational performance of the solar telescope system operating at the National Astronomical Observatory for full-disk

imaging in the Hα (6562.8 Å) and Ca II K (3933.7 Å) spectral lines. The system consists of two refracting telescopes with free apertures of 130 mm and 100 mm, equipped with narrowband filters of <0.5 Å (Hα) and <2.4 Å (Ca II K), respectively. These complementary spectral diagnostics enable routine monitoring of chromospheric structures, including sunspots, plages, filaments, prominences, and flare activity. The telescopes are coupled with 16-bit high-speed digital cameras capable of recording up to 20 frames per second, providing sufficient temporal resolution to investigate the evolution of rapidly changing solar features.

The combination of Hα and Ca II K observations offers a unique opportunity to investigate solar activity by probing different layers of the lower solar atmosphere, from the upper photosphere to the chromosphere.

Observations of the Sun from the Astronomical Center of the University of Shumen (poster)

S. Petrov (1), D. Marchev (1), S. Ibryamov (1), R. Miteva (2), M. Dechev (2)

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(2) Institute of Astronomy and National Astronomical Observatory, Bulgarian Academy of Sciences

The Astronomical Center "Prof. Dr. F.M.N. Vladimir Shkodrov" operates the university's Astronomical Observatory "Prof. Diana Kyurkchieva", located in the Shumen Plateau Nature Park. Here we present the first results of a dedicated solar-observation programme carried out with this facility.

Observations are performed with a Coronado PST (Personal Solar Telescope) equipped with an integrated H-alpha filter. First test observations, obtained on 23 September 2025, resolved several sunspot groups despite a weak interference pattern in the instrument that still requires improvement.

Subsequent observations documented sunspot groups on 31 May 2026, consistent with the elevated activity reported. Some prominences were observed later on.

These results demonstrate that the refurbished solar-observation setup at the Astronomical Center of Shumen University is capable of producing scientifically meaningful, quantitative observations of solar activity comparable to data from dedicated solar observatories. Further development of the programme is envisaged and discussed within a planned national network of solar observations.

H-alpha observations at the Belogradchik observatory (invited talk)

W. Pötzi (1), M. Dechev (2), R. Miteva (2), P. Markishki (2)

(1) Kanzelhöhe Observatory, University of Graz
(2) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

As part of the Bulgarian-Austrian project "Joint observations and investigations of solar chromospheric and coronal activity," this work reports on the establishment of patrol solar observations in Bulgaria. The newly configured telescope setup at Belogradchik underwent initial trials. Test observations conducted during the summer of 2026 successfully demonstrated the operational readiness and performance of the observation system.

Inner heliosphere as a source of virtual relativistic particles fluxes (poster)

R. Shkevov (1), N.N. Zolnikova (2, 3), L.A. Mikhailovskaya (2)

(1) Space Research and Technology Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria
(2) Space Research Institute, Russian Academy of Sciences, Moscow, Russia
(3) Russian University of Transport, Moscow, Russia

In this work, the resonant interaction between charged particles and electromagnetic waves in space plasma in the presence of a transverse weak constant magnetic field is studied. Second order nonlinear nonstationary differential equation for the wave phase on the particle trajectory is solved numerically. The Cherenkov resonance conditions for these experiments are fulfilled exactly. Numerical experiments are conducted with carefully chosen parameters for the differential equation initial conditions, corresponding to relativistic particle energies. Additionally we assume that the wave and the particle move toward each other. The simulations analysis demonstrate that on the base of the energy exchange between waves and particles, the direction of the particles can be reversed. Further research shows that the final particle energy after resonant interactions is quite similar to the initial one, but with the velocity vector pointed in the inverse direction. The calculations results from the numerical experiments are presented in the graphical form. Based on this, we can conclude that the inner heliosphere region, where the resonant interactions occur, acts as a new virtual source of relativistic particle fluxes.

Urban Observatory of Belgrade (UrbObsBel): Study of Light Pollution in Serbia using the TESSW Night Sky Brightness Photometer (talk)

Z. Simić (1), G. Damljanović, S. Samurović, R. Pavlović, B. Rovčanin, Z. Cvetković, D. Bjelajac and D. Lukić

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In this contribution we describe the Urban Observatory of Belgrade (UrbObsBel), a three-year project funded by the Science Fund of the Republic of Serbia started in January 2024 and its instruments used for the study of light pollution. The instruments were mounted at the Astronomical Observatory of Belgrade (AOB) and at the Astronomical Station Vidojevica (ASV). Here we present our results on light pollution levels measured using the TESS-W photometer which is designed to measure and continuously monitor the night sky brightness at both observing stations: the AOB is in the urban area with high levels of light pollution, whereas the ASV in one

of last remaining dark areas in the southern Serbia. We show that there is an increase of light pollution in Belgrade and that at the Vidojevica mountain the opposite is true. This research was supported by the Science Fund of the Republic of Serbia, no. 6775, Urban Observatory of Belgrade.

Selection available Trans-Iron Elements in White Dwarfs for calculation parameters of collisional broadening (poster)

Zoran Simić (1) and Nenad Sakan (2)

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The stellar spectrum can reveal many properties of stars, such as their chemical composition, temperature, density, mass, distance and luminosity. Therefore, spectroscopy with its methods is an important tool in the investigation and study of the physical properties of many types of celestial objects such as planets, nebulae, galaxies and active galactic nuclei.

In this sense, knowledge of atomic data on the elements present in the stellar atmosphere is of great importance. These data can be experimental and theoretical and are inseparable in importance for research in stellar spectroscopy.

The shape of the spectral line is determined by natural broadening, Doppler and collisional broadening. In this work, we considered Stark broadening as the dominant form of collisional broadening of the spectral lines for several elements of the Trans-Iron group. We applied a modified semi-empirical theory (MSE) which is suitable for these elements due to the lack of atomic data, instead of complete semi-empirical method (SE), given examples.

Photometric Observations of Flickering of Mira with the NAO Rozhen 50/70-cm Schmidt Telescope (talk)

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Mira (Omicron Ceti) is one of the first observed variable stars. More than four centuries later its binary system still poses some conundrums. Here we review the results of our photometric observations in Johnson UBV bands of its flickering by means of the NAO Rozhen 50/70-cm Schmidt Telescope, published in our three most recent papers. We find the colours, temperature and radius of the flickering source of Mira B. During the November 2024 minimum of Mira A pulsation, we proceed to further refine these, as well as estimate the mass accretion rate, assuming a Mira B mass of 0.6 M⊙. Finally, in the course of the August-October 2025 minimum, we find the luminosity of the flickering source and estimate the luminosity of the accretion disk. Refining the mass accretion rate, and assuming a white dwarf accretion through Wind Roche Lobe Overflow, we find Mira B to be an extremely low mass white dwarf with Mwd=0.24±0.04M⊙.

We acknowledge project KP-06-H98/8, ”Accretion flows in binary stars” Bulgarian National Science Fund.

GLOBuFIT: From Stellar Density Points to Cluster Shape - An Interactive Workflow for Ellipse Fitting in Globular Clusters (talk)

Orlin Stanchev (1), Georgi Petrov, Maria Petkova, Petko Nedialkov

(1) Sofia University, Department of Astronomy, Faculty of Physics

GLOBuFIT is an interactive desktop software application for globular-cluster morphology analysis based on ellipse fitting of stellar-density contours. Rather than introducing a fundamentally new fitting formalism,

the primary contribution is a complete, research-oriented software environment that makes the workflow practical, transparent, and reproducible. GLOBuFIT unifies data preparation, contour-point selection, interactive filtering, iterative re-fitting, and export of publication-ready plots and metrics within a single graphical interface.

The software also introduces methodological refinements for uncertainty analysis by supporting two complementary error-estimation modes: bootstrap resampling (robust, distribution-aware) and Jacobian-based local approximation (fast, diagnostic). This dual approach enables side-by-side assessment of parameter stability and sensitivity to data selection.

For each fit, GLOBuFIT reports center coordinates, semi-major and semi-minor axes, position angle, and derived morphology indicators (axis ratio, ellipticity, eccentricity), together with uncertainty estimates and evolution diagnostics. The result is a practical platform for interactive experimentation and consistent reporting in comparative studies of globular cluster structure.

The perimeter-area relation as a diagnostic of fractal dimension for dendrogram objects in molecular clouds (poster)

Orlin Stanchev (1), Todor Veltchev, Hristiyan Mihaylov, Lyubov Marinkova, Sava Donkov

(1) Sofia University, Department of Astronomy, Faculty of Physics

Molecular clouds exhibit complex hierarchical structure over a wide range of spatial scales, commonly associated with the turbulent nature of the interstellar medium. In previous work, we used dendrograms extracted from ^{12}CO and ^{13}CO integrated-intensity maps of the Rosette molecular cloud to trace its hierarchical structure and estimate the mass fractal dimension as a function of spatial scale. The resulting variation of the mass dimension suggested multifractal behavior of the cloud.

Here we investigate whether the classical perimeter-area relation can provide an independent geometrical diagnostic of fractality when applied to hierarchically identified dendrogram objects. Areas and perimeters of

individual dendrogram structures are measured and their scaling relation is used to derive the perimeter fractal dimension. Attention is paid to whether this diagnostic reveals scale-dependent behavior consistent with multifractality. As a control experiment, the same analysis is applied to dendrogram structures extracted from synthetic monofractal maps with known fractal properties. Comparison between the observational and synthetic samples allows us to assess whether the combination of dendrogram decomposition and perimeter-area scaling can reliably discriminate between mono- and multifractal structure, and to identify possible biases introduced by the hierarchical segmentation itself.

TOI-2361 - a system of a Warm Jovian Exhibiting Transit Timing Variations Indicating a Nearby Companion, and Evidence for a Cold Jupiter from HARPS and FEROS (talk)

Stefan Stefanov (1)(2), Djemma Ruseva (2), Trifon Trifonov (2)(3)

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(2) Department of Astronomy, Faculty of Physics, Sofia University 'St. Kliment Ohridski', Bulgaria
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We present the characterization of TOI-2361, a solar-type G-dwarf ($M_\star$ = 0.996 ± 0.04 $M_\odot$, $R_\star$ = 0.988 ± 0.02 $R_\odot$) hosting a compact, dynamic planetary system. TESS photometry (Sectors 10, 37, 63 and 101) reveals a transiting warm Jovian-mass planet, TOI-2361 b ($P_b \approx 8.71$ days, M_b = 0.71 M_{Jup}). This planet shows strong TTVs with a super-period of about 320 days. As part of the WINE collaboration, we obtained RV follow-up with FEROS and HARPS, confirming the transiting planet and uncovering an additional long-period signal. A joint N-body analysis of the TTVs and RVs indicates that the TTVs are best explained by an inner, non-transiting Neptune-mass perturber, TOI-2361 d ($P_d \approx 4.47$ days, $M_d \approx 0.049$ M_{Jup}). This perturber is locked in the 1:2 mean-motion resonance with planet b, a configuration confirmed to be dynamically stable over long-term integrations. This perturber remains undetected in the RVs themselves. Injection-retrieval tests place an upper limit of less than 15 m/s on its RV

amplitude. The extended FEROS baseline also suggests a cold, long-period super-Jupiter, designated TOI-2361 c (Pc ≈ 2600 days, Mc sin i ≈ 6.5 M_Jup), on a nearly circular orbit near 3.7 au. We will discuss this setup, which includes a resonant inner pair and a distant massive companion. We will also highlight the challenges of uniquely identifying TTV perturbers without RV confirmation.

Spectropolarimetric Study of the Stellar Wind Bow Shock Nebulae around BD +43 4654 and HD 195592 (poster)

Desislava Stefanova (1) and Yanko Nikolov (1)

(1) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

A bow shock nebula forms when the stellar wind of a massive star moving supersonically through the interstellar medium interacts with the surrounding gas, producing a curved, aspherical shock structure. These nebulae provide valuable information about the stellar motion, the properties of the stellar wind, and the physical conditions of the local interstellar medium.

In this work, we present spectropolarimetric observations of the stellar wind bow shock nebulae associated with the O-type runaway stars BD +43 4654 and HD 195592, aimed at probing the scattering geometry within the shocked regions. Scattering of stellar radiation by dust and free electrons generates measurable linear polarization, with the polarization position angle tracing the projected symmetry axis of the nebula. Our observations were obtained using the FoReRo2 instrument mounted on the 2 m RCC telescope at the Bulgarian National Astronomical Observatory Rozhen.

This study is part of an ongoing systematic spectropolarimetric program targeting stellar wind bow shock nebulae around massive runaway stars. Here, we present results, which aim to provide observational constraints to complement theoretical models of these aspherical structures.

AI-Based Segmentation of Solar Eruptive Phenomena and Space Weather Prediction: Recent Advances at the Solar Physics Group, IA NAO, BAS (talk)

Oleg Stepanyuk

Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

The ESA Vigil mission, scheduled for launch in 2031, will provide unique opportunity for stereoscopic solar observations from the Sun–Earth Lagrange point L5 — a vantage point that, as demonstrated by NASA's STEREO mission, enables three-dimensional reconstruction of coronal mass ejections (CMEs) otherwise seen only in projection. Solar Energetic Proton (SEP) events associated with such eruptions pose significant risks to satellite operations, telecommunications, and human spaceflight, demanding accurate short-term flux forecasting across operational energy channels.

Here we discuss two complementary compact deep learning frameworks addressing both aspects of this challenge, and have potential for on-board applications. For solar eruptive feature recognition, we extend our previously developed wavelet-based algorithmic pipeline — validated on ground- and space-based coronagraphic and EUV data — to the set of physically relevant Compact Coronagraph (CCOR) events. We improve wavelet parameter tuning through grid-search heuristic scoring, and train CNN segmentation models on the resulting pipeline output to further advance automation in preparation for Vigil operations. We additionally discuss the feasibility of CME front three-dimensional reconstruction using neural surface representations (NeRF), moving beyond simplified geometric assumptions toward data-driven 3D modelling validated against synthetic CME datasets with known ground truth.

For SEP flux prediction, we describe a Transformer-based deep learning architecture operating in a Multi-Input Multi-Output (MIMO) configuration, forecasting hourly-averaged integral flux across three standard GOES energy channels (>10, >30, and >60 MeV) over four solar cycles. The model ingests physical drivers — F10.7 index, sunspot number, solar wind speed, interplanetary magnetic field strength, and NOAA active region characteristics — and leverages self-attention to capture long-range temporal dependencies in solar activity pattern.

Together, these compact task-specific models reflect a deliberate design philosophy: interpretable, physically informed architectures optimised for operational deployment under data constraints typical of space weather monitoring. Looking ahead, we discuss how both frameworks may be complemented by emerging vision foundation models — such as IBM/NASA Surya — which offer broad pre-trained representations that could reduce labelled data requirements and improve generalisation across instruments and solar cycle phases, while preserving the domain specificity that operational forecasting demands.These developments collectively advance the infrastructure needed to exploit perspectives for real-time stereoscopic CME tracking, 3D reconstruction, and SEP risk mitigation.

The peculiar X-ray binary 4U 2206+54 (talk)

Kiril Stoyanov

Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

We present a combined kinematic and spectroscopic study of the peculiar high-mass X-ray binary 4U 2206+54. We traced back the motion of the system and find that it most likely originated in a subgroup of the Cepheus OB1 association. The derived kinematic age is 2.8 Myr, while the system is currently located at a distance of 3.1–3.3 kpc and moves with a runaway velocity of 75–100 km/s relative to the probable parent association. Such a high peculiar velocity implies substantial mass loss during the supernova explosion that formed the neutron star, corresponding to ~4–9 solar masses, and requires a natal kick of at least 200–350 km/s. Assuming membership in Cep OB1, the neutron-star progenitor must have evolved off the main sequence within $\lesssim$7–9 Myr, implying an initial mass of $\gtrsim$32 solar masses. In addition, high-resolution optical spectroscopy reveal a variable Hα-emitting circumstellar disc with an outer radius ranging from 7.9 to 15.2 solar radii. The inferred disc size suggests that, during epochs of a small disc, the neutron star does not reach the outer disc regions at periastron.

Cosmic Ray Variations Recorded by the MNM-ROZH Mini-Neutron Monitor Station (talk)

Ts. Tsvetkov (1), N. Petrov, M. Minev, B. Arbutina

(1) Institute of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria

Transient variations in the galactic cosmic ray intensity provide valuable information on the propagation of solar disturbances through the heliosphere and their interaction with the near-Earth environment. Among the most prominent of these events are Forbush decreases, which are commonly associated with coronal mass ejections and interplanetary shocks and can be used to investigate solar-terrestrial relationships.

We present an analysis of selected cosmic ray variations recorded by the MNM-ROZH mini-neutron monitor station, operating for more than a year now at the National Astronomical Observatory of the Bulgarian Academy of Sciences. The station consists of three compact neutron monitor units equipped with BF_3 proportional counters (LND2043) and provides continuous measurements of secondary cosmic rays.

The detected events are analysed together with solar and interplanetary conditions to investigate their origin and evolution. The results demonstrate the capability of the MNM-ROZH station to detect transient cosmic ray variations and highlight its role as a valuable component of the international ground-based cosmic ray monitoring network and in studies of solar-terrestrial interactions.

Magnetic field of FI Cnc (talk)

Svetlla Tsvetkova (1), Pascal Petit (2,3), Renada Konstantinova-Antova (1), Ana Borisova (1), Ivanka Stateva (1)

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(3) Université de Toulouse, UPS-OMP, Institut de Recherche en Astrophysique et Planétologie, Toulouse, France

FI Cnc is a single giant of spectral class G8 with a fast rotation (rotation period equal to 29.1 days). Its chromospheric activity is reported in the 90s. This star is one of the single late-type giants from the sample of Auriere et al. (2015) where the authors measure its longitudinal magnetic field Bl for the first time and show that FI Cnc fits the relation "strength of the magnetic field – stellar rotation period". Based on the whole study, they suggest that the giant probably possesses an α-ω dynamo. In the current study, we present three datasets of spectropolarimetric observations for the periods 2008, 2013 and 2015. Three magnetic maps are reconstructed employing the Zeeman Doppler imaging method. The magnetic field of FI Cnc is variable and complex showing an evolution during the three epochs of observations. The toroidal component of the magnetic field experiences two polarity switches between 2008 and 2015. Further observations are needed to understand whether the giant goes through irregular variations of the magnetic field or magnetic cycle(s).

Cygnus loop: non-radiative and radiative filaments in optical and radio (invited talk)

Dejan Urošević

Department of Astronomy, Faculty of Mathematics, University of Belgrade

We have recently observed with the Karl G. Jansky Very Large Array (JVLA) radio interferometer, previously optically observed non-radiative and radiative filaments in Cygnus Loop supernova remnant (SNR) with the Rozhen telescope, in order to determine radio spectral indices for both types of filaments. By JVLA observations at 1 and 5 GHz, we detected only radiative filaments in the field of view, in which non-radiative optical filaments are also present, but were not detected in radio. We observed spectral slopes characteristic of the thermal radiation mechanism from the radiative filaments in Cygnus Loop, contrary to the expected non-thermal spectral slopes characteristic of SNRs.

Distance determination to the Galactic supernova remnants (talk)

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Determining distances to Galactic supernova remnants (SNRs) remains a challenging task, largely because radio observations continue to be the primary means of detecting and studying these objects. This work therefore reviews the various approaches used to determine distances to Galactic SNRs, with particular emphasis on methods that extend beyond traditional radio-based techniques.

Photometric study of luminous blue variables in IC342 (poster)

Antoniya Valcheva (1) and Petko Nedialkov (1)

(1) Department of Astronomy, Faculty of Physics, Sofia University 'St. Kliment Ohridski'

Luminous Blue Variables (LBVs) are characterized by photometric variability over a wide range of timescales and amplitudes. Most detailed studies of LBVs have focused on stars in the Milky Way and Local Group galaxies. The study of LBVs in more distant nearby galaxies can provide additional information on their variability and evolution in different galactic environments. We present preliminary results from our long-term optical photometric study of two spectroscopically selected LBV candidates in IC 342, F3.7 and F7.3 (Sholukhova et al. 2024). BR-band observations were obtained from 2019 to 2025 with the FoReRo2 instrument mounted on the 2-m RCC telescope at NAO Rozhen, Bulgaria. The photometric variability of the two stars is investigated through their optical light curves on different timescales, together with their color behavior. To extend the temporal coverage, our ground-based photometry is supplemented with archival HST and Pan-STARRS photometry and ZTF observations. The combined data set provides a long temporal baseline for investigating the long- and short-term photometric variability of these two LBV and their color changes.

Mapping Martian Dunes and Wind Patterns Using GIS and Satellite Data (talk)

Aleksandar Valjarević

University of Belgrade, Faculty of Geography, Department of Geospatial and Environmental Science, Studentski trg 3/III, 11000 Belgrade, Serbia

The growing availability of high-resolution orbital observations of Mars has created new opportunities to integrate astronomy, planetary remote sensing, and Geographic Information Systems (GIS) in the study of Martian surface processes. This study examines the spatial distribution of Martian dunes, aeolian landforms, and prevailing wind patterns using satellite imagery, Digital Elevation Models (DEMs), and GIS-based spatial analysis. Orbital datasets from the USGS Astrogeology Science Center and major Mars exploration missions were processed, georeferenced, enhanced, generalized, and vectorized within a GIS environment. The analysis focused on the relationships among dune fields, topography, geological units, and inferred wind directions. Results show a strong concentration of dune systems in the southern hemisphere, particularly within and around the south polar regions, with additional prominent dune fields identified in Noachis Terra, Argyre Planitia, Sinai Planum, and Valles Marineris. Patterns of dune morphology and regolith transport indicate persistent aeolian activity and support the reconstruction of dominant wind trajectories across diverse Martian geological settings. By combining astronomical satellite observations with GIS and remote sensing, this study demonstrates an effective framework for interpreting present-day and past surface-atmosphere interactions on Mars. This interdisciplinary approach advances planetary astronomy by improving understanding of Martian atmospheric circulation, geomorphological evolution, regolith dynamics, and environmental conditions relevant to future robotic and human exploration of the Red Planet.

Active zones - connections with the disk structures (poster)

Krasimira Dimitrova Yankova

Space Research and Technology Institute, Bulgarian Academy of Sciences

In this paper, we consider the accretion disk of a compact object. In the process of evolution, zones of activity are formed and the disk developed structures (spirals, corona ...). We analyze a zone features and the connections whit behavior of the disc spirals. We investigate the energy exchange in the disk and how it support the structures appearance.

Spectral signatures of accretion flows (poster)

R. Zamanov (1), M.D. Christova, S. Kandzichka, M. Moyseev, K.A. Stoyanov, M.F. Bode, V. Marchev

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Accretion processes in interacting binary systems produce a wide range of spectroscopic signatures that probe the physical conditions and dynamics of circumstellar material. We present results from a spectroscopic monitoring program of Be/X-ray binaries, symbiotic stars, and recurrent novae conducted within the project Accretion Flows in Binary Stars. High-resolution spectra were obtained with the 2m Rozhen Telescope and the 2m Liverpool Telescope, enabling analysis of the emission lines and their variability.

Our observations reveal diverse and highly variable emission line profiles that trace different accretion environments. In the recurrent nova T CrB, subtraction of the red giant spectrum uncovers double-peaked HÎ± emission originating from the accretion disc around the white dwarf, while long-term monitoring demonstrates substantial variability in the HÎ±, HÎ², He I and He II emission lines. In the Be/X-ray binary MWC 656, HÎ² consistently exhibits a double-peaked profile, whereas HÎ± displays single, double, triple-peaked, and more complex morphologies, indicating perturbations of the circumstellar disc by the compact companion. In the symbiotic star TX CVn, subtraction of the giant's spectrum reveals a P Cygni profile in HÎ±, suggesting the presence of an outflow from the hot component.

Long-term spectroscopic monitoring is essential for understanding the evolution of accretion flows and the mechanisms driving their observed variability.

We acknowledge project KP-06-H98/8 "Accretion flows in binary stars", Bulgarian NSF.

Low relativistic electrons trapping regions near Cherenkov resonance (poster)

N.N. Zolnikova (1,2), R. Shkevov (3), L.A. Mikhailovskaya (1)

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(2) Russian University of Transport, Moscow, Russia
(3) Space Research and Technology Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria

We study the acceleration of low relativistic electrons by electromagnetic waves in calm plasma. According to the modern models of the heliosphere there are several regions where surfatron particle acceleration can take place. As the main mathematical model we use exact second order nonlinear nonstationary differential equation for the electromagnetic wave phase on the electron trajectory derived from the relativistic equations of motion. Simulating this equation numerically we analyse in which areas in the space of initial conditions the electron capture takes place. We show that in these regions the necessary conditions of Cherenkov resonance are fulfilled only approximately. We also compare the acceleration process of trapping electrons that are in exact resonance with the wave and those in the near resonant region. Our results show that the final gained energy for both cases is of the same order. This fact can lead to an increase of the number of captured electrons and explain the observable cosmic rays spectra variability. We present the results of our simulations in a graphical form.

Program

XV Bulgarian-Serbian Astronomical Conference

13 – 18 September
Varna, Bulgaria

13.09.2026 Sunday

14:00 - 15:00 - Arriving at the hotel and registration
15:00 - 17:00 - Visit of Euxinograde residence (optional)
18:00 - 19:00 - Welcome party

14.09.2026 Monday

9:00 - 9:30 - Registration
9:30 - Official opening of the conference

Session 1 - Chairman : Kamen Kozarev

9:45 - 10:05 - Milan S. Dimitrijević - Fifteen Bulgarian and Serbian Astronomical Conferences - **invited talk**
10:05 - 10:35 - Gordana Apostolovska - A Retrospective Analysis of CCD Photometry of Asteroids: A Quarter-Century at BNAO Rozhen and Nearly a Decade at AS Vidojevica - **invited talk**
10:35 - 11:00 - Goran Damljanovic - Results of SANU-BAN project Gaia astrometry and fast variable astronomical objects (2023-2025)

11:00 - 11:20 - Coffee break

Session 2 - Chairman : Svetla Tsvetkova

11:20 - 11:40 - Branislav Vukotić - Astronomical seeing and meteorological conditions at Astronomical Station Vidojevica
11:40 - 12:00 - Georgi Latev - The new ASA800RC telescope at Rozhen National Astronomical Observatory

12:00 - 12:20 - Zoran Simić - Urban Observatory of Belgrade (UrbObsBel): Study of Light Pollution in Serbia using the TESSW Night Sky Brightness Photometer
12:20 - 12:50 - Pencho Markishki - A rational method for studying the orientation of archaeoastronomical objects

12:50 - 14:00 - Lunch

Session 3 - Chairman : Milan S. Dimitrijević

14:00 - 14:30 - Ognyan Kounchev - Alternatives to the Neural Networks in the Physics Informed Neural Networks (PINNs) in some problems of Astrophysics
14:30 - 14:50 - Hristiyan Mihaylov - Column-density distribution in gravitationally coherent regions of star-forming clouds
14:50 - 15:10 - Orlin Stanchev - GLOBuFIT: From Stellar Density Points to Cluster Shape - An Interactive Workflow for Ellipse Fitting in Globular Clusters

15:10 - 15:30 - Coffee break

Session 4 - Chairman : Dragomir Marchev

15:30 - 15:50 - Borislav Spassov - Photometric Observations of Flickering of Mira with the NAO Rozhen 50/70-cm Schmidt Telescope
15:50 - 16:10 - Kiril Stoyanov - The peculiar X-ray binary 4U 2206+54
16:10 - 16:30 - Stefan Stefanov - TOI-2361 - a system of a Warm Jovian Exhibiting Transit Timing Variations Indicating a Nearby Companion, and Evidence for a Cold Jupiter from HARPS and FEROS
16:30 - 16:45 - Antoaneta Avramova-Boncheva - Photometric and Spectroscopic Investigation of Active G-, K-, and M-type Stars Using TESS and Ground-based Observations

18:30 - 19:15 - Poster session

1. Hristiyan Mihaylov - Modelling the evolution of density distribution in star-forming clouds as a Markov process
2. Krasimira Yankova - Active zones - connections with the disk structures

3. Rumen Shkevov - Inner heliosphere as a source of virtual relativistic particles fluxes
4. N. Zolnikova- Low relativistic electrons trapping regions near Cherenkov resonance
5. Desislava Stefanova - Spectropolarimetric Study of the Stellar Wind Bow Shock Nebulae around BD +43 4654 and HD 195592
6. Magdalena D. Christova - Stability of the Rozhen echelle spectrograph
7. Yanko Nikolov - Spectropolarimetric Observations with FoReRo2: Instrument Overview and Scientific Applications

19:15 - Dinner

15.09.2026 Tuesday

Session 5 - Chairman : Rumen Bachev

9:30 - 10:15 - Daniela Kirilova - Contemporary Cosmological Puzzles and their possible solutions - **plenary talk**
10:15 - 10:35 - Marko Grozdanović - The search for optical counterparts to isolated FASHI HI sources
10:35 - 11:00 - Nikolay Markov - Gravitational Potential as Cumulative Relativistic Interaction Delay: Evidence from Planets, Galaxies, and Galaxy Clusters

11:00 - 11:20 - Coffee break

Session 6 - Chairman : Gordana Apostolovska

11:20 - 11:50 - Elena Vchkova Bebekovska - Combining the Dense Ground-Based Photometry from NAO Rozhen and AS Vidojevica with Sparse Data for Asteroid Modeling - **invited talk**
11:50 - 12:10 - Tsvetan Tsvetkov - Cosmic Ray Variations Recorded by the MNM-ROZH Mini-Neutron Monitor Station
12:10 - 12:30 - Aleksandar Valjarević - Mapping Martian Dunes and Wind Patterns Using GIS and Satellite Data

12:30 - 13:30 - Lunch

Chairman : Zoran Simić

14:00 - 16:00 - Scientific discussion “The future of Balkan collaborations from technical and scientific point of view”

18:30 - 19:15 - Poster session

1. Nikola Petrov - Ground-Based Full-Disk Observations of the Solar Chromosphere in Hα and CaIIK
2. Orlin Stanchev - The perimeter-area relation as a diagnostic of fractal dimension for dendrogram objects in molecular clouds
3. Aleksandar Jeliazkov - Physical properties of planetary nebulae
4. Miljana D. Jovanovic - Flux variability of AGNs important for the Gaia CRF and ICRF link
5. Zoran Simić - Selection available Trans-Iron Elements in White Dwarfs for calculation parameters of collisional broadening
6. Tsvetan G. Georgiev - Flickering of MWC 560 in 2011: Prominent quasi-periods of about 21, 40 and 50 minutes

19:15 - Dinner

16.09.2026 Wednesday

Session 7 - Chairman : Momchil Dechev

9:30 - 10:00 - Werner Pötzi - H-alpha observations at the Belogradchik observatory - **invited talk**
10:00 - 10:20 - Oleg Stepanyuk - AI-Based Segmentation of Solar Eruptive Phenomena and Space Weather Prediction: Recent Advances at the Solar Physics Group, IA NAO, BAS
10:20 - 10:40 - Galin Borisov - Investigation of the Colour Distribution in the Coma of the Disintegrating Comet C/2025K1 (ATLAS)
10:40 - 11:00 - Kamen Kozarev - Interferometric Radio Imaging and Modeling of Type II Solar Bursts

11:00 - 11:20 - Coffee break

Session 8 - Chairman : Goran Damljanovic

11:20 - 11:50 - Veselina Kalinova - Galaxy Evolution from Multi-wavelength Observations - **invited talk**
11:50 - 12:10 - Maria Petkova - Ellipticities of the Central Regions of Old Galactic Globular Clusters
12:10 - 12:30 - Nestor Arsenov - Investigating cosmic structure with quasars from Gaia and red galaxies from DESI LS
12:30 - 12:50 - Rumen Bachev - Blazars as the most extreme and violent multi-wavelength and multi-messenger sources in the Universe

12:50 - 14:00 - Lunch

Session 9 - Chairman : Magdalena Christova

14:00 - 14:20 - Milan S. Dimitrijević - Stark broadening data for N III spectral lines for white dwarfs and hot stars investigations
14:20 - 14:40 - Hristo Georgiev - Estimation of star's physical parameters, based on three-dimensional maps of the extinction in the Milky Way
14:40 - 15:00 - Lyubov Marinkova - On the Origin of Power-Law Tails of the Column-density Distribution in Galactic Star-forming Clouds

15:00 - 15:20 - Coffee break

Session 10 - Chairman : Veselina Kalinova

15:20 - 15:50 - Dejan Urošević - Cygnus loop: non-radiative and radiative filaments in optical and radio - **invited talk**
15:50 - 16:10 - Borislav Borisov - Exploring the Relationship Between Outburst Intervals in RS Ophiuchi
16:10 - 16:30 - Svetlana Boeva - Multicolor observations of V777 Peg in quiescence

18:30 - 19:15 - Poster session

1. Radoslav Zamanov - Spectral signatures of accretion flows
2. Daniela Boneva - Photometric variations and accretion processes of the EM UMa type dwarf novae IX Draconis
3. Magdalena D. Christova - Application of Stark broadening of Sn III spectral lines in astrophysics

4. Vinka Dakić- Temporal and spatial distribution of Galactic supernovae from supernova remnants statistics
5. Andon Kostov - Broadband monitoring of two comets
6. Samuil Petrov - Observations of the Sun from the Astronomical Center of the University of Shumen

19:15 - Dinner

17.09.2026 Thursday

Session 11 - Chairman : Lubomir Iliev

9:30 - 10:00 - Renada Konstantinova-Antova - On the global picture of stellar magnetism in single stars after the main sequence - **plenary talk**
10:00 - 10:20 - Svetla Tsvetkova - Magnetic field of FI Cnc
10:20 - 10:40 - Miroslav Moyseev - Disc properties of the gamma Cas analogue MWC 1023
10:40 - 11:00 - Asen Mutafov - New *BVRI* photometry of the young star GM Cep

11:00 - 11:20 - Coffee break

Session 12 - Chairman : Dejan Urošević

11:20 - 11:40 - Dragomir Marchev - Multicolor photometry of the cataclysmic variable SS Cyg
11:40 - 12:00 - Milica Andjelić - Distance determination to the Galactic supernova remnants
12:00 - 12:15 - Lubomir Iliev - Cyclic variations in the circumstellar environment of the Be/shell star 28 Tau (Pleione)
12:15 - 12:35 - Bojan Arbutina - Massive Contact Close Binary Systems and Their Stability
12:35 - 12:55 - Abolfazl Elsaghi - Binary Companions from SDSS DR17

12:55 - 13:30 - Lunch

13:30 - Excursion to Varna city

19:30 - Conference official dinner

18.09.2026 Friday

Session 13 - Chairman : Galin Borisov

9:30 - 9:50 - Emona Ilieva - Scientific Observations of the Total Solar Eclipse of 12 August 2026
9:50 - 10:10 - Milen Minev - Technical performance and first results of new 80cm telescope at Rozhen NAO
10:10 - 10:30 - Viktor Gerasimov - Re-aluminization of the Primary Mirror of the 2-m Telescope at Rozhen National Astronomical Observatory
10:30 - 10:50 - Vesna Mijatovic & Nenad Milovanović - Комплекс Астрономске опсерваторије у Београду као аутентична амбијентална целина: спој науке, културе и уметности
10:50 - 11:10 - Kamen N. Nedev - Astobiological Aspects of the Genetic Code Origin and Evolution

11:10 - 11:40 - Poster session

1. Antoniya Valcheva - Photometric study of luminous blue variables in IC3422
2. Aleksandar Ivanov - Study of possible hierarchical quadruple stellar system
3. Kaloyan Ivanov - Spectral analysis of ZTF J191814.28+010850.2
4. Daniela Kirilova - Chiral Tensor Particles in the Universe

11:40 - 11:50 - Official closing of the conference