82nd International Scientific Conference of the University of Latvia 2024

Astronomy section

March 21, 2024 *(Thursday)*

09:00 Welcome speach Dr Ilgonis Vilks Chair of Scientific Council of Institute of Astronomy

09:10– 12:40 Morning session (chaired by Ilgmars Eglitis)

1) 09:10 – 09:30 Ilgonis Vilks
"The Lesser-known Directions of Research in the Astrophysics Laboratory of the Academy of Sciences of the Latvian SSR (1958–1967 .... **2.p.**

2) 09:35 – 10:35 Ivan Andronov, H.M. Akopian, L.L. Chinarova, L.S. Kudashkina, N.I. Savchuk, S.I. Iovchev, S.V. Kolesnkov, V.I. Marsakova
"Monitoring and Analysis of Databases of the Characteristics of Variability of Astrophysical Objects" .... **2.p.**

3) 10:40 – 11:00 Ross Burns, Artis Aberfelds, Vladislavs Bezrukovs, Karina Skirmante, Ivars Šmelds, Jānis Šteinbergs
"VLBI observations of maser emission using a remote time standard" .... **5.p.**

4) 11:05 – 11:25 Vladislavs Bezrukovs, Artis Aberfelds, Marcis Bleiders, Ross Burns, Marcis Donerblics, Andris Lesins, Arturs Orbidans, Roberts Rasmanis, Karina Skirmante, Janis Trokss, Ivars Šmelds, Jānis Šteinbergs
"Distributed precise time and frequency keeping using dedicated fibre optics and White Rabbit" .... **5.p.**

5) 11:30 – 11:50 Boris Ryabov, Arturs Vrublevskis
"Sunspot sources of slow solar wind at the base of a dome-shaped structure" .... **6.p.**

6) 11:55 – 12:15 Lorenzo Terlizzi
"Determining the rotational period of TOPEX/Poseidon with photometric analysis" ... **6.p.**

7) 12:20 – 12:40 Diana Haritonova, Augusts Rubans, Ansis Zarins
"Application of frame stacking in equatorial coordinates for observation of space objects" ... **7.p.**

12:40 – 13:40 Lunch

13:40 – 16:05 Afternoon session (chaired by Ilgmars Eglitis)

8) 13:40 – 14:00 Jānis Kauliņš, Jorge Roberto del Pino Boytel, Ilgmārs Eglītis, Kristers Nagainis
"Satellite and Space Debris Photometry Capability Development for SLR Station Riga (ESA project SLR-SD-02)" .... **7.p.**

9) 14:05 – 14:25 Artis Aberfelds, Ross Burns, Karina Skirmante, Jānis Šteinbergs, Vladislavs Bezrukovs
"Maser and radio continuum monitoring observations of high-mass protostars" ..... **8.p.**

The Lesser-known Directions of Research in the Astrophysics Laboratory of the Academy of Sciences of the Latvian SSR (1958–1967)

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From 1958 to 1967, the Astrophysics Laboratory operated at the Academy of Sciences of the Latvian SSR (ZA), headed by Jānis Ikaunieks (1912–1969). Its predecessor was the Astronomy Sector, its successor was the Radioastrophysics Observatory. The studies of red giant stars and the Sun by local astronomers are well known, but there is less public information about other work that started at that time and was not continued. Using the materials of the University of Latvia Museum, the State Archive of Latvia and periodicals, the author has collected information about the determination of geographical coordinates, observations of noctilucent clouds, photographic and radio observations of Earth's artificial satellites, as well as observations of ionospheric radio signals, carried out in the Astrophysics Laboratory. Main conclusions. 1. The development of the Astrophysics Laboratory was not as smooth and linear as it is often shown in later activity reports, there were also dead ends. 2. J. Ikaunieks tried to include various topics of modern research in the laboratory's plans, but this fragmented the resources because the scientific staff was small (15-20 persons). It was not possible to do full-scale scientific research in all planned directions.

Monitoring and Analysis of Databases of the Characteristics of Variability of Astrophysical Objects

I.L. Andronov[1], H.M. Akopian[1], L.L. Chinarova[1], L.S. Kudashkina[1], N.I. Savchuk[1], S.I. Iovchev[1], S.V. Kolesnkov[1], V.I. Marsakova[2]
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The scientific school of variable star research in Odesa, Ukraine, was created by the eminent astronomer Vladimir Platonovich Tsesevich (11.10.1907 – 28.10.1983) [1, 2]. Since 2003, the studies have been carried out via the "Inter-Longitude Astronomy" (ILA) project, some highlights for which were reviewed for the long-period variables (LPV) [3] and interacting binary stars [4]. This direction is also related to the "AstroInformatics" and "UkrVO" projects [5].

The analysis of variability of stars of different types is based on own observations made by our group, foreign co-authors, and the data obtained using ground-base and space telescopes and published in photometric surveys.

An expert system for the time series analysis has been elaborated, taking into account the irregularity of distributions of times of observations and (often) the presence of a few mechanisms of variability. The first review of the basic algorithms [6] was significantly enlarged by more recent algorithms [7], which are to replace popular over-simplified methods.

The algorithms are based on phenomenological approximations. Ideally, the study of each star is to be done with dense multi-color (at least quasi-) simultaneous monitoring, with spectral (and optionally, polarimetric) covering of different phases of variability and a

parallax/distance determination. In reality, this is made for a miserable per cent of objects, currently, 310 in the CALEB [8]. However, the majority of discoveries of variability are based on one-color (or wide-band) photometry. Thus, physical modeling (e.g. [9,10,11] has a lot of extra parameters, which can't be determined separately. Some astronomical examples are visual magnitude (phenomenological parameter), from which is impossible to determine physical parameters - the absolute magnitude and distance from pure photometry. In modeling light curves of eclipsing binaries, there are many physical parameters, which are highly correlated (e.g. the depth and duration of the eclipse are dependent on the inclination, radii of stars, distance between them, surface brightness of them in the spectral band of observations, limb darkening effect).

To make a statistically optimal determination of the moments of extrema (ToM, in the terminology of the AAVSO [12]), the software MAVKA [13,14] was elaborated. For the approximations of multi-harmonic and multi-period variations with trends, we use the software MCV [15, 16].

A very interesting binary, which may be called "a Direct Impactor" and maybe a progenitor of the new class is V361 Lyr [17], which is phenomenologically intermediate between the classical eclipsing binary and a cataclysmic variable.

For the EA-type stars with narrow eclipses, the "New Algol Variable" (NAV) algorithm was proposed [18], but the model may be applied to other eclipsing systems as well [19].

For the period search, we typically use a trigonometric polynomial approximation, which uses a complete mathematical model instead of "oversimplified" models, where the data are modified by removing a sample mean, a trend, or a periodic contribution. So no "detrending" or "prewhitening" is used, which may hardly bias the results of the analysis. These approximations are involved in MCV, as well as a (unique) possibility of the multi-harmonic periodogram analysis in the presence of a trend, the parameters of which are assumed to be dependent on frequency. This is particularly useful for the superhumps in the dwarf novae or for the asteroids with changing (mean) brightness.

In the MCV, the algorithm of the "mean weighted" comparison star for the photometry using CCD-cameras, has been described and realized. The expressions for self-consistent determination of the weights and scatter of the comparison stars and the "mean weighted" star have been presented. This algorithm of using the "artificial" star instead of one control star allows for improved accuracy of the comparison star determination by dozens of percent or sometimes by a few times.

The types of variability studied using our methods are very numerous, ranging from short-period pulsating variables of d Sct and RR Lyr–type stars, to d Cep and Long-Period Variables of RV, SR and Mira type, and pulsating giants in symbiotic variables. The wide class of interacting binary stars ranges from classical eclipsing variables (including transits of exoplanets and non-eclipsing elliptic systems) to cataclysmic variables with different degrees of influence of the magnetic field onto accretion ("non-magnetic" dwarf novae and Nova-Like, intermediate, asynchronous and classical synchronous polars).

An unprecedented series of photopolarimetric observations of classical polars (AM Her, QQ Vul), series on synchronous polars (BY Cam, V1432 Aql), eclipsing polar V808 Aur, intermediate polars (MU Cam and

PQ Gem) and some related objects have been obtained at the 2.6m telescope ZTSh of the Crimean Astrophysical Observatory since (1989) by Drs S.V. Kolesnikov and N.M. Shakh.

References

[1] Andronov, I.L. (2017). Odessa Scientific School of Researchers of Variable Stars: from V.P.Tsesevich (1907-1983) to Our Days, Odessa Astronomical Publications. 30, 252-255. {2017OAP....30..252A}

[2] Vavilova, I.B. (2017). Scientific Astronomical School by Professor Volodymyr P. Tsesevich on the Physics of Variable Stars, Odessa Astronomical Publications. 30, 256-262. {2017OAP....30..256V}

[3] Andronov, I.L., V.I. Marsakova, L.S. Kudashkina, L.L. Chinarova (2014). ``Inter-Longitude Astronomy'' project: long period variable stars, Advances in Astronomy and Space Physics. 4, 3-8. {2014AASP....4....3A}

[4] Andronov, I.L., K.D. Andrych, K.A. Antoniuk, et al. (2017) Instabilities in Interacting Binary Stars, ASPC, 511, 43-50 {2017ASPC..511...43A}

[5] Vavilova, I.B., Y.S. Yatskiv, L.K. Pakuliak, I.L. Andronov, V.M. Andruk, Y.I. Protsyuk, V.E. Savanevych, D.O. Savchenko, V.S. Savchenko (2017). UkrVO Astroinformatics Software and Web- services, Astroinformatics. IAU Symp. 325, 361-366. {2017IAUS..325..361V}

[6] Andronov, I.L. (1994). (Multi-) Frequency Variations of Stars. Some Methods and Results, Odessa Astronomical Publications. 7, 49-54. {1994OAP.....7...49A}

[7] Andronov, I.L. (2020). Advanced Time Series Analysis of Generally Irregularly Spaced Signals: Beyond the Oversimplified Methods, Knowledge Discovery in Big Data from Astronomy and Earth Observation. 191-224. {2020kdbd.book..191A}

[8] CALEB: Catalogue and Atlas of the Eclipsing Binaries (2024), https://caleb.eastern.edu/choose_star_view.php

[9] Zola S, Gazeas K, Kreiner JM, Ogloza W, Siwak M, et al., (2010) Physical Parameters of Components in Close Binary Systems - VII, Mon. Not. R. Aston. Soc. 408, 464-474.

[10] Prša, A. The brave new world of eclipsing binary modeling (2020). Contributions of the Astronomical Observatory Skalnaté Pleso, vol. 50, no. 2, p. 565-569.

[11] Callrath J. Fifty Years of Eclipsing Binary Analysis with the Wilson–Devinney Model (2023) Galaxies, 10, id.17

[12] AAVSO (2024) http://aavso.org

[13] Andrych, K.D., I.L. Andronov, L.L. Chinarova (2020). MAVKA: Program of Statistically Optimal Determination of Phenomenological Parameters of Extrema. Parabolic Spline Algorithm And Analysis of Variability of The Semi-Regular Star Z UMa, Journal of Physical Studies. 24, 1902 {2020JPhSt..24.1902A}

[14] Software MAVKA (2020). http://uavso.org.ua/mavka

[15] Software MCV (2004) http:// uavso.org/mcv/MCV.zip

[16] Andronov, I. L. Baklanov, A. V. (2004) Algorithm of the artificial comparison star for the CCD photometry (2004) Astronomical School's Report, 5, 1-2, 264-272 {}

[17] Andronov, I. L., Richter, G. A. (1987) V361 Lyrae : an exotic binary system with a "hot spot" between the components ? Astronomische Nachrichten, 308, 4, 235-238

[18] Andronov, I. L. (2012) Phenomenological modeling of the light curves of algol-type eclipsing binary stars. Astrophysics, 55, 4, pp.536-550 { 2012Ap.....55..536A}

[19] Tkachenko, M.G.; Andronov, I.L.; Chinarova, L.L. (2016) Phenomenological Parameters of the Prototype

Eclipsing Binaries Algol, β Lyrae and W Uma Journal of Physical Studies, 20, p. 4902
{2016JPhSt..20.4902T}

VLBI observations of maser emission using a remote time standard

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Very long baseline interferometry (VLBI) is a technique of combining data from distant radio telescopes to create a synthetic imaging telescope with extremely fine image resolution. VLBI observations require precise time synchronization of participating observatories, achieved using atomic clocks. Due to their high purchase cost, it is more economical to share the time standard of a single atomic clock across multiple radio telescopes. In this contribution, we introduce the results of European VLBI Network observations in which the Ventspils 32m radio telescope participated using a distributed time standard from a clock 800m away. The observations successfully imaged a ring of methanol masers around a high-mass protostar.

Distributed precise time and frequency keeping using dedicated fibre optics and White Rabbit

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Throughout epochs, astronomy and time/frequency metrology have been closely intertwined: historically, timekeeping relied heavily on astronomical phenomena. However, in the sixties, the second was redefined in the International System of Units (SI) to be based on atomic physics. Today, astronomy, particularly in the radio domain, utilizes atomic clocks for timekeeping, essential for deeper exploration of the Universe and enhanced understanding of our planet. One of the most influential techniques in radio astronomy is Very Long Baseline Interferometry (VLBI), which involves simultaneous observations of the radio sky using many antennas on Earth's surface. By correlating signals from distant antennas, VLBI drastically improves angular resolution compared to single-antenna observations. VLBI holds immense potential across various fields, from studying compact radio sources to probing the interstellar medium, offering insights into fundamental physics and the search for transient events.
The Ventspils International Radio Astronomy Centre (VIRAC) at Ventspils University of Applied Sciences (VUAS) actively engages in international VLBI experiments with its two fully steerable parabolic antennas, RT-16 and RT-32 (with mirror diameters of 16 m and 32 m respectively). In these experiments, signal correlation begins with down-conversion and sampling at each telescope, facilitated by a local oscillator referenced to an atomic clock. Ensuring the spectral purity and long-term stability of atomic clocks is crucial, as any loss in coherence between clocks can lead to interferometer fringe fading. Traditionally, radio

telescopes relied on local atomic clocks due to the lack of proper clock signals from remote sites. However, the advent of fibre optic links now allows the transmission of stable frequency standards. In 2023, VIRAC installed a new active hydrogen maser, iMaser 3000, in the RT-16 radio telescope for time and frequency synchronization. Additionally, an 800 m fiber optic link, powered by White Rabbit (WR) technology from the Orolia Group (Shafran) solution, was established for 1 PPS and 10 MHz signals synchronization on the RT-32 telescope.

This presentation will delve into the technical solution for synchronizing two telescopes from a single active maser and share operational insights gained from VLBI experiments.

Sunspot sources of slow solar wind at the base of a dome-shaped structure

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We investigate plasma upflow above dominant sunspots in two solar active regions. A narrow open-field region crosses these sunspots providing a path for plasma outflow into the heliosphere. We have identified a related large-scale dome-shaped magnetic field structure. The observed slow solar wind is of velocity ~ 340 km/s with the freezing-in temperature of T = 1.26 MK (O^{+7}/O^{+6} = 0.06) and evidence (from the high Fe/O = 0.32) of an input from the sunspots. From the Potential Field Source Surface (PFSS) model we confirm the association between highly squashed field lines at heliospheric heights and the complexity of the underlying coronal structures.

Determining the rotational period of TOPEX/Poseidon with photometric analysis

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One of the major problems that the space industry currently faces is the growing amount of space debris in orbit around Earth. Several methods have been devised for the removal of these objects from orbit. A subset of these is based on achieving physical contact with the object. For instance, one such method is space debris capture by a remotely controlled vehicle. When achieving physical contact with space debris through these methods, it is important to know whether the debris in question is rotating since this could significantly complicate the retrieval operation.

There are multiple valid ground-based approaches to determining this rotational velocity. One possibility that is actively being studied is the photometric analysis of man-made debris. Because artificial space debris is often covered by surfaces of various reflectivity, photometric measurements of these rotating objects yield time-varying intensities that are periodic in nature, with the signal period closely matching the rotational period of the studied object.

The purpose of this work is to present a photometric analysis of the rotational period of the TOPEX/Poseidon satellite, which malfunctioned in 2006 and has been spinning uncontrollably ever since. Measurements were performed at the University of Latvia's SLR observatory, and multiple orbital passes were processed to find the rotational period. Past studies have determined that the rotational velocity of this satellite is not constant but rather is changing according to certain empirical descriptions. Therefore, the data obtained in this study was also compared to these existing empirical models to ascertain whether the rotational period has changed as predicted.

Application of frame stacking in equatorial coordinates for observation of space objects

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Image stacking is a method when the photons coming from the same source (i.e. space object) on different frames are driven onto the same position on an output frame, to prolong the "effective exposure time" of the object. In common practice, image stacking is generally done by comparing patterns on frames or directly overlying images and requires frames, which are obtained by the same optics and in similar circumstances.
In this study, a method of frame stacking in equatorial coordinates is considered. The use of absolute equatorial coordinates allows the stacking of frames of different origins, having different scales, distortions, framing and epochs. The method requires an astrometric solution for all involved frames, i.e. transformation from image (pixel) coordinates to an equatorial coordinate system. The proposed stacking mechanism is based on the calculation of coinciding positions on source frames using a frame astrometric model. A stacked frame is generated in a rectangular coordinate system, having as coordinates right ascension and declination.
This method is proposed to improve the detection efficiency of faint space objects. It facilitates the detection of faint stars, and a larger number of reference stars can improve the accuracy of the astrometric solution. However, the main goals of frame stacking lie in the detection of fainter objects, such as near-Earth objects (NEOs) or space debris, and obtaining their coordinates or other properties.
For research in the area of positional astrometric observations of different space objects the Institute of Geodesy and Geoinformatics (GGI) of the University of Latvia uses an optical tracking system (OTS) and control software, developed in the institute. The location of the OTS in a city means relatively bad astroclimate. Nevertheless, recent observation results have shown that by applying the frame stacking in star tracking mode and using frames with a cumulative exposure of 270 seconds, it is possible to reach a star magnitude of 21.

Satellite and Space Debris Photometry Capability Development for SLR Station Riga (ESA project SLR-SD-02)

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The ESA project SLR-SD-02 "Satellite and Space Debris Photometry Capability Development for SLR Station Riga" was carried out during 2022 and 2023 and successfully concluded in the last quarter of 2023.
The project goal of "To develop a photometric capability for the observation of Space debris and Active Satellites at the Satellite Laser Ranging (SLR) station 1884 Riga" was reached.
The project included the upgrading and optimization of the EMCCD camera Andor iXon Ultra 888 setup on the SLR (Satellite Laser Ranging Telescope) LS-105 visual Coudé path and developing or adapting a user-optimized (observer-friendly) satellite photometry software for the camera.
The Andor Andor iXon Ultra 888 camera was initially installed for visual guiding and pointing to satellites during the standard SLR operations.
We present a project overview and the status of several research activities being done after the project closure.

Maser and radio continuum monitoring observations of high-mass protostars

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High-mass stars are thought to achieve their final mass in short, episodic 'accretion bursts'. These bursts are often identifiable by enhancements in the radio frequency methanol masers. Furthermore, accretion bursts are thought to be followed by the launching of new protostellar jets which emit radio continuum emission. In this contribution we introduce the results of monitoring observations of methanol masers and radio continuum data for a sample of high-mass protostars using radio telescopes operated by Ventspils University as part of the A single-baseline radio interferometer in a new age of transient astrophysics(IVARS) project.

A new gas-grain model for interstellar astrochemistry

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I will present an astrochemical gas-grain model that combines a number of state-of-the-art features for modeling the surface chemistry of dense molecular interstellar cloud cores or circumstellar envelopes. The features include multiple-size bins for interstellar grains, chemically active bulk ice, divided into several layers, residing below the outer icy surface of a grain, efficient chemical desorption and general, all-molecule approaches for chemical species' binding energy on bare and icy grain surfaces and photodesorption yield.
The model shows that the formation of an ice layer on an interstellar grain in translucent molecular clouds can be delayed by hundreds of kyr because of chemical desorption if it is so effective in the interstellar medium as laboratory experiments indicate. Moreover, the overall ice composition, namely, the proportions between H2O, CO and CO2 ices can be explained by the action of several selective desorption mechanisms that are more effective for volatile species with low surface binding energies. If one of these mechanisms in a molecular cloud core becomes inefficient for some reason, then other mechanisms can partially offset it, explaining the ubiquity of similar ice compositions observed in different molecular cloud complexes.

Microwave Observations of the Sun with RT-32 Radio Telescope: Progress Report

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Microwave spectral polarimetric observations of the Sun are still an important issue of solar physics and one of the scientific activities of Ventspils International Radio Astronomy Centre (VIRAC), Latvia. Nowadays microwave solar observations are restored after reconstructions of the VIRAC RT-32 radio telescope. Actual observations are implemented now with the multichannel spectral polarimeter at a 2.1 - 7.2 cm wavelength range for both circular polarizations in a "single dish" regime.

The presentation concerns some technical, methodological and scientific points of the current implementation of microwave solar observations. Some solar physics tasks that are relevant today and could be solved with new microwave observations of the Sun are discussed also.

The research of Earth-MOID asteroids in Baldone Observatory

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Earth-Moid asteroids are interesting objects for research. Firstly, approaches within 1 AU of massive Jupiter can dramatically change the orbit from the Main belt sometimes even to NEO. Secondly, these asteroids approach the Earth too. The rotation of twelve Earth-MOID asteroids was studied using Baldone Schmidt telescope measurements and in combination with published brightness data from the MPC database. Four of asteroids have previously obtained period values to check our methodology of analyzing. For three of them, our obtained periods agree within error. For the other nine periods, amplitudes were detected and given in the table.

Asteroid No	Period (h)	Error (mag)	Amplitude (mag)
1951	5.300	0.001	0.4
1963	18.201	0.012	0.7
2128	19.867	0.134	0.9
2150	6.125	0.001	0.9
2174	4.785	0.006	0.5
2318	5.458	0.002	0.7
2497	77.760	0.065	0.7
75410	6.824	0.007	0.6
75410	9.626 0.024		
78490	4.715	0.005	0.6
108411	17.465	0.003	0.4
108808	2.951	0.023	0.6
225899	4.864	0.012	1.0

The Fourier series method gives usable results analyzing long series observation in multiple following nights when the rotation period isn't longer than 7-10 hours. In cases of a small series of observations scattered over a large period, with gaps between series, with uncertainties in brightness, the Lomb-Scargle and Phase Dispersion Minimization (PDM) methods work more reliably. The PDM method is sensitive to a small number of observations and mostly does not work if the number of observations is less than a hundred. The starting point for analysis must be long-time continuous observations, satellite data, or a rich data set with low dispersion on the phase diagram. For the true rotation period, the luminosity curve contains two full minima and maxima, the peak of the power spectra is at least 20% above the ambient background and its shape resembles a Gaussian distribution. The resulting period was calculated as weighted by the number of observations, the magnitude of the probability from the power diagram, and the magnitude of the spread in the phase diagram. The shown methodology allows for obtaining good results analyze data whose brightness accuracy is ±0.1.