



AGENTÚRA
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VÝSKUMU A VÝVOJA

International meeting on variable stars observing

KOLOS 2008

Vihorlat Observatory Humenné

Gymnázium Snina

N. F. "Teleskop" Snina

DRZ Vihorlat Sninské rybníky, Snina, Slovakia

December 4–6, 2008

ABSTRACT BOOK

Oral presentations:

I. Kudzej

Vihorlat Observatory, Humenné, Slovakia

From Kolos to Kolos

Brief overview of recent achievements in instrumental and infrastructural equipment of Astronomical Observatory at Kolonica Saddle.

P. Dubovský

Vihorlat Observatory, Humenné, Slovakia

Observational results of AO Kolonica

Introductory presentation about observing program at Astronomical Observatory at Kolonica Saddle. Short overview of main observing campaign during last year, most important results, interesting light curves, new publications based on observations at AO Kolonica Saddle.

„This work was supported by the Slovak Research and Development Agency under the contract No. LPP-0049-06“

D. Bruncko

Institute of experimental Physics, Košice

LHC and ATLAS in these days

Short review of present situation of the LHC collider and ATLAS detector will be presented in moreless for pedestrians. I will shortly discuss the present status quo and our schedule for next year.

S. Udovichenko 1, P. Dubovský 2,

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2. Vihorlat Observatory, Humenné. Slovakia

Photometric investigation of Blazhko RR Lyr star DM Cyg (preliminary results)

The photometric CCD observations for RR Lyr type star DM Cyg during 36 nights 2008 on Astronomical stations in Odessa and Kolonica (V system) have been carried out. It was the light curves obtained and the maximum moments were determined. For the purpose of investigation Blazhko effect the periodogram analysis performing in progress.

Zdeněk Mikulášek (1, 2), Pavol A. Dubovský (3), Jozef Žižňovský (4), Juraj Zverko (4), Miloslav Zejda (1)

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Phenomenological ephemeris of the HgMn CP eclipsing binary AR Aurigae

Eclipsing binary AR Aurigae consisting of two HgMn chemically peculiar stars shows well defined light time effect bearing evidence on the presence of the third body in the system. Aiming to improve its light curve ephemeris we have newly determined 59 times of both primary and secondary minima of AR Aur based on more than 15 thousands of individual photoelectric measurements treated simultaneously by specially developed code. The list of minima has been supplemented by farther 39 minima found in literature. Analysing all the data we have established a new "phenomenological ephemeris" enabling swift phase prediction of the eclipsing system.

T. Pribulla 1,2, D. Balud'anský 3, P. Dubovský 4, I. Kudzej 4, Š. Parimucha 5, M. Siwak 6 and M. Vaňko 7,2

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VW LMi as a quadruple system

Tightest known quadruple system VW LMi consists of contact eclipsing binary with $P_{12} = 0.477551$ d and detached binary with $P_{34} = 7.93063$ d revolving in rather tight, 355.0-d orbit. This paper presents new photometric and spectroscopic observations yielding 69 times of minima and 36 disentangled radial velocities for the component stars. All available radial velocities and minima times are combined to better characterize the orbits and to derive absolute parameters of components. The total mass of the quadruple system was estimated at 4.56 M_{\odot} . The detached, non-eclipsing binary with orbital period $P = 7.93$ d is found to show apsidal motion with $U \sim 80$ yr. Precession period in this binary, caused by the gravitational perturbation of the contact binary, is estimated to be about 120 yr. The wide mutual orbit and orbit of the non-eclipsing pair are found to be close to coplanarity, preventing any changes of the inclination angle of the non-eclipsing orbit and excluding occurrence of the second system of eclipses in future. Possibilities of astrometric solution and direct resolving of the wide, mutual orbit are discussed. Nearby star, HD95606, was found to form loose binary with quadruple system VW LMi.

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4. Astronomical Observatory, Odessa National University, Ukraine

New eclipsing binaries discovered at Kolonica Observatory

We report our observations of four eclipsing binaries discovered at Kolonica observatory. We present basic parameters of the systems, their light curves, ephemerides, as well as preliminary solutions of the light curves and their 3D models.

I.L. Andronov 1,2, A.V. Baklanov 3, V.V. Breus 1,2 L.L. Chinarova 2, S.V. Kolesnikov 2, P.A. Dubovský 4, I. Kudzej 4, Y. Kim 5,6, P.A. Mason 8, J. Yoon 5, K. Petrík 7

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5. Chungbuk National University, Cheongju, Korea
6. University of California, USA
7. Trnava University and Planetarium and Astronomical Observatory in Hlohovec, Slovakia
8. New Mexico State University, USA

"Inter-Longitude Astronomy" Project: Monitoring of Cataclysmic Variables

The "Inter-Longitude Astronomy" project consists of few directions of theoretical and observational study of structure and evolution of variable stars in a wide range from white dwarfs to supergiants:

"Polar" (or "Gravi-Magnetic Rotator") - classical (AM Her - type), asynchronous (BY Cam - type) and intermediate (DQ Her - type polars);

"Superhumper" - observational appearance of positive and negative superhumps in dwarf novae and nova-like systems and dependence of the characteristics of the orbital light curve (including eclipses) on time and luminosity;

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"Symbiosis" - multi-component variability of symbiotic binaries with nova and pulsating components based on photographic and visual monitoring;

"Stellar Bell" - periodic, multi-periodic, quasi-periodic and aperiodic pulsations in the Mira, semi-regular, RV Tau - type stars;

"New Variable Stars" - robotic time series analysis and photometric classification of space and ground-based observations of newly discovered or neglected variable stars.

Currently, the total number of stars studied is ~1300.

We review some highlights of the extensive study of some key objects at the best telescopes in Ukraine, Slovakia, Korea and plans for a continuation of these studies: intermediate polars DO Dra, BG CMi, MU Cam, RXJ 1803, RXJ 0636, RXJ 0704, RXJ 2133, RXJ 1926 et al.; asynchronous polars V1432 Aql, BY Cam; magnetic dwarf nova (=outbursting intermediate polar) DO Dra; dwarf nova EM Cyg.

Special attention is paid for organization of the "inter-longitude" campaigns (Ukraine/Slovakia, Korea, USA).

I.L Andronov 2, V. Breus 1,2, K. Petrík 3

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3. Hlohovec Observatory and Planetarium, Slovak Republic

Characteristics of Spin Variability vs Luminosity in the Intermediate Polar RXS J180340.0+401214

We observed newly discovered intermediate polar RXJ1803 (B.T. Gänsicke et al. (MNRAS 361, 141-154, 2005) using the Zeiss-Cassegrain 600 telescope of the Hlohovec Observatory and Planetarium. The star was observed during 12 nights. There were 976 in R and 1038 exposures in V filter obtained.

The photometric wave is originated due to a spin rotation of the white dwarf. One hump shape at the phase light curve argues for a high inclination of the magnetic axis in this system, so we see mainly an upper accretion column.

We have computed quazi-simultaneous sets of data in V and R filter. The color index was computed for the moments of observations for which both V and R data were available.

The highest peak of the periodogram corresponds to the period 25.34 minutes. This period is consistent with that determined by Gänsicke and co-authors.

The color index shows a statistically significant dependence on the spin phase, indicating a necessity of multicolor observations rather than mono-filter or unfiltered ones.

These results will be used for most precise period determination after the data reduction of all data obtained in other observatories (Ukraine, Slovakia and Korea).

Time series analysis was carried out using the MCV program (I.L.Andronov, A.V.Baklanov, Astronomical School Reports, 2004, 5, 264, <http://uavso.pochta.ru/mcv>).

I. Solovyova 1, I. Andronov 2, A. Halevin 1, I. Kudzej 3

„This work was supported by the Slovak Research and Development Agency under the contract No. LPP-0049-06“

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Investigation of accretion disc structure of the eclipsing dwarf nova EM Cyg

We have obtained data of EM Cyg in different conditions of outburst activity using the Pupava Telescope (d=280 mm, Newton system) with the CCD camera MEADE PRO in Astronomical Observatory at Kolonica Saddle (Slovakia). Data have been received in April-October, 2007. EM Cyg is a eclipsing dwarf nova ($P_{orb} = 6.98$ hr) which shows outbursts every 15-40 days.

We apply a method of eclipse mapping to the light curves of eclipsing dwarf nova EM Cyg and have received model of an eclipsed part of accreting disk. To model of accretion disk we used the "fire-flies" conception. This model allows us to reconstruct the distribution of radiating matter in the disk.

On distribution of shone substance temperature distribution in a disk and accretion rate has been calculated. Our results will be co-ordinated with received earlier.

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RS Oph 2 years after outburst

S. Andrievsky

Astronomical Observatory, Odessa National University, Ukraine

Nucleosynthesis in Universe

T. Mishenina

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Chromospheric activity of BY Dra - type stars

The atmospheric parameters T_{eff} , $\log g$, $[Fe/H]$, V_t and $vsini$, and Li, O, Na, Mg, Al, Si, Ca, Sc, Ti, V, Cr, Co, Ni and Zn abundances in 131 stars of the lowest part of MS were determined. Among them about 30 stars are the variable stars of BY Dra type, some stars of RS CVn, FI types. The Li is detected in 54% of variable stars and in 20% of MS stars. Our data have shown the absence of correlation between the lithium abundance and parameter of rotation $vsini$ and practically the anticorrelation with an index of chromospheric activity S .

I.L. Andronov

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Advanced Mathematical Modeling of the Multi-Component Variability in Variable Stars of different types

TA series of algorithms and computer programs is reviewed. They have been elaborated for statistical-

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ly optimal data processing of observations of variable stars. Due to a wide variety of types of variability, statistically optimal determination of the parameters may be provided using corresponding different methods, which should be most adequate to the underlying astrophysical processes. Thus it was necessary to elaborate a set of complementary methods,

The methods may be distributed into few groups:

Linear and non-linear fits.

Periodogram analysis: Parametric methods

Periodogram analysis: Non-parametric methods

Autocorrelation function analysis of detrended data

Spline Functions: constant degree (histogram-like, linear and cubic splines)

Spline Functions: variable degree (EA, RR "catchers" et al.)

Wavelet Analysis of irregularly spaced data

Scalegram Analysis of irregularly spaced data

Principal Component Analysis (multi-channel observations of one or multiple objects)

Special attention is paid to statistical properties of optimal smoothing functions, effective degree of the mathematical model, possible multiple-component character of the signal. The methods have been applied to ~1300 variable stars of different types by the members of our group, including monitoring from space (Hipparcos-Tycho, Chandra, XMM, IUE and HST missions) and ground-based ("Inter-Longitude Astronomy" Project) observatories in a collaboration with colleagues from Slovakia, Korea, Germany, France, Greece, Spain, Hungary, Poland, USA and other countries. The methods may be applied to signals of arbitrary nature.

Z.T. Kiss

Baja Astronomical Observatory, Hungary

Triggered star formation on large and small scales

A complex study of visual and infrared properties of ISM and an examination of cloud morphology was carried out using USNO, 2MASS, DIRBE, IRAS and ISO data of an extended region in Cepheus to explore the conditions of cloud and star formation.

I.L. Andronov, L.L. Chinarova

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Characteristic Time-Scales and Amplitudes of 173 Semi-Regular Variables

Extending the "running parabola" "sigma-" scalegram analysis (I.L.Andronov, 1997, AsApS 125, 207), we propose a new method for determination of the characteristic amplitudes and time scales of oscillations of low coherence time. The "Sigma- scalegram" may be computed using the recent version of the "OW" computer program (I.L.Andronov, this conference). Three "effective values" of the parameters are determined, i.e. the semi-amplitude of the oscillation, the period and the error estimate of a single observation. As a measure of the stability of the period, we introduce the fourth parameter,

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so-called "effective width of scalegram". The "sigma-" scalegram analysis was previously used for variable stars of different types - intermediate, asynchronous and classical polars, nova-like variables and symbiotic stars.

Here we present results on 173 semi-regular variables based on ~550,000 visual observations from the AFOEV (France) and VSOLJ (Japan) international databases. An atlas of scalegrams is presented with an electronic table of new statistical characteristics. Special attention is paid to the stars showing multi-periodic variations and pulsational mode switching, for which an additional characteristic of the scalegram is introduced, These additional criteria may be used for a phenomenological classification of objects.

The work is a part of the "Stellar Bell" (pulsating variable stars) direction of the international project "Inter-Longitude Astronomy".

J. Žižňovský

Astronomical Institute, Slovak Academy of Sciences

Chemical composition of HR 1094

Chemical composition of the magnetic CP star HR 1094 is derived by means of synthetic spectra. Based on observations at the 6-m BTA telescope.

J. Zverko

Astronomical Institute, Slovak Academy of Sciences

How a CP star produces photometric variability

The light curve of a CP star HR7224 is studied and explained by means of modeling of stellar atmospheres with anomalous abundances of chemical elements.

T. Hegedüs

Baja Astronomical Observatory, Hungary

On-line demonstration of BART robotic telescope remote operation

During this short presentation, we would like to demonstrate the remote operation of the BART-1 robotic telescope, as well as its subsystems. The main technical information can also be delivered by the actual questions of the audience.

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Processing of multicolumn astronomical data by using the program MCV

We present features of the program MCV (Multi-Column Viewer) which has been specially written by us for processing results

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of CCD-photometry. The program allows to use the "optimally weighed" "artificial" comparison star. This procedure that allows to improve accuracy of the photometric calibrations typically by a factor of 1.4-2, depending on the number of comparison stars. However, it is suggested to use the input data in a form of instrumental magnitudes instead of magnitude differences, to check atmospheric conditions and thus to check additionally the validity of data at some time intervals.

Among dozens of features, there is an opportunity of data approximation using a polynomial and trigonometric polynomial, editing of data (e.g. removing bad points), plotting of time and phase curves, saving of figures in a graphic format (jpg and bmp), creation of journal of observations etc. For a forthcoming next version, we add to the "to do" list an opportunity to determine error estimates of the characteristics of the "polynomial trend + multi-periodic" fit, in an addition to current periodogram analysis using "polynomial trend + multi-harmonic" fit.

The program computes trends simultaneously with multi-harmonic observations, what is statistically optimal, contrary to an (often used) preliminary subtraction of a polynomial trend. Such approximation is useful, particularly, for signals with trends, e.g. superhumps in "non-magnetic" cataclysmic variables, spin variability in the intermediate polars, pulsations in SR and RV stars etc.

The program is available at the site of the Ukrainian Astronomical Association (UAVSO) <http://uavso.pochta.ru/mcv> with a description in Russian.

I.L. Andronov

Department of High and Applied Mathematics, Odessa National Maritime University

"Observation Obscurer" for Windows: A Tool for the Time Series Analysis

It was initially developed in 1992 for the DOS operating system and the EGA screen resolution ("O.exe").

The advanced version ("OL.exe") was written in 32-bit FreePascal (www.freepascal.org), which allowed to use larger data arrays and had more additional features. It works perfectly in Windows 98, but has problems with Windows XP and new screen resolution modes. The description of both programs was presented by Andronov (2001OAP....14..255A, <http://oap14.pochta.ru>).

Here we introduce a new version ("OM.exe"), which uses a graphic interface and works under operation system Microsoft Windows and Linux (using the WINE program). This version is still in development, having already a majority (but still not all) features of the "OL".

It allows: to view the data in the "time" or "phase" mode, to remove ("obscure") or filter outstanding bad points; to make scale transformations and smoothing using few methods (e.g. mean with phase binning, running mean, determination of the statistically optimal number of phase bins; "running parabola" (Andronov, 1997, *As.Ap. Suppl.* 125, 207) scalegram and fit, and to make time series analysis using some methods, e.g. correlation, autocorrelation and histogram analysis; determination of extrema; barycentric correction etc.

The program is available at the site of the Ukrainian Association of Variable Stars Observers (<http://uavso.pochta.ru/om>). There are other programs started as the "Windows versions of O.exe" - VSCalc (<http://uavso.pochta.ru/breus>, featuring Bitalii Breus) and MCV (<http://uavso.pochta.ru/mcv>, featuring Alexej Baklanov), they are pointed to other classes of methods for the time series analysis. All these programs were used for time series analysis of hundreds of stars in due of the "Inter-Longitude Astronomy" campaign. Thus OM, VSCalc and MCV are complimentary programs of the same origin and different tasks.

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J. Janík

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Photometry at Canakkale Onsekiz Mart University

Canakkale Onsekiz Mart University is very successful on the field of binary stars research and this success is due to own observational program at Ulupinar Observatory which belong to the University. During my stay in September 2008 I could observe with 2 telescopes at Ulupinar Observatory. I would like present my experience with their instruments and describe reduction problems and first preliminary results.

Karol Petrík 1,2, Andrej Bočík1, Július Krempaský 1,3, Zdenka Baxová 4

1. Pansophia, n.o., Trenčín, Slovakia
2. Hvezdáreň a planetárium Hlohovec, Slovakia
3. Katedra fyziky FEI STU, Bratislava, Slovakia
4. Gymnázium Ľ. Štúra, Trenčín, Slovakia

The Project for Popularization of Natural Sciences

Pansophia, n.o. was granted by the project to promote the beautiful and interesting parts of natural sciences for young people. Unusual and entertaining performances get closer to our youth the scientific results in appropriate, non scientific form. The aim is to get rise the interest on the science among young people and to motivate them to study natural sciences.

R. Bury

City of Krosno, Poland

Project Carpathian Sky

I. Kudzej

Vihorlat Observatory, Humenné, Slovakia

Astronomy as a tourist attraction in South America

New experiences about popularization of Astronomy in Chile.

I. Lazorová

Gymnázium Snina, Slovakia

Alternative forms of teaching astronomy at gymnázium

In the field of teaching physics, astrophysics or astronomy one of the alternative teaching forms is education based on cooperation with professional institutions. They usually offer chances of getting knowledge and skills not only in traditional educational proces but also within out-of-school and free time activities of young people. The aim of my work is to give complete outline of different forms of cooperation between school and observatory in the field of astronomy teaching.

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J. Uniwersal

Uniwersal company, Zywiec, Poland

School's observatories and planetaria in Poland

J. Jagla

MOA, Niepolomice, Poland

Astronomical education of young people in MOA

Y. Gorbanev

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Meteor patrol in Odessa and on Zmeinyi island

N. Koshkin, L. Shakun, V. Dragomiretsky, O. Paramonova

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Investigation of the satellite's move in near-Earth space

P o s t e r s :

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Orbital And Spin Variability of The Intermediate Polar RXJ2133.7+5107

We observed the new intermediate polar RXJ2133 (J. M. Bonnet-Bidaud et al. (A&A, 2006, 445, 1037)) using the Zeiss-Cassegrain 600 telescope of the Hlohovec Observatory and Planetarium in 2007 and 2008. We obtained 12 nights of observations in R and V (1055 and 1038 CCD-exposures, respectively). This cataclysmic variable has one of the smallest values of the “spin to orbital period ratio” among the intermediate polars, but shows polarization in the UBVRI photometric systems (S. Katajainen et al., A&A, 2007, 475, 1011), indicating an presence of a strong magnetic field.

We determined a spin period of $0^d.00660973(11)$ (in an agreement with published values). For the seasons 2007 and 2008, we determined initial epochs for maxima 2454308.74817(18) and

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2454686.50168(17). Mean semi-amplitudes of spin variability are $r_R=0.0356(64)$, $r_V=0.0384(64)$ (2007) and $r_R=0.0461(74)$, $r_V=0.0520(85)$ (2008).

We note a systematic difference in amplitudes between the observations obtained in 2007 and 2008. In 2008, the mean brightness of the system was by $0.^m44$ lower, than in 2007. The larger amplitude in 2008 can be explained by an increasing contribution of emission of the accretion columns to total luminosity of the system (with a corresponding decrease of the accretion rate and accretion disc emission, increase the magnetospheric radius and the height of accretion columns).

The orbital period determined using spectral observations doesn't coincide to the photometric one. We determined a new value of orbital period of 6,836 hours.

Time series analysis was carried out using the MCV program (I.L.Andronov, A.V.Baklanov, Astronomical School Reports, 2004, 5, 264, <http://uavso.pochta.ru/mcv>) and FO (I.L.Andronov, Odessa Astronomical Publications, 1994, 7, 49).

V. Breus

Department of Astronomy, Odessa National University, Ukraine

Data Reduction Tool: "Variable Stars Calculator"

Variable Stars Calculator is the computer program for data reduction of photometric observations and other periodical processes.

The main features of the program are

- Translation of estimates of brightness on the Niyland - Blazhko method into stellar magnitudes
- Transformation of the numbers of plates of plate's collection into the JD (database for the Odessa 7-camera astrograph is included)
- Barycentric correction
- Phase curve calculation and viewing
- Periodogram analysis of brightness variations using the method of Lafler & Kinman (1967) revised by Kholopov (1970)
- Determine extremes of brightness of any star (signal of any nature)
- Principal component analysis (PCA) of multi-channel signals
- Partial restoration of signal (PCA filtration)
- Graph viewer
- Saving of the curve into popular graphical formats
- Viewing double-channel diagrams for multi-channel data.

The program supports text-format data files:

- Single channel data files (JD, data, comments columns separated by spaces)

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- Multicolumn data files (JD, data columns) – UBVRI photometry etc.

The program currently has an English, Russian and Ukrainian interface and manual, user-editable unlimited language profiles.

VSCalc is a freeware program available from the site of the Ukrainian Association of Variable Stars Observers (UAVSO) <http://uavso.org.ua/breus>

Author is thankful to Prof. Ivan L.Andronov for a supervision of this work.

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New approach on the theory of Earth Accretion

Classical theories of planetary creation suppose the planetessimals to be created merging the collisioning orbiting material in the protoplanetary disc, using only the gravitational attraction of larger pieces to attract the material and creating larger objects - the embryos of the nowadays planets. There are few problems not solved satisfactorily up to now in these theories, especially the fact, that the Earth core should consist of mostly one element - iron. Also the time duration of such gravitationally induced process of planet formation does not fit satisfactorily the real age of the planets. Our new approach is based on the fact of the evidence of impulse magnetic field in the galactic nebulae and the protoplanetary accretion discs. Theory was preliminary confirmed by the experimental equipment made in Slovakia.

Š. Parimucha 1, P. Dubovský 2, I. Kudzej 2

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2. Vihorlat Observatory, Humenné

Monitoring of Cataclysmic Variables at AO Kolonica Saddle

We present a part of our systematic monitoring of cataclysmic variables of SU UMa type in superoutbursts obtained at Kolonica Observatory, which began in 2006 and still continue. We have observed superhumps in more than 20 dwarf novae. Here we present our observations and preliminary analysis of 5 such a systems: MR UMa, UV Per, RXJ053234, CSS080505 and NSV1485. We performed period analysis of light curves and determined O-C diagrams for analysis of period changes. Our observations demonstrate that also small telescopes with low cost CCD camera could be used for a serious observations, which give interesting and useful results.

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„This work was supported by the Slovak Research and Development Agency under the contract No. LPP-0049-06“

Intermediate Polars Campaign at AO Kolonica Saddle

We presents results of the new observing program for 1 meter telescope at Astronomical Observatory at Kolonica Saddle. Nasmyth focus of the telescope is equipped by CCD camera. We have the opportunity to perform fast multicolor photometry of relatively faint objects. We decided to join the "Inter-Longitude Astronomy" project of regular monitoring of cataclysmic variables with different degree of influence of the magnetic field onto accretion (Andronov et al. 2003). The most intensive collaboration exist with Crimean Astro-physical observatory and Chungbuk National University, South Korea. We have observed the following intermediate polars: RXJ2133.7+5107, MU Cam, BG CMi, PQ Gem, 1RXS J063631.9+353537, 1RXS J070407.9+262501 and 1RXS J180340.0+401214. Additionally we had the chance to observe two objects during outbursts: DO Dra and HT Cam.

Daniel Balud'anský

Roztoky Observatory

15th Slovak Observational Astronomy Workshop "ZIRO"

We announce the traditional workshop will be held between February 12-14, 2009 at the Roztoky Astronomical Observatory near Svidník, Slovakia. The goal of this workshop is to present results of the observations in various areas of stellar photometry, Sun, interplanetary mass etc., as well as discussions on the astronomical devices and new observational techniques.