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EURÓPSKA ÚNIA
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Astronomy and developement of interest in natural science

December 02 - 04, 2010

The third conference within the project

Carpathian Sky

Abstract Book

Oral presentations, scientific part:

I. L. Andronov

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Mathematical Modeling of the Light Curves Using the "New Algol Variables" (NAV) Algorithm

We introduce a non-polynomial-spline approximation for approximation of the light curves of eclipsing binary stellar systems with relatively narrow minima. Any periodic function may be fitted by a trigonometric polynomial (TP), and there are well-known continuous and discrete Fourier transforms. The situation is much more complicated for the signals with irregular spacing between the times (or phases) of the observations, which is a very common situation in astronomy. There are at least 6 modifications of the "Fourier transform" for such cases. The algorithms to determine the statistically significant degree of such a TP are discussed by Andronov (*1994OAP.....7...49A*, *2003ASPC..292..391A*) and are realized in the program FDCN.The program was applied to ~1400 variables of different types - pulsating, eclipsing, cataclysmic, which were studied in terms of the "Inter-Longitude Astronomy" (ILA) campaign (*2003A&AT...22..793A*).

However, according to the GCVS = "General Catalogue of Variable Stars" (Samus' et al., *2009yCat....102025S*, *http://www.sai.msu.su/groups/cluster/gcvs/*), the main difference of the Algol-type (EA) systems from that of the EB- and EW- types, "it is possible to specify, for their light curves, the moments of the beginning and end of the eclipses". In the mathematical terminology, this may be interpreted as an abrupt change of the derivative of the smoothing function, which causes a slow decrease of the TP coefficients and thus to a large number of parameters m to be taken into account for the fit. E.g. for D=0.10 (full duration of eclipse in units of the period), $m \sim 1+1/D \sim 11$ and even larger for smaller D. The Hibbs phenomenon and statistical errors cause apparent waves at the light curve, although outside the eclipse. To decrease a number of parameters and to make them more adequate for the Algol variables (especially for the new ones, for which the parameters are to be determined for the first time), we propose a fit combined from a second-order trigonometric polynomial (TP2) plus localized contributions of minima (parametrized in depth and profile separately for the primary and secondary minima). For circular orbits, the width of both minima should be equal for both minima.

As the basic dimensionless function, we have used $V(z)=(1-|z|^b)^{3/2}$ (for $|z|<1$), where $z=2f/D$, f is phase and D is a full duration of minimum, as defined in the GCVS. The parameter b describes the mid-eclipse (from $b=2$ for parabolic minima typical for partial eclipses to $\beta \to \infty$ for "rectangular-shaped" full eclipses of "point sources"). The power index is fixed to 3/2, based on asymptotic behaviour of eclipses of round, elliptical (or, generally, bulgy) shaped objects with non-unity darkening coefficient. To estimate the free parameter D, we compute a grid of test-function and determine the position of its minimum.

This "semi-physical" approximation with 3 parameters per minimum differs from accurate integrations of a physical models of binary systems with a large number of unknown parameters (e.g. Binary Maker (*www.binarymaker.com*; *2005SASS...24...23B*), Phoebe (*phoebe.fiz.uni-lj.si*) and other based mainly on the Wilson-Devinney model (*1971ApJ...166..605W*)). However, it seems to provide an effective possibility either to determine the parameters needed to be listed in the GCVS, or to get preliminary estimates of physical parameters needed for further multi-parameter detailed modeling.

In this work, we illustrate the method and compare the NAV and the TP fits, particularly, using the light curves of new variables Kol7 and Kol8 discovered in Kolonica by Natalia A.Virnina (*2010OEJV..119....1V*). The application of this method to her other new variables has been recently published *(2010OEJV..129....1V*). Our tests show that the "New Algol Variables" (NAV) algorithm is also effective also for the EB- and EW- type stars.

The method is proposed for determination of phenomenological parameters needed for the GCVS and other catalogues.

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Luminosity-Dependent Changes of Variability Types in the Nova-Like Binary System TT Arietis.

TT Ari is a nova-like star, which exhibits few types of photometric variability - from (sometimes) 8-sec oscillations to 15-25 min Quasi-periodic oscillations - QPO, positive (~0.1428d) and negative (~0.1329d) superhumps (whereas the orbital period is 0.13755d), a few-day possible superhump-orbital beat period and ~year-scale excursions from a typically bright (10.7-12 mag) state to ~18. We discuss changes of characteristics of variability in either high luminosity state with positive (or, alternatively, negative) superhumps based on observations from our international campaigns (2009A&A...496..765K, 2005IBVS.5664....1A, 1999AJ....117..574A, 1996A&A...312..121T), or during an extremely low and deep state of low luminosity observed from September, 2009, to November, 2010. At the low state, the variability was dominated by ~2-mag waves with a 2h timescale. During a rise to an usual bright state, the system exhibited positive superhumps; a double-wave (during a positive superhump period) variability, and, finally to the current moment, negative superhumps. The QPOs were observed at different luminosity states, their characteristics are also discussed. Discoveries of changes of type of variability and brightness were published in numerous VSNET-circulars.

The observational campaign from 2009 to 2010 was succeeded in ~100 observational runs. The study is a part of the "Inter-Longitude Astronomy" project (2003A&AT...22..793A)

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Detection of the O'Connel's Effect vs Improved Photometric Elements of the EW-Type System GSC 04270-00206

We present results of two-color photometric study of the newly discovered (2004JASS...21..191K) eclipsing binary star GSC 04370-00206 in the field of the intermediate polar MU Cam (2005JASS...22..197K). CCD V,R observations were obtained in the Astronomical Observatories in Hlohovec, Baja and Kolonica in 2007-2009.

The mean weighted values of the photometric elements are Min.BJD=2454805.75635 and P=0.44264511(27). The range of the brightness variations is 13.7916-14.1692 (V) and 13.0665-13.4442 (R) based on the trigonometric polynomial fit of statistically optimal order s=4. The algorithm and program FDCN are described in (1994OAP.....7...49A, 2003ASPC..292..391A). The accuracy of the period determination is by a factor of 4500 times better than the one published by the discoverers based on only one night of observations.

Phase curves were computed. There are systematic changes from night to night.

So we may suggest that there is a variability of brightness of star which can be interpreted as the O'Connel's effect i.e. the presence of the migrating spots in the atmosphere.

Systematic changes of brightness from one minimum to another are significant only in R filter. The V-R color variations are rather strange. The largest value of V-R corresponding to smallest temperature occurs unexpectedly at the phase 0.5 of the secondary minimum, whereas the largest color temperature is observed at phase 0.9, i.e 0.1 prior to the main minimum, practically at the middle of the descending branch. This differs from expectations for deformed stars, for which a double-hump wave is observed with a temperature maximum at maximum phases of 0.25 and 0.75. This phenomenon is a subject of further investigations to check its stability.

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Photometric Study of the Intermediate Polar PQ Geminorum

We obtained photometric observations at the 150-mm TOA, 14" Maksutov and 16" Richie-Chritien telescopes of the Tzec Maun Observatories (Morook, Australia and Mayhill, New Mexico, USA). Observations were done with Bessel V and R filters. PQ Gem was observed by V.V.Breus during 2 nights in February, 2010. We used finding chart obtained from Digital Sky Survey. The comparison stars were measured by A. Henden. Also we used 6 nights of observations obtained by P. Dubovsky in Kolonica in 2007-2009.

Using the published spin period 0d.0096459939(17) (Hellier, C. 1997, MNRAS, 288, 817-832) we have computed a new epoch T_E=2455245.902230 for the cycle number 616602 and a new period 0d.0096466105.

The O-C diagrams and corresponding period variations are discussed.

D. Bruncko

ATLAS collaboration

ATLAS - highlights from this year

The high-lights from ATLAS experiment at LHC received during this year will be shortly presented. I will be mention some "rediscovery" results, e.g. top/anti-top quarks production, average charged multiplicity behavior depending on the energy and rapidity, weak bosons production, etc.

P. Dubovský

Vihorlat Observatory, Humenné, Slovakia

Annual Report on Observational results of AO at Kolonica Saddle

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.

Hegedüs, Szakáts, Bíró, Vinkó, Csák, Szalai, Nagy + 7 others (1), G. Howie Marion (2), J. Craig Wheeler (3), Szergej Rosztopcsin (4)

(1) Baja Astronomical Observatory & Szeged University, Hungary

(2) Harvard-Smithsonian Center for Astrophysics

(3) University of Texas

(4) McDonald Observatory

First results of Baja-Szeged Supernova Search program

A new supernova search program started in 2009 at Baja Astronomical Observatory, based on the 1 degree-field of view BART-1 robotic telescope. 638 target fields were selected and monitored through one and a half year. The results are: independently found 4 supernovas (1 real co-discovery with light curve and spectrum), and 54 new unknown object. The project is still going on.

L. Hric, E. Kundra

Astronomical Institute, Slovak Academy of Sciences, T. Lomnica, Slovakia

Eclipsing binary V471 Tau

V471 Tau is a semi-detached binary classified as pre-cataclysmic system of post-common envelope consisting of white dwarf and main sequence star of the spectral type K2 V. Whereas during our observations the (O - C) diagram trend changed we could determine the right model of V471 Tau system, interpret the changes of (O - C) diagram by third body in the system.

I. Kudzej

Vihorlat Observatory, Humenné, Slovakia

From Kolos to Kolos - A New Concept of Organization of AO and Planetarium at Kolonica Saddle

The overview of recent achievements in instrumental and infrastructural equipment of Astronomical Observatory at Kolonica Saddle connected with installation of new instruments purchased in the frame of Carpathian sky project.

A. Kutka (1), Š. Parimucha (2)

(1) Slovak Organization for Space Activities, Slovakia

(2) Institute of Physics, Šafárik University, Košice, Slovakia

Slovakia on the way to ESA

We present current activities of Slovakia on its way to ESA. We discuss why is ESA important for our next development as well as our possibilities to involve in ESA projects.

Š. Parimucha

Institute of Physics, Šafárik University, Košice, Slovakia

SKALTA - detector of secondary cosmic rays showers

We present basic facts about SKALTA detector of secondary cosmic rays showers. This detector is located on the roof of the building of Faculty of Natural Sciences of Safarik University in Kosice. It consists of three scintillation detectors which in coincidence detect secondary cosmic rays showers. System fully operate from October 2010 and provide data to central server. Detector is a great improvement of technical infrastructure of cosmic research at Safarik University. It allows us to study high energy particles as well as to involve students into cosmic physics research and give them opportunity to work with original data.

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

(1) Institute of Physics, Šafárik University, Košice, Slovakia

(2) Vihorlat Observatory, Humenné, Slovakia

Photometric solution of newly discovered spotted eclipsing binary GSC 2787-1836

We present our preliminary analysis of the light curves of newly discovered eclipsing binary GSC 2787-1836. We found that system exhibits asymmetric light curves changing in time. It could be explained by moving spot(s) on the one of components.

E. Semenko, I. I. Romanyuk

Special Astrophys. Obs. Zelenchuk, Russia

Study of stellar magnetism

N. Virnina (1), R. Kocián (2), L. Hambálek (3), P.A. Dubovský (4), I. Kudzej (4)

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(3) Astronomical Institute of the Slovak Academy of Sciences, Tatranská Lomnica, Slovakia

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A new multiperiodical pulsating star USNO-A2.0 1425-1870026

The variability of the star USNO-A2.0 1425-1870026 had been discovered by R. Kocián and L. Hambálek in the vicinity of the EW binary system BS Cas in 2007, and investigated using the telescopes 200/1200 Newton, Schmidt-Cassegrain 12" and 508/2500 Newton. Using the Peranso software, they determined the following parameters: the period P=0.419782±0.00001 d, the epoch E0 = HJD 2454335.497728±0.00013, the amplitude of the variability A = 0.19 ±0.04 mag in R-band, and classified this new variable star as a low-amplitude RRc-type. They noticed that there was some variance in amplitude between their archive data, which covers the time interval from 2004 August to 2004 October, and the recent ones (2007-2008).

In 2009 the new observations were obtained using the same telescopes and the other one - 280-mm reflector of Vihorlat Observatory, Slovakia. As far as according to the united observations the shape of the phase curve wasn't perfect, we decided to look for the secondary period. Using the software WinEfk (Goransky), 3 most probable (close to each other) secondary periods were found: 1.267365 d, 1.267276 d and 1.262606 d. In each case the amplitude and the shape of the light curve are changing during the period.

N. Virnina (1), I.L. Andronov (1), S. Zola (2,3), M. Mogorean (4)

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WZ Crv: a semidetached system with mass transfer

We present the results of the first two color VR investigation of the Algol-type binary system WZ Crv (12h44m15.19s, -21o25'35.4" (2000)), and the physical parameters of this system resulting from the Wilson-Devinney code (1971ApJ...166..605W).

All observations of WZ Crv were obtained using the remotely controlled telescope TOA-150 of the Tzec Maun Observatory (USA). We determined the moments of individual minima, the orbital period, the initial epoch, the color indices V-R and estimated temperature of the secondary component. Using the archive observations of the ASAS and NSVS databases, and individual minima timing, obtained by Otero & Dubovsky (2004IBVS.5557....1O), we plotted the O-C diagram. This diagram indicates the increasing of the period. Assuming that the system consists of a rather hot, more massive and bright, but smaller first component, and of a larger but cooler second component, which nearly fills its Roche Lobe, we estimated the mass transfer rate from the secondary star to the primary.

The new light curves of WZ Crv show an obvious asymmetry: the system brightness at the second maximum is higher than that of the first one. We interpreted this feature as being caused by a spot on the photosphere of one of the components. Using the Wilson-Devinney code, appended with the Monte Carlo search algorithm, we made the light curve modelling. The procedure has been described in details by Kreiner, Rucinski, Zola et al. in the paper "Physical parameters of components in close binary systems. I" (2003A&A...412..465K).. Two spotted models had been considered: one assuming a cool spot on the secondary star, while the other a hot spot on the primary component. Both computations resulted in a similar model: the hotter star is well within its Roche lobe, while the cooler star exactly (or almost) filling in its Roche lobe. For comparison, also a non-spotted model has been computed showing a much worse fit in maxima. The model with the hotter primary (~11 080K) with a hot spot on the equatorial zone of its atmosphere – due to mass transfer from the Roche lobe filling companion and a cool (5650K – fixed from the V-R color index) star describes all observed data of WZ Crv in the most consistent way.

M. Zejda, Z. Mikulášek

Masaryk University, Dept. of Theor. Physics and Astrophysics

Timings of Minima. Estimation or Determination

Short overview of common graphical and numerical methods of timings of minima determinations is given. Authors show that well known Kwee-van Woerden method is used in uncorrect way without fulfil of its own assumptions. They offer two new Mikulasek's methods for quick and precise determinations of extrema timings. Short introduction of their usage is given.

Oral presentations, educational part:

M. H. Bartolomejová (1), L. Hric (2)

(1) Slovak Astronomical Society, Slovak Academy of Sciences, T. Lomnica, Slovakia

(2) Astronomical Institute, Slovak Academy of Sciences, T. Lomnica, Slovakia

Vyhodnotenie Astronomickej Olympiády a budúcnosť

V roku 2006 sme v Slovenskej astronomickej spoločnosti (SAS) pri SAV podali projekt Astronomickej olympiády (AO) (LPP-0172-06) cez Agentúru na podporu výskumu a vývoja (APVV). Projekt bol schválený a agentúra nám v priebehu 4 rokov financovala organizovanie AO na Slovensku a účasť obmedzeného počtu študentov na Medzinárodných olympiádach.

R. Bury

Vihorlat Observatory, Humenné, Slovakia

Stereo i 3D w edukacji astronomii

Przykłady zastosowania oprogramowania do edukacji astronomicznej z wykorzystaniem stereografii i widoku 3D. Przykłady zastosowań stereofotografii w badaniach i edukacji astronomicznej. Samodzielne przygotowanie stereofotografii. Obiekty astronomiczne 3D (obserwatoria i planetaria) w sieci Internet.

T. Bury

I Liceum Ogólnokształcące w Krośnie

Projekt KOPERNIK- Krosno-Stropkov 2010

Prezentacja realizowanego przez I Liceum Ogólnokształcące w Krośnie i Gymnazium w Stropkovie astronomicznego Projektu KOPERNIK. Cele projektu, doświadczenia w jego realizacji, wyniki. Edukacja astronomiczna, poznawanie regionu, współpraca polskiej i słowackiej młodzieży.

P. Dubovský

Vihorlat Observatory, Humenné, Slovakia

APVV Projekty Vihorlatskej hvezdárne pre popularizáciu astronómie

Vihorlatská hvezdáreň v Humennom v posledných rokoch využíva na podporu svojich popularizačných aktivít program Podpora ľudského potenciálu v oblasti výskumu a vývoja a popularizácia vedy Agentúry na podporu výskumu a vývoja. Projekt Vesmír v priamom prenose bol financovaný v rámci výzvy LPP2006 a jeho riešenie bolo ukončené. V súčasnosti sa rieši projekt Vesmír pre pokročilých podporený v rámci výzvy LPP2009. Najzaujímavejšie výsledky a skúsenosti z oboch projektov sú predstavené v tomto príspevku.

Tatiana Roháčová

Technical University of Košice, Slovakia

Possibility of applying the ideas of the alternative schools in the educational process of the traditional school

An article shows the possibility of using the theory and practice of the alternative schools as one of the valuable sources of innovation in today's school. Unconventional methodical practices and organizational forms of learning process used in these schools provide a variety of reform impulses to organize the school life, creating of interpersonal relationships, and pedagogical formation of teaching and incorporation of region into the school life. They also have a democratic and humanistic effect on the teaching, school, students and influence the formation and acquisition of skills and attitudes such as initiative, independence, creativity, critical

thinking, the ability of cooperation, communication, empathy, ability to learn, solve problems and so on (Key skills), which form the basis of our new educational system. An application of the modern and alternative approaches of teaching requires a change in organizational forms of education, enabling scholars to learn about the objects, phenomena and processes directly in the natural environment and here we see a great benefit and importance Carpathian Sky project for regional educational system.

M. Vidovenec

Slovak Central Observatory, Hurbanovo, Slovakia

Pomaturitné štúdium astronómie

Slovenská ústredná hvezdáreň organizuje od roku 1969 pomaturitné štúdium astronómie. Štúdium je úrčené pre každého, kto absolvoval všeobecnú maturitnú skúšku a študent ňou získava úplné stredoškolské odborné vzdelanie v oblasti astronómie. Vyučovací proces je organizovaný tak, aby študenti získali teoretické vedomosti a praktické zručnosti, ktoré im umožnia samostatne vykonávať pozorovania, ich spracovania, odprezentovať získané dáta a samostatne pracovať v oblasti popularizácie astronómie.

J. Žižňovský

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Vplyv učebných osnov na kvalitu vedomostí žiakov

Prezentujú sa poznatky získané vo Veľkej Británii šesť rokov po zavedení celonárodných učebných osnov z astronómie.

P o s t e r s :

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(2) Department "High and Applied Mathematics", Odessa National Maritime University, Odessa, Ukraine

Atlas and Catalogue of Characteristics of Extrema of Individual Pulsations of Semi-Regular Variable Stars

We introduce the "Atlas and Catalogue ..." which is an extended version of the "Catalogue of main characteristics of pulsations of 173 semi-regular stars" by Chinarova and Andronov (2000OAP....13..116C) taking into account observations from the AFOEV international databases obtained during 10 more years of photometric monitoring. Statistical study of semi-regular variables using scalegram-based characteristics was made by Andronov and Chinarova (2003ASPC..292..401A). Comparison of different methods for determination of characteristic time scales in semi-regular stars was made by Andronov and Chinarova (2001OAP....14..113A). In this work, we use for the analysis improved values of the parameters based on more extensive time series and more individual extrema.

I. Kudzej, P.A. Dubovský

Vihorlat Observatory, Humenné, Slovakia

1 Meter Telescope in Kolonica Saddle - 4 Years of Operation

The actual technical status of 1 meter Vihorlat National Telescope at Astronomical Observatory at Kolonica Saddle is presented. Cassegrain and Nasmyth focus, autoguiding system, computer controlled focusing and fine movements and other improvements achieved recently. For two channel photoelectric photometer the system of channels calibration based on artificial light source is described. For CCD camera FLI PL1001E actually installed in Cassegrain focus we presents transformation coefficients from our instrumental to international photometric BVRI system. The measurements were done during regular observations when good photometry of the constant field stars was available. Before FLI camera acquisition we used SBIG ST9 camera. Transformation coefficients for this instrument are presented as well.

In the second part of the paper we presents results of variable stars observations with 1 meter telescope in recent four years. The first experimental electronic measurements were done in 2006. Both with CCD cameras and with two channel photoelectric photometer. Starting in 2007 the regular observing program is in operation. There are only few stars suitable for two channel photoelectric photometer observation. Generally the photometer is better when fast brightness changes (time scale of seconds) must be recorded. Thus the majority of

observations is done with CCD detectors. We presents an brief overview of most important observing programs: long term monitoring of selected intermediate polars, eclipse observations of SW Sex stars, eclipses of hot subdwarfs stars. Occasional observing campaigns were performed on several interesting objects: DW UMa, OT_J071126.0+440405, V603 Aql, TT Ari in low state, V471 Tau eclipse timings, Z And in outburst.

Finally four new eclipsing variables were discovered during observations with 1 meter Vihorlat National Telescope. Additionally VNT data have exhibit strong spot activity in another new eclipsing variable discovered in Kolonica in the field of CN And.

J. Žižňovský (1), Z. Mikulášek (2)

(1) Astronomical Institute, Slovak Academy of Sciences

(2) Dept. of Theoretical Physics and Astrophysics, Masaryk University, Brno

Orbital motions in the triple system AR Aurigae

New orbital parameters were derived for the HgMn eclipsing binary AR Aur. The system has a third body with a well pronounced light-time effect.

The project is co-funded by the European Union through the European Regional Development Fund and the National Public Contribution within the Cross-border Cooperation Operational Programme Poland – Slovakia 2007 - 2013