International conference

Binaries

- key to comprehension of the Universe

June 8-12, 2009 Brno, Czech Republic

Abstract Book

SCIENTIA EST POTENTIA

FACULTAS MATHEMATICA PHYSICAQUE

SKALNATÉ PLESO

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14:30 Closing remarks

I. Monday, 8 June

The Future of Binary Star Research: Challenges and Rewards

I

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The recent advances in binary stars research will be discussed. These cover new techniques that span the electromagnetic spectrum from X-ray to gravity waves. Also discussed will be the future expectations of research in binary stars. Results from ultra-high precision spectroscopy and photometry will be evaluated as well as what new astrophysical information can be obtained from the expected tens of thousands of new eclipsing binaries that will be discovered from all sky surveys such as the LSST, PanSTARRS, and later by GAIA. What new astrophysical information will be gained? What new discoveries await us? And what new problems will be uncovered? New strategies for utilizing these new data need to be developed to fully exploit these rich data sets on binaries will be discussed. Also discussed will be how to accomplish these goals and what new discoveries await us. These will be the major themes of this talk.

The CoRoT light curves: a goldmine for binary research

C

Maceroni, C.[1]

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In January 2008 began the distribution of the first data from mission Corot. Since its launch at the end of 2006 continuous and high accuracy photometry of hundred thousand stars has been acquired in several long (150d) and short (30d) runs. Hundreds of new eclipsing binaries have been discovered and photometry of unprecendented accuracy is becoming available. We will present a few highlights from the fist year of analysis on EBs and illustrate the opportunities which are offered with the public opening of the archives (started this year).

Binary Detection and Parameter Estimation in the Automated Spectroscopic Surveys

C

Matijevič, G.[1]; *Zwitter, T.*[1]; *RAVE Collaboration*[1]

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Automated all-sky spectroscopic surveys like the ongoing RAVE survey and the SDSS and the forthcoming Gaia mission and Hermes survey are providing large

spectroscopic surveys of the Galaxy for the first time. Although primarily aimed at the galactic archeology and evolution, they are a valuable source for the binary star research community. Identification of non-blended double-lined spectra is easy and it is not limited by the rare occurrences of eclipses. When the spectrum is properly classified, its atmospheric parameters can be calculated by comparing the spectrum with the best fit model. In addition, single lined binaries are easily discovered if more than one spectrum of the particular object is available. Here we present the analysis of the binary stars from the sample of roughly 100 000 RAVE survey spectra. The classification and binary discovery method is based on the correlation function analysis. The comparison of these spectra with the model shows that it is possible to estimate the essential atmospheric parameters relatively well. Large number of such estimates and the fact that RAVE consists of a magnitude selected sample without any color cuts makes it suitable for a binary star population study.

Precise distances to the Magellanic Clouds from the unique late-type long-period eclipsing binaries

C

Pietrzynski, G.[1]; *Thompson, I.*[2]; *Graczyk, D.*[1]; *Gieren, W.*[1]; *Minniti, D.*[3]

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We will present first results on distance determination to the LMC and SMC based on very rare late-type long-period eclipsing binaries with G type giant components. It has been already demonstrated that based on accurate photometric and spectroscopic data and applying currently very well established surface-brightness color (V-K) relation one can easily get 3 % accurate distance determination to individual system (Pietrzynski et al., 2009, ApJ in press, arXiv0903.855). Having a few dozens such systems recently discovered in both Clouds we should be able to measure distances to the LMC and SMC with 1 and 2 % accuracy, respectively.

Instruments and missions in the 21st century

I

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Current and future techniques relevant to binary-star observations will be reviewed. Computers have changed the field dramatically, making some traditional

20-th century approaches obsolete. Size of the samples often exceeds human capacity to maintain catalogs, while data mining becomes a viable research tool (examples: 2MASS, transits, LSPM today, LSST and GAIA in the future). High angular resolution is reached with adaptive optics, speckle interferometry, and long-baseline interferometry. High astrometric precision demonstrated by Hipparcos will make the next huge step forward with GAIA and SIM, while precisions in the 10-100 microarcsecond range are also reachable from the ground. A similar progress in the radial-velocity precision has spun a new field, exoplanet research, which benefits from the techniques developed for binary stars. However, the quantity and quality of the RV data for binaries remains largely insufficient, calling for dedicated projects like RV robots. Taken together, new observational capabilities permit detailed study of interesting objects or object classes. The space of binary parameters can now be covered almost completely (at least for nearby stars), giving access to un-biased statistics of binary and higher-order systems. Statistical properties of binaries and study of key objects will finally reveal the mystery of binary-star formation.

Introduction to VSAA - the method of Variable Sine Algorithmic Analysis and its applications to active binaries

C

Tsantilas, S.[1]*; Rovithis-Livaniou, H.*[1]*; Latkovič, O.*[2]*; Cséki, A.*[2]*; Djuraševič, G.*[2]

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The quasi-periodic modulation of the orbital period, common among active binaries of RS CVn-type, Algols or contact systems, is mainly attributed to the development of magnetic activity cycles. And in most of the cases the corresponding periodicities are extracted using Fourier transform. But, this yields to the loss of time information, as the analysis is made in the frequency domain only. For this purpose, we have introduced the prototype method of Variable Sine Algorithmic Analysis (VSAA). VSAA analyzes the orbital period in the joined time-frequency domain, and thus provides an accurate description of the time variation. This makes the method ideal for tracing variable periodicities, as detected in the above-mentioned cases, and to many others, too. Moreover, VSAA is incorporated in a computer code, for which a Graphical User Interface has been developed. Here we present a complete analysis of some representative RS CVn systems, using VSAA, acquiring the variable frequency and amplitude of their orbital period modulation. In addition, the RMS subsurface magnetic field of the active component has been estimated.

The delay time distribution of type Ia supernovae: comparison between theory and observation

C

Mennekens, N.[1]*; De Donder, E.*[1]*; Vanbeveren, D.*[1]*; De Greeve, J-P.*[1]

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It is widely accepted that type Ia supernova explosions (SNe Ia), which are very important for the chemical enrichment of the interstellar medium, are caused by white dwarfs (WD) in binary stars accreting matter and thus exceeding the Chandrasekhar limit (see e.g. Livio 2001). The exact nature of this process is however still uncertain, the two leading explanations being that either the WD accretes matter from a late main sequence or red giant companion (the single degenerate scenario, SD, see e.g. Nomoto 1982) or that the explosion is caused by the merger of two WDs spiraling into each other due to the emission of gravitational wave radiation (the double degenerate scenario, DD, see e.g. Webbink 1984). In this paper, we use the population number synthesis (PNS) evolution code by De Donder & Vanbeveren (2003) to compute the expected time distributions of SNe Ia, both through the SD and DD scenario. The code has been updated with the latest results of Hachisu et al. (2008) to include the mass stripping effect in determining the SN Ia progenitors in the SD scenario. This effect reduces the amount of mass transferred to the WD and can allow the system to avoid a phase of common envelope (CE) evolution. The code also allows to differentiate between the alpha (based on the balance of energy, Webbink 1984) and gamma (based on the balance of angular momentum, Nelemans & Tout 2005) scenarios describing the energy conversion during the CE evolution of binaries. The results of this Brussels code can be directly compared to those obtained by Belczynski et al. (2005) with the StarTrack evolution code. Both evolution codes agree that SNe Ia occur in a wide time range after star formation and that the shape and extent of this delay time distribution (DTD) critically depends on whether the SD or DD scenario is used. In the case of the DD scenario, the SN Ia rate decreases inversely proportional to the time, whereas in the SD scenario, the distribution shows multiple peaks. The results predicted by the PNS code are then compared to the latest observed DTDs obtained by Totani et al. (2008) and Mannucci et al. (2006). This allows to draw conclusions on the constraints put on the theoretical models by these observations. References K. Belczynski, T. Bulik, A. Ruiter, ApJ 629, 915, 2005 E. De Donder & D. Vanbeveren, NewA 8, 817, 2003 I. Hachisu, M. Kato & K. Nomoto, ApJ 679, 1390, 2008 M. Livio, Space Telescope Science Institute symposium series 13, 334, 2001 F. Mannucci, M. Della Valle, N. Panagia, MNRAS 370, 773, 2006 G. Nelemans & C. Tout, MNRAS 356, 753, 2005 K. Nomoto, ApJ 253, 798, 1982 T. Totani, T. Morokuma, T. Oda, M. Doi & N. Yasuda, PASJ 60, 1327, 2008 R. Webbink, ApJ 277, 355, 1984

Eclipsing Binary Models in the 21st Century

I

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Two eclipsing binary (EB) modeling areas will be discussed - absolute light curve analysis and pulsational EB analysis. Absolute light curve modeling and analysis leads naturally into a Direct Distance Estimation (DDE) algorithm, with advances in generality, simplicity, and accuracy. Distance becomes an ordinary parameter in Least Squares DDE solutions, with no loss of accuracy for semi-detached or over-contact *vis a vis* detached binaries. In principle, temperatures of both components can be measured from absolute light curves (2T solutions), although practical issues persist at present so 1T solutions may be preferred for now. Phase and inclination dependence for spectroscopically measured EB temperature can be computed rigorously. DDE prescribes a definite rule, via a temperature-distance (T-d) theorem, for the number of light curves to be solved simultaneously, but otherwise the process is essentially the same as conventional analysis. Essential requirements for absolute solutions are light curves in standard bands with known flux calibrations and negligible or reliably estimated interstellar extinction. For more than a decade, EB's have been providing distances substantially more accurate than those from standard candles, far beyond the range of trigonometric parallaxes. Now DDE promises wider and easier applications, with the intricacies of EB proximity effects condensed into a computer model. It has produced distances with accuracies similar to those of the Hipparcos mission for solar neighborhood EB's. In the second area of the talk, the number of known pulsational EB's has been growing rapidly so as to consitute a new sub-discipline. The value of EB pulsation for progress in stellar structure and evolution has been emphasized in recent reviews, although developments in light-velocity curve modeling and analysis are needed if the promise is to be realized. EB pulsation is now commonly analyzed by superficial schemes such as addition of pulsation waves to theoretical EB light curves, subtraction of pulsation waves from observed EB light curves, or subtraction of a theoretical EB curve from an observed curve. As none of these procedures are valid to first order for obvious reasons, a clear need has arisen for a proper model that joins pulsational and EB properties. Basic strategies in which the model stars pulsate radially and local physical variables follow the pulsations will be discussed, as will parameterization and Least Squares solutions. Output consists of pulsation waveforms, amplitudes, and ephemerides, properly separated from EB behavior and with standard errors. Non-radial modes are left to future work.

Artificial Intelligence in Astronomy

C

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Brief overview of the use of AI technologies in Astronomy and discussion of results of AI for Eclipsing Binaries.

Shellspec - a code for modelling the spectra and lightcurves of interacting binaries

C

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Shellspec is a new program designed to calculate light curves, spectra and images of interacting binaries immersed in a moving circumstellar environment which is optically thin. It is exactly this environment which is the source of a variety of emission lines seen in the real spectra of such objects. The code solves a simple radiative transfer along the line of sight in moving media. The assumptions include LTE and optional known state quantities and velocity fields in 3D. Optional (non)transparent objects such as a spot, disc, stream, jet, shell or stars as well as an empty space may be defined (embedded) in 3D and their composite synthetic spectrum calculated. The stars may have Roche geometry and known precalculated spectra. We will introduce and describe the program as well as inform about the recent development of the code.

The widest binary stars: A statistical approach

C

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A large and unbiased sample of wide binary stars constitutes an excellent tool for the study of the Galaxy. Its astronomical applications range from probing the

conditions of star formation to testing the dark matter hypothesis. In view of the difficulties in constructing an useful catalogue of wide binaries, we choose a statistical approach to obtain large numbers of binaries, at the expense of individual pair identification. We select a homogeneous sample of nearly one million stars in the direction of the Northern Galactic Pole from the SDSS DR6 database. Constructing the angular two-point correlation function reveals a strong clustering signal at angular separations smaller than $10''$. Modelling this signal by means of the Wasserman-Weinberg technique allows us to infer the local wide binary number density as well as the power-law index of the semimajor axis distribution in the range from 0.001 pc to 1 pc. The data are consistent with Oepik's law (a single power-law model with index 1) and suggest that nearly 830 wide pairs with projected separations between 0.1 pc and 0.7 pc exist in our sample, while none can be observed beyond 0.7 pc.

David Dunlap Observatory program of short-period binary spectroscopic orbits. $\boxed{\text{I}}$

Rucinski, S. M.[1]

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The DDO program was conducted in 1999 – 2008 using the 1.9m telescope. It has resulted in radial velocity orbit for 149 short period (P<1d) binaries of the total observed 161 systems with the completion level of about 8 % for photometrically known binaries to 10 mag. A large group of people from several countries helped to accomplish this useful project; their contribution is very highly appreciated and valued. The observatory has been closed for one year now and the binary program has been finalized with 15 publications, each containing several RV orbits and 6 additional papers with additional individual systems. This review will summarize the main results based mostly on the radial velocity data themselves, without reference to subsequent combined (photometry & spectroscopy) orbital solutions. Useful properties of the Broadening Functions approach will be illustrated by several interesting individual cases. Particular attention will be given to issues related to the very high frequency of triple-systems reaching 100 % and to serious deviations from the contact model for contact binaries; it will be noted that the linearity of the BF's makes it an excellent tool for studies rapid rotation, spots or even non-radial pulsations.

Interferometric observations of the hierarchical triple system Algol

C

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Algol is a triple stellar system consisting of a close semi-detached binary and a third object orbiting them. Due to the disputed spatial orientation of the close pair, the third body perturbation of this pair is the subject of much research. In this study, we determined the spatial orientation of the close pair orbital plane using the CHARA Array, a six-element optical/IR interferometer located on Mount Wilson, and state-of-the-art e-EVN interferometric techniques. We find the longitude of the line of nodes for the close pair is $\mathrm{Omega}_{close} = 48 \pm 2$ deg and the mutual inclination of the orbital planes of the close and the wide pairs is 95 ± 3 deg. This latter value differs by 5 deg from the formerly known 100 deg which would imply a very fast inclination variation of the system, not borne out by the photometric observations. We also investigated the dynamics of the system with numerical integration of the equations of motions using our result as an initial condition. We found large variation in the inclination of the close pair (its amplitude approx. 170 deg) with a period of about 20 millenia. This result is in good agreement with the photometrically observed change of the amplitude of Algols' primary minimum.

Common proper motion white dwarf companions to bright Hipparcos stars

C

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We will present our analysis of white dwarfs that are in common proper motion with bright Hipparcos stars. The parallax measurement of the Hipparcos companion allows to obtain an accurate mass estimate of the white dwarf. In addition, since the stars are distant companions, they would have evolved without any interaction, and hence provides us with an additional constraint on the evolution of stars and the initial to final mass relations.

II. Tuesday, 9 June

Formation and Evolution of Very Close Binaries of Low Mass

I

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Binaries of low mass are subject to a number of evolutionary processes, of which some are (i) nuclear evolution, (ii) Roche-Lobe Overflow, (iii) mass loss by stellar wind, enhanced by rapid rotation, (iv) angular momentum loss by stellar wind, magnetic braking and tidal friction, (v) mass transfer in contact, potentially in either direction, and (vi) heat transport from one component to the other during contact. The first two are probably fairly well understood, both qualitatively and quantitatively, although some remaining problems will be discussed, but the last four are very enigmatic. Unfortunately it is among low-mass binaries, with total mass of say $1 - 3M_\odot$, that all of these phenomena can be expected to occur, on something like the same timescale. This makes it particularly difficult to tie a particular system to a particular set of evolutionary processes.

Theory suggests that very close binaries (say $P \leq 3\,\mathrm{d}$) – restricting myself to those which appear to have undergone rather little nuclear evolution so that both components arguably are not very different from main-sequence stars – should appear in four morphological forms: (a) detached binaries, (b) semidetached binaries in which the more massive component is the one that fills its Roche lobe (reverse Algols), (c) semidetached binaries in which the less massive component is the one that fills its Roche lobe (normal Algols), and (d) contact, or as some would say overcontact, binaries, where both components overfill their Roche lobes up to the same equipotential surface. This is not to say that perhaps some other configuration may be important, but I am not sure that any has yet been put forward that is incontrovertible.

I have developed an evolutionary code in which the two components are solved *simultaneously*, and subject in principle to all six of the processes in the first paragraph. It is still preliminary, partly at least because of the difficulty of quantifying all six processes. I will illustrate some possibly peculiar evolutionary scenarios that can emerge; but I will mainly argue, on the basis of observed data from a variety of systems, that it is indeed necessary to include all these processes, and not, for example, to ignore mass loss by stellar wind by claiming that it cannot be strong enough to be significant.

Pan Binary Scenario for the Origin of Extremely Metal-Poor Stars in the Galactic Halo

C

Suda, T.[1]*; Komiya, Y.*[2]*; Yamada, S.*[3]*; Katsuta, Y.*[3]*; Nishimura, T.*[4]*; Ishizuka, C.*[1]*; Fujimoto, M. Y.*[3]

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Binaries are important probes of the early epoch of the Galactic evolution from the recent studies of the observations of extremely metal-poor (EMP) stars and the models of stellar evolution and nucleosynthesis. Thanks to the large-scale surveys of metal-poor stars in the Galaxy, more than hundred stars are identified as EMP stars having the metallicity of [Fe/H] $<\leq -3$, from thousands of candidate stars covered by the flux limited volume of $B \sim 18$ mag. In addition, the follow-up observations with high-dispersion spectroscopy reveal the detailed elemental abundances of more than 1000 metal-poor stars. In order to identify the first stars in our Galaxy, we have been focused on carbon enhanced metal-poor stars (so called CEMP stars). Some of these stars are considered to be (or have been) in the binary systems, inferred from the derived abundance pattern of CEMP stars. In particular, we showed that the three most iron-deficient stars known to date ([Fe/H] ~ -5) can be affected by the binary mass transfer, which is concluded by the comparisons of observed abundances with stellar models considering AGB evolution and nucleosynthesis (Suda et al. 2004, ApJ; Nishimura et al. 2009, PASJ). We also extended our work to derive the initial mass function (IMF) of our Galaxy using the statistics of CEMP stars with the assumption that all of them are affected by binary mass transfer. It is concluded that the IMF in the early Galaxy should have been in peaked at $\sim 10\ M_\odot$ (Komiya et al. 2007, ApJ). Based on the hypothesis that binaries make a significant contribution to the chemical enrichment of the early Galactic halo, we present a general picture of the origins of EMP stars and the chemical evolution of the Galaxy with the theoretical models of stellar evolution and nucleosynthesis, hierarchical clustering combined with the database of observed EMP stars that we have developed (The Stellar Abundances for Galactic Archaeology database available at http://saga.sci.hokudai.ac.jp). The present paper quantitatively compares the MDF and abundances of EMP stars derived from observations with the theoretical models of hierarchical merging based on the high mass-peaked IMF with the role of binaries taken into account. We discuss about the constraints on star formation history and the chemical evolution model of our Galaxy.

The formation of very wide binaries

C

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Numerous wide (>1000 AU) binaries in the Galactic field and halo have been discovered over the last decades. Their existence cannot be explained by star formation theories or by dynamical interactions in the Galactic field. We explain the origin of at least a part of these wide binaries by wide binary formation during the dissolution phase of young star clusters. Two single stars that leave the cluster at the same time, in the same direction, and with similar velocities, may form a new, very wide binary. Using N-body simulations, we study how frequently this occurs, and how the orbital parameters of such binaries depend on the properties of the cluster from which they originate. The resulting wide binary fraction for individual clusters initially consisting of single stars is 1-20 %, depending on the initial conditions. As most stars form as part of a binary or multiple system, we predict a high multiplicity fraction among very wide binaries.

Exotic Objects from Kozai Cycles, Tidal Friction and Magnetic Braking

C

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Several studies in the last three years indicate that *close* binaries, i.e. those with periods of ≤ 3 d, are very commonly found to have a third body in attendance. We argue that this proves that the third body is necessary in order to make the inner period so short, and further argue that the only reasonable explanation is that the third body causes shrinkage of the inner period, from perhaps a week or more to the current short period, by means of the combination of Kozai cycles and tidal friction (KCTF). In addition, once KCTF has produced a rather close binary, magnetic braking also combined with tidal friction (MBTF) can decrease the inner orbit further, to the formation of a contact binary or even a merged single star.

Some of the products of KCTF that have been suggested, either by others or by us, are W UMa binaries, Blue Stragglers, X-ray active BY Dra stars, and short-period Algols. We also argue that some components of *wide* binaries are actually merged remnants of former *close* inner pairs. This may include such objects as rapidly rotating dwarfs (AB Dor, BO Mic) and some (but not all) Be stars.

Binary populations in galaxies

I

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Understanding the galaxy in which we live is one of the great intellectual challenges facing modern science. With the advent of high quality observational data, the chemical evolution modeling of our galaxy has been the subject of numerous studies in the last years. However, all these studies have one missing element which is the evolution of close binaries. Reason: their evolution is very complex and single stars only perhaps can do the job. (Un)Fortunately at present we know that the majority of the observed stars are members of a binary or multiple system and that certain objects can only be formed through binary evolution. Therefore galactic studies that do not account for close binary evolution may be far from realistic. Because of the large expertise developed through the years in stellar evolution in general and binary evolution in particular at the Brussels Astrophysical Institute, we found ourselves in a privileged position to be the first to do chemical evolutionary simulations with the inclusion of detailed binary evolution. The complexity of close binary evolution has kept many astronomers from including binary stars into their studies. However, it is not always the easiest way of living that gives you the most excitement and satisfaction.

An overview of the interacting binaries "Double Periodic Variables"

C

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We introduce the class of intermediate mass binaries named Double Periodic Variables (DPVs), characterized by orbital photometric variability (ellipsoidal or eclipsing) in time scales of few days and a long photometric cycle lasting roughly 33 times the orbital period. After a search conducted in the OGLE and ASAS catalogues, we identified 114 of these systems in the Magallanic Clouds and 11 in the Galaxy. We present results of our photometric and spectroscopic campaigns on DPVs conducted during the last years, outlining their main spectroscopic characteristics. We present convincing evidence supporting the view that DPVs are semidetached interacting binaries with optically thick circumprimary discs, that experiencie regular cycles of mass loss into the interstellar medium. Their evolution stage is investigated, along with their relationship to classical Algols and W Serpentids. We conclude that DPVs can be used to test models of non-conservative binary evolution including the formation of circumbinary discs.

Probing evolutionary trends in close binaries from observed period changes

P

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O-C diagrams analysis offers an opportunity to view the very late orbital evolution history (about 100 yrs) of nearly synchronized close binaries. The orbital period function $P(E)$ becomes known in this way and hence it can be related with the most important physical mechanisms that modulate the orbital period of such binary systems through $\mathrm{d}J/\mathrm{d}t$ - $\mathrm{d}P/\mathrm{d}t$ (angular momentum - orbital period relations). Given the $\mathrm{d}P/\mathrm{d}E$ function and a variety of the implemented parameters, analytic parametric solutions can be sought in order to have estimations of the action of the most important of the physical mechanisms driving the observed orbital period variation trends. Preliminary analytic parametric solutions of such a generalized (non-conservative) $\mathrm{d}J/\mathrm{d}t$ - $\mathrm{d}P/\mathrm{d}t$ equation involving mass loss, magnetic braking and tidal evolution are presented here for some detached synchronized pairs (mainly members of the RS CVn group) whose orbital period variations are known by *O-C* diagram analysis.

Reconstruction and analysis of component spectra of binary and multiple stars

I

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In the last two decades about a dozen methods were invented which derive, from a series of composite spectra over the orbit, the spectra of individual components in binary and multiple systems. Reconstructed spectra can then be analyzed with the tools developed for single stars. Eventually this has created the opportunity for chemical composition studies in previously inaccessible components of binary stars, and to follow their chemical evolution, an important aspect in understanding evolution of stellar systems. First, we review new developments in techniques to separate and reconstruct individual spectra, and thereafter concentrate on some applications. In particular, we emphasize the elemental abundance studies for high-mass stars, and present our recent results in probing theoretical evolution models which include effects of rotationally induced mixing.

Fourier Disentangling Using Technology of Virtual Observatory

C

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The Virtual Observatory is a new technology of the astronomical research allowing the seamless processing and analysis of a heterogeneous data obtained from a number of distributed data archives. It may also provide astronomical community with powerful computational and data processing on-line services replacing the custom scientific code run on users computers. Despite its benefits the VO technology has been still little exploited in stellar spectroscopy. As an example of possible evolution in this field we present an experimental web-based service for spectral disentangling based on code KOREL. This code developed by P. Hadrava enables Fourier disentangling and line-strength photometry, i.e. simultaneous decomposition of spectra of multiple stars and solving for orbital parameters, line-profile variability or other physical parameters of observed objects. We discuss the benefits of the service-oriented approach from the point of view of both developers and users and give examples of possible user-friendly implementation of spectra disentangling methods as a standard tools of Virtual Observatory.

The Hyades binary Theta 2 Tauri: a new spectroscopic orbit and orbital parallax

C

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Theta 2 Tauri is an interferometric spectroscopic binary system and the brightest member of the Hyades cluster whose components show a complex pattern of pulsations of type delta Scuti. Due to the fast rotation of the components, mainly of the secondary, the lines in the observed composite spectra are heavily blended. This fact has prevented an accurate determination of the mass ratio of this system in previous studies. In attempt to minimize the errors in the radial velocities of the components, we have analyzed 114 echelle spectra of Theta 2 Tauri using the spectra disentangling algorithm, leading to a new spectroscopic orbit for this difficult system. In addition, the orbital parallax and the component masses were obtained, with unprecedented accuracy, combining both spectroscopy and long-baseline optical interferometry.

Applications of Doppler Tomography in 2D and 3D

C

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Over the past few years, the applications of Doppler tomography have been extended beyond the usual calculation of 2D velocity images of circumstellar gas flows. This technique has now been used with the new Shellspec spectrum synthesis code to demonstrate the effective modeling of the accretion disk and gas stream in the TT Hya Algol binary. The 2D tomography procedure also projects all sources of emission onto a single central (Vx – Vy) velocity plane even though the gas is expected to flow beyond that plane. So, new 3D velocity images were derived with the Radioastronomical Approach method by assuming a grid of Vz values transverse to the central 2D plane. The 3D approach has been applied to the U CrB and RS Vul Algol-type binaries, to reveal substantial flow structures beyond the central velocity plane.

Polarimetric analysis of binary stars

I

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Polarization of starlight carries important information on the physical processes and the radiation mechanisms in the source of emission. These include scattering by free electrons in the hot circumstellar plasma, and cyclotron emission by mildly relativistic electrons in accretion shocks on highly magnetic white dwarf stars. We review the analytical and numerical methods of modeling multi-wavelength polarization observations, and phase-locked variations detected over the binary orbital period, with the aim to determine some of the key parameters of the binary system, such as the orbital inclination, masses of the component stars, and structure and evolution of the circumstellar material. One important aspect of our work is to study magnetic fields of collapsed stars in binary systems. We can resolve cyclotron harmonics with spectropolarimetry, which offers an efficient tool of studying the extremely high magnetic fields (up to$\sim$100 million Gauss) in these end-products of magnetic star evolution.

Polarization in Soft X-ray Intermediate Polars

C

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The evolutionary connection between polars and intermediate polars (IPs) is not yet well established. Soft X-ray IPs are good candidates for progenitors of polars, but their magnetic field strengths are poorly constrained. Only a handful of them are known to be circularly polarized and converting polarized fractions into magnetic field strengths is problematic, so it is still unclear whether they are of comparable magnetic field strength to polars or not. We have performed a polarimetric survey for a sample of Soft X-ray IPs. Results provide evidences that some IPs have comparable magnetic field strengths to some polars and can hence evolve from one to the other as their orbital period decreases and synchronism is achieved.

A new evolutionary scenario for the formation of close massive black hole binaries such as M33 X-7

C

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The formation of close massive black-hole binaries poses a puzzle to binary evolutionary models, especially the intriguing system M33 X-7 (Orosz et al. 2007) which harbours one of the most massive stellar-mass black holes (16 solar masses) orbiting a 70 solar mass O-star every 3.5 days. In standard binary evolution theory an episode of mass transfer or common envelope is inevitable in a binary with such a small orbital period, which would prohibit the formation of a black hole with such a high mass. We argue that a new binary evolution channel, in which rotational mixing plays an important role (referred to as "Case M" in De Mink et al., 2008) can explain the formation of this system. We find that in very massive close binaries, the tides force the rotation rate of stars to be so high that rotationally induced mixing becomes very efficient. The stars evolve almost chemically homogeneously.

Instead of expanding during their main-sequence evolution (with the inevitable consequence of mass transfer), these star stay compact, inside their Roche lobe. Gradually, they evolve into massive helium stars. This scenario naturally leads to the formation of very massive black holes in a very close orbit with a less evolved massive companion such as M33 X-7.

III. Wednesday, 10 June

Galactic populations of X-ray binaries and related systems

I

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I will present an overview of the Galactic population of X-ray binaries and related systems, including cataclysmic variables. The advent of new instrumentation with unprecedented capabilities–spatial resolution, time resolution, sensitivity at higher energies–has advanced our understanding of accretion-powered X-ray sources over the last decade. There have been discoveries of new source classes including faint X-ray transients, super-fast X-ray transients and highly-obscured X-ray binaries. We have gained more insight into low-luminosity X-ray binaries in regions that were previously less accessible for studying faint sources, for example the crowded central region of our Galaxy and the cores of globular clusters. While there has been much progress in putting together a more complete picture of the population of X-ray binaries and their multi-wavelength properties, many new questions have arisen. I will review some of these new discoveries and address aspects where our knowledge is still incomplete.

Hard X-ray Emission of Intermediate polars

C

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Cataclysmic variables and especially intermediate polars represent significant fraction of all INTEGRAL detections in hard X-ray/soft gamma ray. Our deep survey of all known intermediate polars revealed 5 new sources, previously undetected by INTEGRAL. Our analysis based on all available observational data from INTEGRAL/IBIS and INTEGRAL/JEM-X showed that the fluxes of some intermediate polars are long-term variable. Moreover this hard X-ray/soft gamma ray variability is correlated with the changes in optical spectral band. The broad-band spectra (3 - 100 keV) of surveyed intermediate polars can be well fitted by a thermal bremsstrahlung model, with reflection from an optically thick cold medium (the surface of the white dwarf) in some cases.

Spectro-interferometric observation of interacting massive stars with VEGA/CHARA

C

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We have obtained interferometric observations in the visible of β Lyrae and υ Sgr using the instrument VEGA of the CHARA interferometric array. For β Lyrae, the S1-S2 pair of telescopes, separated by 34 m, and oriented North-South was used and the fringes were obtained at four epochs of the 13.8 d orbital period. The dispersed visibilities and differential phases was obtained around Hα and HeI 6678 lines (with R of about 1640) and around Hβ and HeI 4921 lines (with R of about 1220). Whereas the source is unresolved in the spectral continuum, the source appears to be partially resolved in the emission lines. In the Hα line the differential phase exhibits significant offset correlated with the orbital phase. This data are analyzed, using a robust geometric model based on the previous optical interferometry observations, available in the literature. For υ Sgr, the S1-S2 baseline was mostly used and some data were also recorded with the East-West W1-W2 baseline, separated by 107 m. Only the Hα line is in emission and was studied interferometrically, and significant absolute visibilities were also recorded in the red and blue continuum, near Hα and Hβ, respectively. The source associated with the Hα line is well resolved. The differential phase shift across the line reveals that the bulk of the Hα emission seems to be located between the two components.

Eclipsing Stars Among Variables Discovered Using Scans of the Moscow Plate Stacks

C

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We found about 150 new eclipsing variables among almost 500 new variable stars discovered using scans of the 10x10-degree field centered at 66 Oph, made from 30x30 cm plates of the 40-cm astrograph of the Sternberg Instituteś Crimean Laboratory. Two CREO EverSmart Supreme II scanners were applied, at a resolution of 2540 dpi. Light elements were derived for the new variable stars. The results show effectiveness of our semi-automatic techniques of variable-star search even in previously studied fields and even for Algols, not very easy to detect and solve because of the specific character of their variations. Stars of special interest will be discussed in more detail.

A Survey of the Most Massive Stars in the Local Universe

I

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Despite the large impact very massive stars (¿30 Mo) have in astrophysics, their fundamental parameters remain uncertain. The most accurate method for deriving masses, radii and luminosities of such distant stars is to measure them in eclipsing binary systems. Currently, the most massive eclipsing binary accurately measured is WR20a, which consists of two 80 solar mass stars in a 3.7 day orbit. In total, only 15 very massive stars (¿30 Mo) belonging to our Galaxy and Local Group galaxies have accurate determinations of their parameters. I will present the first results of a wide-ranging survey targeting the brightest and thus most massive stars in eclipsing binaries in both young massive clusters in the Milky Way and in nearby galaxies. The measurement of fundamental parameters for massive stars at a range of metallicities will provide much needed constraints on theories that model the formation and evolution of massive stars and will observationally probe the upper limit on the stellar mass

Properties and distances of eclipsing binaries in the Andromeda Galaxy

C

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Extragalactic eclipsing binaries (EB) are powerful tools to determine the fundamental properties of massive stars – masses, radii, temperatures, etc. In addition, EBs are excellent distance indicators, since they provide basically geometric distances, being essentially free from many assumptions and uncertainties that plague other less direct methods. We present the results of a project aimed at determining the first direct distance to the Andromeda Galaxy (M 31) from EBs. High quality light curves (rms$\sim$0.01 mag) were obtained from a 34'$\times$34' photometric survey in

M 31 (in Johnson B and V filters) carried out at the Isaac Newton Telescope (La Palma, Spain). This survey provided light curves for almost 4000 variable stars, with over 400 EBs and 400 Cepheids. After a preliminary selection, a small field (5'×5') was chosen as the optimum region to obtain multiobject spectroscopy with the Gemini-North telescope. The analysis of four EBs in the spectroscopic field (18.5 < 20.5 mag) revealed the fundamental properties of several massive stars. Two of these EBs were used to determine a direct distance determination to M 31 of $(m-M)_0$=24.36±0.08 mag. The other two EBs provided a direct determination of masses and radii of massive stars in another galaxy, enabling a comparison with stellar evolutionary models. In addition, one of these systems is the most massive EB with apsidal motion ever reported, enabling the analysis of the distribution of matter in the interior of stars with masses larger than 40 $M_\odot$.

Accurate fundamental parameters of five OB-type binaries in the SMC

C

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Photometric OGLE (I) and MACHO (VR) light curves together with AAT 2dF spectra of three semi-detached and two detached OB-type eclipsing binaries in the SMC were analyzed. A specifically designed procedure for the correlated photometric MORO solution and FITSB2 spectrum fitting based on NLTE model atmospheres yields highly accurate fundamental stellar and orbital parameters as well as distance moduli.

Evolution and colliding winds in massive binaries

I

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The evolution of binary systems consisting of two massive stars is strongly affected by stellar wind mass loss and internal mixing processes in the two stars, as well as by the interaction between the stars. Our understanding of all these processes is still very limited. The interaction of the powerful stellar winds of the two components produces observational signatures over a broad range of wavelengths. Many observational and theoretical studies of this phenomenon have been performed over the last two decades. In very close massive binary systems, mass exchange due to Roche Lobe overflow can also occur and the signatures of the two phenomena are sometimes hard to distinguish. We review the observational evidence for past or current mass exchange episodes in some specific massive binaries. We also discuss how abundance measurements in close massive binaries with well-determined masses, radii and temperatures can be used to test theoretical models of binary evolution as well as of internal mixing in *single* stars.

Catching the binaries amongst B[e] stars

C

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The group of B[e] stars is very heterogeneous in terms of the evolutionary phases of its members. There are evolved massive supergiants, pre-main sequences Herbig stars, compact planetary nebulae, and symbiotic objects. All these stars have, however, one common characteristics: they show the B[e] phenomenon, i.e., they have strong Balmer emission lines, emission of permitted and forbidden lines of low-ionized metals, and some substantial amount of circumstellar hot and warm dust, which must, except for the Herbig stars, originate from the stellar wind material itself. Binarity was suggested as the cause of the B[e] phenomenon in such a diversity of stars, but to date only a few B[e] stars (besides the symbiotics) have been proven to be binary systems. Based on the available ESO facilities, we started a combined optical spectroscopic (FEROS) and infrared interferometric (AMBER and MIDI) survey of close-by galactic B[e] stars in order to search for possible binary components. Here, we will present our results for a selected sample of B[e] stars.

IV. Thursday, 11 June

CP binaries

I

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We will present the results of recent studies of binarity and multiplicity of chemically peculiar stars. The rate of binarity is strongly varying among different sub-classes, which encompass magnetic Ap and Bp stars, HgMn stars, and metallic-line Am stars. The obtained observational results are discussed in the context of understanding the mechanisms generating chemical pecularities and of A and B star formation in general.

New discovered pulsational components in Algol type binaries and their positions on the plane of Porb - Ppuls

C

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In this study, eclipsing binaries located in the delta Scuti region of the instability strip were chosen from the list of candidate eclipsing binary systems with delta Scuti components. These candidate systems were photometrically observed and some of them were announced to be new Algol-type binaries with delta Scuti components. Although the pulsational variability could not be determined for some of the candidate Algols, pulsational components in EW Boo and DY Aqr have been discovered for the first time. The V light curves of EW Boo and DY Aqr were analyzed to model the variations caused by the eclipsing behavior and we determined the pulsational periods, amplitudes and modes of the pulsating components in these Algols. The relationship between the pulsation and orbital periods of the eclipsing binaries and between the pulsational period and the gravitational force were tested and discussed for the cases EW Boo and DY Aqr.

Symbiotic stars from high to low energies

C

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Symbiotic stars comprise a cool giant and a white dwarf on, typically, a few years orbit. The white dwarf accretes from the giant's wind, heats up to 1-2 E5 K, ionizes the circumbinary environment, and is subject to occasional outbursts. As a result the spectrum of symbiotic stars is composed from three basic components of radiation – two stellar (from the binary components) and one nebular (mostly from the ionized winds of both the stars). The hot star radiation can be identified directly from the supersoft X-rays to the ultraviolet, the giant's contribution dominates usually the optical/near-IR, and the nebular component from thermal plasma is best seen in the near-UV and radio wavelengths. During active phases an extremely hot nebula can be detected at hard to soft X-rays. In my contribution I will introduce a method of disentangling the composite spectra of symbiotic stars with a strong supersoft X-rays, and determine fundamental parameters of the individual components of radiation.

Shifts of ultraviolet lines of symbiotic binaries

C

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In a new study of UV emission lines of symbiotic binaries, we confirm the redshift of optically thick resonance lines of highly ionised atoms, compared with optically thin intercombination lines. We show that this is very probably due to P Cygni absorption on the short wavelength sides of the resonance lines, with, when the continuum is weak, lower velocity material in front of higher velocity material. Intercombination lines of more ionised atoms (especially of O[IV]) appear to be also redshifted with respect to corresponding lines from less ionised atoms. That might indicate downfall on to outer parts of an accretion disc.

Close binaries with pulsating components

I

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I review the present status of the pulsation studies of close binary systems, focusing on pulsating gainers of semi-detached Algol type eclipsing binaries. I discuss the advantages of pulsation studies of eclipsing binaries, influence of the activity cycles of a mass-losing star on mass transfer and accretion rate and on how it can drive the amplitude and frequency variability of the acoustic oscillation spectrum. The sensitivity of stellar acoustic frequency spectra to mass accretion makes pulsating mass-accreting gainers the sensitive indicators of the short-term evolution in binary systems.

A CCD Search for Pulsations in RZ Dra and EG Cep

C

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This paper presents CCD observations carried out during 8 nights in July and August 2007 on the Algol-type eclipsing binaries system RZ Dra and EG Cep, where the primary component are candidate for delta Scuti type pulsator. Both systems were observed with the 40-cm Cassegrain telescope of the Observatory of the University of Athens, equipped with the ST8XMEI CCD camera and with Bessell VRI-filters. Our light curves have been analysed with the PHOEBE program (Prsa and Zwitter, 2005) which uses the 2003 version the Wilson-Devinney code (Wilson and Devinney, 1971; Wilson, 1979, 1990). To each filter individually we applied the code in MODE 5 which solves the light curve of semi-detached eclipsing binaries where the secondary (cooler) component fills its Roche lobe, while the primary (hotter) one is well inside its Roche lobe. A detailed photometric analysis, based on these observations, is presented for both binarity and pulsation. The results indicate a semidetached system where the secondary component fills its Roche lobe. After removing the binary light curve, the pulsation of the primary component can be analyzed using the remaining residuals. The frequency analysis was made with PERIOD 04 program.

The intrinsic variations of bright stars in NGC 7160

C

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We report about the results of observations of EM Cephei and V497 Cep in young open cluster NGC 7160. The observations were carried out at three observatories. In 1987 at Maidanak observational station of Vilnius Observatory, in 2001 at Tallinn Observatory and in 2008 at Hlohovec Observatory.

3D modeling of accretion discs and circumbinary envelopes in close binaries

I

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A number of observations prove the complex flow structure in close binary stars. The gas dynamic structure of the flow is governed by the stream of matter from inner Lagrange point, the accretion disc, the circumdisc halo, and the circumbinary envelope. The observations reflect the current state of the binary system and for the interpretation of them one should consider the gas dynamics of flow patterns. In this report the review of 3D gas dynamic models of mass transfer in close binaries is presented. The special attention is paid at physics of accretion discs in binary systems and particularly at waves in discs. It is shown that in systems with stationary accretion discs there are following shock waves: the bow shock caused by the motion of the accretor and the disc in the gas of the circumbinary envelope; the hot lineformed due to interaction between the circumdisc halo and the stream from the inner Lagrange point L1, and two arms of the tidal shock. It is also shown that an additional spiral density wave can exist in inner parts of an accretion disc. This spiral wave is due to the retrograde precession of flow lines in the binary system. On timescales comparable to the orbital period, this precessional wave (and hence an appreciable fraction of the disc) will be virtually stationary in the observer's frame, whereas positions of other elements of the flow will vary due to the orbital rotation. The periodic variations of the positions of the disc and the bow shock formed when the inner parts of the circumbinary envelope flow around the disc result in variations in both the rate of angular-momentum transfer to the disc and the flow structure near the Lagrange point L3. All these factors lead to periodic ejections of matter from the accretion disc and circumdisc halo into the outer layers of the circumbinary envelope. The analysis of the numerical model and comparison of the computational result with observational data allow us to define more exactly physical processes occurring in accretion discs in binary stars.

Nova V2467 Cyg as possible intermediate polar

C

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We present the results of unfiltered and UBVRI band CCD photometry fast nova V2467 Cyg. Our analysis of the data gives two distinct frequencies corresponding to periods of 3.8h and 35 min. The observed light curve of V2467 Cyg is typical for an intermediate polar.

Accretion disks in massive binary systems

C

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The results of our investigations of some massive close binaries (CB) (RZ Sct, V448 Cyg, UU Cas and V455 Cyg), based on the photometric and spectroscopic observations indicate the existence of the accretion disk around the more massive component, located deep inside the Roche lobe. The light curve shapes of some of this systems are similar to the ones of the overcontact systems like W UMa, but the nature of these massive CBs is completely different. Here we present the models of these systems and their basic elements.

Properties and evolution of post-common envelope binaries

C

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Post common-envelope binaries are the progenitors of cataclysmic variables. We review current knowledge of their binary properties and we analyze recent

ultraviolet spectroscopy revealing the chemical composition of the white dwarfs. We interpret their peculiar abundance pattern as evidence of ongoing accretion and constrain the accretion rate of red dwarf mass loss material onto the white dwarf surface.

Modelling of Circumstellar Dust around Symbiotic Miras in Infrared

C

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We determined circumstellar dust properties and modelled inner dust regions around the cool Mira components in a sample of symbiotic Miras which showed obscuration events during the observed time intervals. The published JHKL magnitudes of o Ceti, RX Pup, KM Vel, V366 Car, V835 Cen, RR Tel, R Aqr have been collected. In order to follow the evolution of their colours in time, their light curves were corrected by removing the Mira pulsations. Using the simultaneously available JHKL magnitudes and ISO spectra for different time intervals we obtained SEDs for RR Tel which cover the near- and mid-infrared spectral region in the periods with and without obscuration. The same procedure has been applied to other stars from the sample. The DUSTY code was used to solve the radiative transfer in order to determine the dust temperature and its properties in each particular case under the assumption of the spherical temperature distribution of the dust in the close neighbourhood around the Mira component. Dust temperature, grain size, density distribution and optical depth during intervals with and without obscuration have been obtained. Using the reconstructed SEDs in the infrared, we were able to model the chemical dust composition. Special attention was given to model circumstellar envelope around RR Tel.

Cool active binaries recently studied in the CAAM stellar programme

C

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The CAAM group is applying the well-known "eclipse method" of stellar astronomy particularly to relatively under-observed, or newly discovered, binaries. An end-target is to have clearer information on stellar absolute properties and their galactic environment. The present short review concentrates on some cool active binaries recently studied in our programme. For this we have made use of high-resolution spectroscopy obtained with the Hercules spectrograph and 1m McLellan telescope of the University of Canterbury at Mt John University Observatory, New Zealand, together with optical and UV photometry. A combination of analysis techniques, including our own "information limit optimization technique" (ILOT), with physically realistic fitting functions that include proximity and eclipse effects, as well as other well-known public-domain software packages, have been used to find system parameters. For the examples CF Tuc and V 711 Tau, we have compared broadband (B and V) maculation effects with emission features in high-resolution Ca II K-line spectroscopy. We also compare emission effects in the Ca II K and H_α lines observed at different rotational phases. Broadband light curves are typically characterized by one or two outstanding maculae. These appear correlated with the locations of main chromospheric activity sites (faculae). The latter are found at similar latitudes and of comparable size to the photometric umbras, but sometimes with significant displacements in longitude. The possibility of large-scale bipolar surface structure is considered, keeping in mind the bipolar character of solar activity centres: the activity of rapidly rotating cool stars being generally compared with that of the Sun, scaled up by a few orders of magnitude. Other recent cool active star studies include those of AB Dor, V2075 Cyg, FG UMa and BM CVn. Light variations, sometimes over several consecutive orbital cycles, have been investigated. We present some typical findings. This optical work can form part of broader multiwavelength studies involving X-ray and microwave observations.

Precise Radial Velocity Measurements - Key to Discover Low-mass Companions and Exoplanets Around Stars

C

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The search for planets around stars with empirical methods turn out to be as one of the most remarkable astronomical topics since late 90s. New observational techniques and instrumentations which are introduced in last decade made possible the discoveries of very low-mass and planetary companions around distant stars. With the aid of these sophisticated instrumentation and techniques more than 340 extrasolar planets have been discovered so far (see http://exoplanet.eu) and their numbers are still increasing. These planets that are out of our solar system show a surprising diversity in their physical and orbital properties and most of them discovered with Precise Radial Velocity Measurement Technique. In this contribution, we shall give a summary on our exoplanet search project started at TÜBİTAK - Turkish National Observatory in the framework of an international collaboration between Turkish, Japanese and Russian colleagues and explain how a binary star researcher could easily became also an exoplanet searcher.

Search for sub-stellar companions in low-mass binaries via high precision relative astrometry

C

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We are searching for sub-stellar companions in binaries with precise relative astrometry. With our achieved astrometric precision of about 100 micro-arcsecond we are able to search for extrasolar planets in nearby binaries down to about one Jupiter mass. While astrometric companions of a given mass introduce a larger astrometric signal on low-mass star, our search is concentrated on low-mass-binaries. The goal of our search program is to improve our knowledge about planets in multiple stellar systems and around low-mass stars by increasing the number of planet detections in such systems. The dependencies of planetary parameters of the host binary (especially in close binaries with a separation ¡ 100 AU) will yield a deeper knowledge of planet formation and migration processes.

V. Friday, 12 June

Multi-ring structure of the eclipsing disc in EE Cep - possible planets

C

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Photometric and spectroscopic campaign for 2008/9 eclipse of EE Cep have revealed recurrent features, which can indicate that the eclipsing disc in EE Cep system has a multi-ring structure. It can be suggested that the gaps are a result of planets formation.

Protoplanetary disks of T Tauri binaries in Orion: Prospects for planet formation

C

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Since more than a decade it is known that the process of low-mass star formation leads, almost exclusively, to the formation of binary or multiple systems. Another inevitable consequence of the star formation process is the formation of a dusty protoplanetary disk surrounding each young star, the birthplace of planets. However, apparently not every protoplanetary disk induces planet formation.

Intriguingly, extra-solar planets discovered in binary systems so far are found only around one star, never around both stars of the binary system (considering systems with component separation $\sim>50$ AU). The cause of this may be a very discriminative early evolution of the binary components disks. In order to trace protoplanetary disks and their properties in young binary systems we have carried out spatially resolved spectroscopy as well as spectral energy distribution analysis for several low-mass binaries in the well-known Orion Nebula Cluster. In this presentation I report on the first results of this detailed investigation of protoplanetary disks among the ONC binary population.

ν Octantis: a close binary with a possible planet

C

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A new astrometric-spectroscopic orbital solution for the single-line K-giant binary ν Octantis ($P \approx 2.9$ yr, $e = 0.2358 \pm 0.0003$) has been derived based on 222 high-precision spectroscopic radial velocities (RVs) from the aHercules spectrograph at Mt John and from *Hipparcos* astrometry. An inclination of $\mathrm{i} = (70.8 \pm 0.9)^\circ$ has been derived, based on a spectroscopic solution and the *Hipparcos* astrometry. We have discovered low-amplitude periodic behaviour in the residuals of the orbital solution, with a semi-amplitude of 50 ms^{-1} and a 418-d period, which is coherent over several years. The RV curve of the perturbation is apparently in a 5:2 resonance with that of the binary. The possible causes of such a perturbation are rotational modulation of a surface phenomenon, pulsations or an orbiting body. We have carefully assessed these alternatives and conclude that both a rotational modulation and pulsation appear unlikely explanations. The data imply that a planetary mass is a realistic cause. The hypothetical planet ($M \approx 2.5 M_{\mathrm{Jup}}$) would have an orbit ($e \approx 0.1$, $a_3 \approx 1.2$ AU) about mid-way between the stars, whose periastron distance is only 1.9 AU. This orbit, supposedly in resonance with the binary system, appears however to be highly unlikely based on current planet formation and orbit-stability expectations. More observations and theoretical modelling may be needed to confirm that we have discovered a planet in a resonant orbit around the K giant of ν Octantis.

The Nature of Type Ia Supernovae and Implications for the Properties of Binaries

C

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Recent work on supernova rates strongly suggests that SNe Ia originate preferentially from intermediate mass ($3 < M < 8$ $M_\odot$) binary progenitors. A simple model (Pritchet et al. ApJL 683, L25) can be used to explain many of the systematics of SN Ia rates. This model predicts that about 2 % of all white dwarfs in binaries explode as SNe Ia, and favours the "double degenerate" scenario for SNe Ia. This talk will focus on properties of binary stars, and how these properties may affect conclusions regarding the nature of SNe Ia.

The outburst activity of classical novae V2467 Cygni and V2468 Cygni

C

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We analyse UBVRcIc light curves of the classical Novae V2467 Cyg and V2468 Cyg in time interval from their outbursts till now. The light of both stars faded by 8 mag. The stars show outburst activity with cycles 21.3d (V2467 Cyg) and 2.4d (V2468 Cyg). From our multicolor phorometry we determined absolute magnitudes in outburst.

The mysterious eclipsing binary epsilon Aurigae

C

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Epsilon Aurigae is an eclipsing binary with the longest known orbital period (27.1 years). It consists of a supergiant F0Ia primary star with a mass about $15 M_\odot$ and a radius more then 100R(sun), secondary object has still not been detected. A primary eclipse lasts almost 2 years which predicts a secondary object to be huge. Most probably, it is a massive optically thick cool disk with an estimated radius of

9 AU. A central object is not seen even if it should be very massive (about 16M$_\odot$). Therefore, there is a hypothesis that it could be a close binary system. There are more interesting facts about this mysterious system and its structure is still not fully established. The next primary eclipse, which should begin this August, is therefore wishfully awaited since it can help us to reveal many secrets of this system. After resuming interesting facts about epsilon Aurigae and introducing its current model and predictions for the next eclipse, I am going to present results from my spectroscopic analysis, using 92 "red" spectra from the years 2006-2009 secured at Ondrejov Observatory (Czech Republic).

HD 143 418 - an interacting binary with a subsynchronously rotating primary

C

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HD 143418 is a non-eclipsing close binary with orbital period $P_{\rm orb} = 2.282520$ d. The photometrically and spectroscopically dominant primary component is a normal A5V star in the middle of its stay on the main sequence with extremely slow, subsynchronous rotation ($P_{\rm rot} > 12$ d!). Its photometric monitoring since 1982 revealed orbitally modulated variations with changing form and amplitude. PCA disentangling extracted a constant part of light curves obviously caused by the ellipticity of the primary. Seasonal components of light curves may be related to the expected incidence of circumstellar matter ejected from tidally spinning up primary component. A possible scenario of the synchronization process is also briefly discussed.

The Unique Triple System V577 Oph, 20 Years of Observations

C

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The investigation of light-time effect both in moments of minima and in delta Sct pulsations of the primary component of eclipsing variable V577 Oph revealed the presence of the third component in the system. The absolute parameters of the triple system were derived. The apsidal motion was found in the double system as well.

Probing Dark Matter with Very Wide Halo Binary Stars

C

Quinn, D.P.[1]; *Wilkinson, M.I.*[2]; *Irwin, M.J.*[1]; *Marshall, J.*[3]; *Koch, A.*[2]; *Belokurov, V.*[1]

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Very wide and hence fragile Halo binaries are vulnerable to disruption from encounters with compact objects such as MACHOs. Studying the shape of the wide binary separation distribution function for signs of evolution provides a potential way to place limits on the of amount of Dark Matter in compact bodies. However, the sample of wide binaries is small and till now constraints on Dark Matter from wide binaries relied on the reality of a handful of very wide common proper motion candidate binaries with projected separations of around 1 pc. Recently in Quinn et al. 09 we presented radial velocity measurements of 4 of these candidates including the 2 widest ones. Here we discuss these measurements which allow us to test the binarity of these objects and to update the existing wide binary sample accordingly. Armed with the updated sample we re-examine the constraints that can be drawn on Dark Matter from the shape of the observed wide halo binary separation function. Reference: Quinn et al., MNRAS in press (arXiv:0903.1644)

About the distribution of WD masses in superhump systems

C

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Using the published data for periods, mass ratios and a theoretical mass-radius relation for the low mass stars we obtained the distribution of WD masses in CVS. The retrieved distribution of WD masses is close to the log-normal with its mean at $0.83M_\odot$ and standard deviation 0.16. We showed that the tidal and rotational distortions can play a significant role on the observed mass-radius relation for such systems.

Posters

White dwarfs in common proper motion binaries

P

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Common proper motion binaries with a white dwarf component are very useful objects for studies of stellar evolution. We examined 6 pairs of common proper motion stars containing a hydrogen-rich (DA) white dwarf and a main-sequence component. White dwarfs were selected from the revised New Luyten Two-Tenths (rNLTT) catalog on the basis of the optical/infrared (V-J) reduced proper motion diagram and the optical-infrared color diagram. Their spectra were obtained at Cerro Tololo Inter-American Observatory (NLTT 7051) and taken from Sloan Digital Sky Survey (NLTT 1374, NLTT 19311, NLTT 28712, NLTT 28772 and NLTT 39605). We compared these spectra to model atmospheres of white dwarfs to acquire their effective temperature and surface gravity. Using the mass radius relations we determined their mass and cooling age, as well as their kinematics. For NLTT 7051 and NLTT 28712 we calculated radial velocities from echelle spectra taken from ESO archives.

Nature of the multiple system V831 Centaurus

P

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We present our preliminary analysis results of high resolution spectra and historical light curves of the multiple system V831 Centaurus which is one of the secure members of Lower Crux Centaurus association. Spectral analysis with modern disentangling methods yielded the spectrum of the visual component (B component) which constitutes a 27 year long orbit with the close binary (Aab components). The use of the new times of minimum of the system together with the historical astrometric data allowed us to obtain more precise orbital elements of the long orbit.

Spectrophotometry of southern symbiotic binaries

P

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The interstellar extinction and the temperature of the hot components of a large sample of southern symbiotic stars are presented. We have derived these parameters using the Balmer decrement and the HeII/H-beta flux ratio, taking into account the self-absorption effects in Balmer lines.

MUNI-FITS-Utils

P

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The FITS standard allows arbitrary use of name-space for keywords, except some reserved keywords. Result of this freedom is that several keywords have the same meaning. Similar problem is that values of keywords have different physical units. These facts complicate automated data processing and also creation of FITS file archives with simple structure. MUNI-FITS-Utils is a package of Python scripts which have been developed in PyFITS, a Python FITS Module. Scripts are user-friendly and allow manipulating FITS headers to get uniform shape. Further functions will be added soon.

Calculation of emergent intensities for WD code with new Kurucz stellar atmosphere models

P

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One of the major challenges in eclipsing binary modeling is improving the accuracy of the model while keeping the execution time manageable. In order to do

that, time-intensive synthetization of spectral energy distribution across the stellar surface is implemented via the lookup tables. We present a utility that builds a WD-compatible table entry for any supplied passband transmission function by using Castelli & Kurucz (2004)'s NEWODF intensities across the H-R diagram. The output of the utility can be readily used for detailed model light curve computations in the given passband.

The CoRoT light curves: accurate photometry's input in eclipsing binaries modelling

P

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Thanks to its high accuracy, the CoRoT satellite has allowed the discovery of a significant number of objects of interest. Among them are eclipsing binaries for which the light curve, besides the steady pattern of eclipses, exhibit as well regular variations in intensity. We present in this poster some of those objects that are currently under study. We will address the issue of disentangling the effects due to the orbital motion of both stars, i.e. the eclipses or the presence of spots ..., from the intrinsic light variations that can be seen as pulsations, allowing the seismologic study of the system. In that case, the determination of the system parameters using the binarity can help seismic interpretation and give in-depth information on the interior of both components. Reciprocally, seismic mass and age estimates of the pulsating components would help the understanding of the formation and evolution of the binary.

Radiation pressure and pulsation effects on the Roche lobe

P

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Several observational pieces of evidence indicate that specific evolutionary channels which involve Roche lobe overflow are not correctly accounted for by the classical Roche model. We then suggest to generalize the concept of Roche lobe in the presence of extra forces (caused by radiation pressure or pulsations). By computing the distortion of the equipotential surfaces, we are able to evaluate the impact of these perturbing forces on the stability of Roche-lobe overflow. Radiative forces are parameterized through the constant reduction factor that they impose on the gravitational force from the radiating star (neglecting any shielding in case of large optical thickness). Forces imparted by pulsations are derived from the velocity profile of the wind. We provide analytical expressions to compute the generalized Roche radius. Depending on the extra force, the Roche-lobe radius may either stay unchanged, become smaller, or even become meaningless (in the presence of a radiatively- or pulsation-driven wind).

HD 64315: a likely double spectroscopic binary

P

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We present the results of a spectroscopic campaign on the early-type double-lined binary HD 64315. Radial velocity curve was calculated, using a fit model atmospheres, considering two components , after that we have some evidences about HD 64315 is composed of two binaries systems, one of both eclipsing binary. We re-analyze HD 64315 for four components and find stellar parameters and we use photometry to derive absolutes masses for the eclipsing system.

Absolute parameters of five eclipsing binaries in the LMC.

P

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We present a simultaneous spectroscopic-photometric analysis of five eclipsing binaries in the LMC. Using spectroscopic observations obtained with VLT+UVES and MagellanII+MIKE and photometric data from the MACHO and OGLE databases we determine absolute stellar parameters. The object MACHO 82.9010.36 is a spectroscopic triple system. The binary MACHO 78.6708.115 is an eccentric system showing apsidal motion due to tidal forces. The apsidal motion rate is used to obtain information about the internal mass distribution of these stars.

Eridanus - the specialist in eclipsing binary observation

C

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In this contributions are summarised information on more than ten-year-long work of open observational group of amateur observers, which makes the CCD photometry of miscellaneous kinds of variable stars and transit exoplanets at Observatory and Planetarium of Johann Palisa in Ostrava (Czech Republic). This group co-operate with other scientific programmes and the memebers of Eridanus group are coauthors of many scientific papers. Observational data are available on the internet (800 CCD observations of 273 objects, *http://ostrava.astronomy.cz/int.php*). Group of observers - Eridanus - is also ready to make observations for every professional astronomer, too.

AG Dra - a symbiotic mystery

P

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AG Dra is well known bright symbiotic binary with the white dwarf and pulsating red giant. Long-term photometry monitoring and new behaviour of the system are discussed. In the system of AG Dra were detected two periods of variability. The longer 549.73 day is connected with orbital motion and the shorter 355.27 one was interpreted in our older paper as the pulsation of the red giant. Moreover we found resonance between both periods. We understand that this resonance can produce an activity of the system. Nevertheless, many questions are still open and it is also worth noting them: where is the recent stage of quiescence?, why the maximum of brightness during the year 2008 was occurred 60 days earlier?, how many types of outbursts are present in the system?

RS Oph: flickering study for 3 years after the outburst

P

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A long-term photometric study of the recurrent nova RS Oph is presented. The basic physical characteristics have been obtained using the statistical calibrations

and the light curves secured in four colours since the outburst. Moreover, the flickering activity study is discussed. The monitoring of flickering activity has covered the period since the evolution of the light curve of the RN with no flickering variability up today when very marked flickering variations are observed. The possible source of the flickering is discussed.

A study of the Herbig Be binary FU Orionis object Z CMa.

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The Herbig Be binary/FU Orionis object Z CMa has FU Ori like characteristics with numerous strong emission lines, and displays a jet and evidence for asymmetric outflows. We present low resolution spectroscopic observations in circular and linear polarized light carried out with FORS1 at the VLT during the recent outburst as well as the results of photometric and spectroscopic monitoring in the last months. The observations are used to put constraints on the model of this system.

Spectral observations of Algol type binary TX UMA

P

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High resolution spectral observations were carried out in attempt to look for evidences of circumstellar disk.

The photometric investigation of a dwarf nova with large orbital period VW Vul

P

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Cataclysmic variable VW Vul was classified both Z Cam-type (see HTTP catalogue *http://www.cvcat.net*) and a long-periodic SU UMa-type star (catalogue by Downes, Webbink, Shara et al., 2001, PASP, 113, 764). In spite of largish brightness of the system (13.6-15.6) there are not so many information about this binary, and its classification keeps uncertain. We observed VW Vul during its quiescence and during the outbursts. The results of the BVR-CCD photometry of cataclysmic variable VW Vul from 2005 to 2008 yrs are presented here.

Common proper motion white dwarf companions to bright Hipparcos stars

C

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We will present our analysis of white dwarfs that are in common proper motion with bright Hipparcos stars. The parallax measurement of the Hipparcos companion allows to obtain an accurate mass estimate of the white dwarf. In addition, since the stars are distant companions, they would have evolved without any interaction, and hence provides us with an additional constraint on the evolution of stars and the initial to final mass relations.

Hα observations of the contact binary EE Cet

P

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High-resolution spectroscopic observations around the H_α line of the W UMa-type star EE Cet covering the whole orbital period are presented. Our radial

velocity solution leaded to the following global parameters of the system: masses M_1=0.27 $M_\odot$ and M_2=1.27 $M_\odot$ (q=4.69); radii R_1=0.85 $R_\odot$ and R_2=1.29 $R_\odot$; separation a=2.48 $R_\odot$. These values mean that the less massive star is eclipsed at the primary eclipse, i.e. EE Cet belongs to the W-subtype of the W UMa stars. The measured equatorial velocities $V_{eq}(2)$=175.5 km/s and $V_{eq}(1)$=116.3 km/s mean fast rotation of the components of EE Cet that is an important requirement for chromospheric activity. It is confirmed by the filled-in H_α profiles at some phases. The different intensity of the spectral lines of the two components of EE Cet at the two quadratures was called a "spectral O'Connell effect".

Radial velocity solution of the contact binary HX UMa

P

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High-resolution spectroscopic observations around the H_α line of the W UMa-type star HX UMa covering the whole orbital period are presented. Their analysis and modeling lead to the following global parameters: masses M_1=1.44 M_{sun} and M_2=0.32 M_{sun} (q=0.22); radii R_1=1.61 R_{sun} and R_2=1.15 R_{sun}; separation a=2.72 R_{sun}; equatorial velocities $V_{eq}(1)$=209 km/s and $V_{eq}(2)$=149 km/s. Our results show that HX UMa is a contact configuration belonging to A-subtype of the W UMa stars. We found appearances of weak chromospheric activity of the two stellar components of HX UMa.

The study of resonant variability observed in the massive LMC system BI 108

P

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The hot massive LMC system BI 108 has been observed within the OGLE project. This object shows lightcurve with two periods in a strict 3:2 resonance. Along with high-resolution spectroscopic data we want to explain the nature of this unique case.

Photometric observation of transiting extrasolar planet Wasp-10 b

P

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We present the observation of transiting extrasolar planet Wasp-10 b, made with 50cm telescope in Stará Lesná, Slovakia

NLTE models of Vela X-1 primary wind

P

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We calculate NLTE models of the stellar wind of Vela X-1 primary. The predicted wind mass-loss rate and terminal velocity show a good agreement with observations. The wind in the vicinity of the secondary neutron star is strongly affected by X-ray photoionization. In accordance with observations, the wind velocity close to the neutron star is lower due to the presence of X-ray radiation.

New disk-loss phase of the binary Be star κ Dra

P

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Recent spectroscopic observations of the binary Be star kappa Dra show weaker emission in the hydrogen H-alpha line, which means that the circumstellar disk is decreasing. This behaviour supports the idea of a 23-year activity cycle.

Precataclysmic variable V471 Tau - striking (O-C) diagram

P

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V471 Tau was discovered as a spectroscopic binary and is a prototype post-common envelope system and cataclysmic binary progenitor. The system consists of the cool red dwarf K2 V or main-sequence star and the hot white dwarf. The exact distance of V471 Tau system with the value of 47 pc was derived from the Hipparchos satellite data. The object was classified as the eclipsing binary star with orbital period around 0.5 day. Wave-like feature on the light curves with the period of 191 days was interpreted as moving large spots on the surface of the cool component. We have monitored the system photoelectrically in U, B, V and R colours since 1994. The new times of minima have been derived. They suggest that the cause of the (O-C) curve may be more complicated than the curve corresponding to the light-time effect only. Timing variations can be explained by perturbations of third body in the system or by apsidal motion.

Spectrum disentangling of AK Her and VW Cep

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We introduce a spectrum disentangling experiment to find third- or forth- components in close binaries. The aim of this experiment is to detect the extra components' lines after subtracting the primary and secondary components' spectral lines from observed spectra. The experiment has been applied to two close binaries, AK Her and VW Cep. Their orbital periods show sinusoidal changes in their *O-C* diagrams, which can be explained by two effects; the light-time effects (LITE) which indicates the possibility of multiple systems, and the intrinsic orbital period variations probably caused by spot cycles due to magnetic activities on the late type close binaries. To disentangle each component's spectral line from observed spectra, high resolution spectra with high signal to noise ratio (SNR) are essential. High spectral resolution (R=45K) and high SNR (>100) spectra near H_α of AK Her and VW Cep have been obtained using Bohyunsan Optical Echelle Spectrograph (BOES) which is attached to an 1.8m telescope at Bohyunsan Optical Astronomy Observatory in Korea. Exposure time of each observation does not exceed 2% of orbital period, and the observations show good phase coverage. We will present detailed spectroscopic results.

DD Mon and XY UMa: CCD Photometry and modelling of two close binary systems with solar-type components

P

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We present our ground-based CCD observations of the close binary systems DD Mon and XY UMa in B,V,R and I bands. The light curves are analyzed using the Wilson-Devinney light curve synthesis code for the derivation of the geometric and photometric elements of the two systems. We compare the methods of photometric and spectroscopic mass ratio determination in these two systems, as a function of all typical difficulties, which arise during the analysis of such systems (light curve asymmetries, third light etc). Finally, a new spot model is suggested for the eclipsing system XY UMa, which belongs to the RS CVn type of active binaries.

The Algol type eclipsing binary X Tri: BVRI modeling and O-C analysis

P

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CCD photometric observations of the Algol-type eclipsing binary X Tri have been obtained. The light curves are analyzed with the Wilson-Devinney code and new geometric and photometric elements are derived. A new O-C analysis of the system, based on the most reliable timings of minima found in the literature, is presented and apparent period changes are discussed with respect to possible and multiple Light-Time effects (LITE) in the system. Moreover, the results for the existence of additional bodies around the eclipsing pair, derived from the period study, are compared with those for extra luminosity, derived from the light curve analysis.

The delay time distribution of type Ia supernovae: comparison between theory and observation

P

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It is widely accepted that type Ia supernova explosions (SNe Ia), which are very important for the chemical enrichment of the interstellar medium, are caused by white dwarfs (WD) in binary stars accreting matter and thus exceeding the Chandrasekhar limit (see e.g. Livio 2001). The exact nature of this process is however still uncertain, the two leading explanations being that either the WD accretes matter from a late main sequence or red giant companion (the single degenerate scenario, SD, see e.g. Nomoto 1982) or that the explosion is caused by the merger of two WDs spiraling into each other due to the emission of gravitational wave radiation (the double degenerate scenario, DD, see e.g. Webbink 1984). In this paper, we use the population number synthesis (PNS) evolution code by De Donder & Vanbeveren (2003) to compute the expected time distributions of SNe Ia, both through the SD and DD scenario. The code has been updated with the latest results of Hachisu et al. (2008) to include the mass stripping effect in determining the SN Ia progenitors in the SD scenario. This effect reduces the amount of mass transferred to the WD and can allow the system to avoid a phase of common envelope (CE) evolution. The code also allows to differentiate between the alpha (based on the balance of energy, Webbink 1984) and gamma (based on the balance of angular momentum, Nelemans & Tout 2005) scenarios describing the energy conversion during the CE evolution of binaries. The results of this Brussels code can be directly compared to those obtained by Belczynski et al. (2005) with the StarTrack evolution code. Both evolution codes agree that SNe Ia occur in a wide time range after star formation and that the shape and extent of this delay time distribution (DTD) critically depends on whether the SD or DD scenario is used. In the case of the DD scenario, the SN Ia rate decreases inversely proportional to the time, whereas in the SD scenario, the distribution shows multiple peaks. The results predicted by the PNS code are then compared to the latest observed DTDs obtained by Totani et al. (2008) and Mannucci et al. (2006). This allows to draw conclusions on the constraints put on the theoretical models by these observations.
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Spin-up and hot spots can drive mass out of a binary

P

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It has been reported that the observed distribution of Algol binaries contains more systems with large mass-ratios than can be produced by conservative evolution. We developed a code of liberal evolution in which during a short, violent phase of Roche Lobe Overflow (RLOF), the gainer can be incapable of accreting all matter transferred by the donor. Enhanced rotational velocity caused by spin-up of the gainer combined with accretion luminosity, resulting from the concentration of RLOF-material in an equatorial hot spot, drives matter from the system. The development of a non-conservative phase depends on the initial parameters of the system. Low mass binaries never achieve high enough mass transfer rates, and hence do not lose mass. In intermediate mass binaries matter will be blown away by the gainer during the short era of rapid RLOF, before or at the start of the Algol phase. We have calculated the evolution of binaries over a wide range of initial primary masses, orbital periods and mass ratios (VizieR J/A+A/487/1129). We present the results for the cases where RLOF starts during hydrogen core burning of the donor and find systems with non-conservatism during which approximately 50% of the transferred mass is blown into the interstellar medium. Finally, we present the comparison of the observed mass-ratio distribution of Algols with the new theory.

Modeling light curves of eclipsing Double Periodic Variables

P

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We present results of the investigation of the nature of double periodic variables (DPVs). We have selected a sample of eclipsing DPVs for a multiwavelength photometric study aimed to reveal their nature. The short orbital periodicity and the cyclic variability are decoupled and separately investigated with the aid of the Wilson-Devenney program. Our analysis of the photometric and available spectroscopic observations support the view that DPVs are semi-detached Algol-like systems with mass loss and probably circumbinary discs.

StHa 190 - symbiotic star with possibly shortest orbital period? P

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We present the primary analysis of the radial velocity changes observed in symbiotic binary StHa 190. A possible orbital period of 30 days have been found and will be disccused here.

Phenomenological ephemeris of the HgMn CP eclipsing variable AR Aurigae P

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The eclipsing binary AR Aurigae consists of a chemically peculiar HgMn primary star and a secondary star near the ZAMS. It shows a well defined light time effect bearing evidence for the presence of a third body in the system. Aiming at an improvement of its light curve ephemeris we have recently determined 54 times both primary and secondary minima of AR Aur. These observations are based on 17320 individual photoelectric measurements treated simultaneously by a specifically developed code. The list of minima has been supplemented by additional 39 minima found in the literature. Analysing all available data we have established a new "phenomenological ephemeris" (P1,2 = 4.1346656(8) d, P3 = 8585(45) d) allowing us a swift phase prediction of the eclipsing system. The efficiency of the method used for the time of minimum determination is briefly discussed.

Spectroscopic study of HD 306414, optical counterpart IGR J11215-5952

P

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We present a study of HD 306414, the optical counterpart to the peculiar transient X-ray pulsar IGR J11215-5952. We follow the optical counterpart during a significant fraction of the 165 d orbit. We fit a model atmosphere to determine the parameters of this B0.7Ia supergiant. Radial velocity measurements show a curve dominated by effects other than the orbital motion, a situation typical in these very luminous stars.

Variable star survey in galactic open clusters

P

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Compared to field stars, the parameters like age, distance, or metallicity can be determined more accurately for open clusters by means of numerous cluster members. Since all kinds of variable stars are present also in open clusters, they offer the unique possibility to study all the various star groups and their dependency with age or environmental properties in much more detail. We therefore present the initiation of a longtime multisite programme to monitor several galactic clusters and their variable content.

The Statistics of Times of Minima

P

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We present the statistical properties of a database of minima of eclipsing. The poster shows histograms of the numbers of primary and secondary minima according

to the basic parameters given by GCVS (period, magnitude, coordinates, etc.). All pictures are automatically generated using a public and open WWW service. In particular, histograms can be made by creating lists of interesting objects fulfilling specific criteria, including number of observations, date of last observation, period, magnitude, etc..

DV Psc - spotted short-period eclipsing binary

C

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We present our study of eclipsing binary DV Psc. We used multicolour CCD observations from 2005 to 2008 obtained at Stara Lesná Observatory of the Slovak Academy of Sciences and from Kolonica Observatory in east Slovakia. New spectroscopic observations were obtained with Magellan-II Clay telescope in September 2005. Analysis of all available minima times suggest continuous period increase with a rate $\mathrm{d}\,P/\mathrm{d}\,t$=$1.87\times10^{-7}$ d yr^{-1}. Broadening function fitting revealed radial velocity of the both components and enable us to find spectroscopic mass ratio $q = 0.690 \pm 0.025$. The light curves of DV Psc show high variability. Light curve model was derived by PHOEBE code and we estimated the parameters of spots and their time evolution. Using spectroscopic and photometric parameters we derived absolute parameters of the both

Echelle spectroscopy of Algol and chemical composition of its components

P

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We are undertaking a new observational project to study the prototypical semidetached binary system, Algol. Over 80 high-resolution and high S/N spectra

were secured in 2006 and 2007 with FIES at the Nordic Optical Telescope on La Palma. All three components were successfully detected by the method of spectral disentangling, which yields the individual spectra of the three stars and also high-accuracy spectroscopic elements for both the inner and outer orbits. Our next step is to study the chemical composition of the components in detail, in particular the close eclipsing system which is in the stage after mass reversal.

Probing the models: V380 Cygni revisited

P

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The eclipsing and double-lined spectroscopic binary V380 Cyg is a particularly interesting probe of stellar evolution as its primary component is a high-mass star which has evolved to the terminal age of core hydrogen burning. We have secured extensive new high-resolution echelle and classical grating spectra at Ondrejov, Victoria, La Palma and Calar Alto. We have applied spectral disentangling to unveil the individual spectra of the two components, and to obtain new spectroscopic elements. The secondary star contributes only about $\sim 4\%$ of the system light, and remains the main limitation to measurements of the system's properties. A detailed abundance analysis has been performed fitting non-LTE theoretical line profiles to the disentangled spectrum of the primary star, and reveals an elemental abundance pattern reminiscent of a typical nearby B star. Contrary to the predictions of recent theoretical evolution models which include rotational mixing, no trace of abundance modifications due to the CNO cycle are detected. No match can be found between the predictions of these models and the properties of the primary star: a mass discrepancy of 1.5 M_*odot* exists and remains unexplained.

Comparison of the B and V colours as calculated at maximum from physical parameters of W UMa stars observed by the Tycho mission

P

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The possible application of contact binaries as standard candles was discussed for a long time. The most promising approach is based on the Period-Luminosity-Color relation. Recently, the accuracy of such calibrations has been significantly improved thanks to the David Dunlap Observatory Spectroscopic program and the related photometric program at the Mt Suhora Observatory. Together, these have now provided a homogenous sample containing W-UMa stars with a complete set of physical parameters. This means that a reverse procedure to that used to establish the Rucinski - Duerbeck P-L-C calibration can be applied. To perform distance determinations for our sample, a homogenous set of V and B luminosities at maximum brightness is highly desirable. A potential source of that data is the Tycho (and Hipparcos) Epoch Photometry Catalogue (*Hipparcos and Tycho Photometry Annex*), however the record fields in the Hipparcos and Tycho Catalogues (ESA 1997) are not very suitable for these purposes (especially for stars with important temperature difference between components) as they contain only $V_{\mathrm{T,max}}$,$B_{\mathrm{T,max}}$ defined as the 15% percentile along with mean values of B_{T} and V_{T}.

In the presented paper we examine the possibility of performing more accurate analysis of the Tycho data to derive more reliable B_{T} and V_{T} at maximum brightness (despite of theirs poor quality). The first step was phasing of Tycho data. Light elements were derived from Kreiner's Database of Minima and their correctness checked with Hipparcos photometry (in its instrumental system). The data around phases 0.25 and 0.75 ($\pm$ 0.1) were then statistically analyzed and fitted with an appropriate light curve approximating function through the procedure of elimination of outliers. Values of $V_{\mathrm{T,max}}$ and $B_{\mathrm{T,max}}$ were transformed into the Johnson system, using the relation proposed by Bessel, and compared with that derived from physical parameters of stars included in our sample, supported by parameters from literature. Only stars for which parameters are derived in the model with geometry given by spectroscopic mass ratio and fill factor were taken into account.

V2028 Cyg, binary or not? P

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We present new observations of B[e] star V2028 Cyg (MWC 623). Our work is based on 66 spectra taken during five years observation run with Ondřejov 2m telescope. V2028 Cyg is presumed to be a binary composed of a B star with K type companion. We made a new absorption line identification, an emission line identification was taken from Zickgraf (1989). Our results show variability of intensity and equivalent width of the Hα emission. The radial velocity measurements of the Hα emission line and absorption lines are also presented. There are slight variations but no clear period was found up to now.

Contact binaries - new prospects and challenges P

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The field of contact binaries has generally been stagnant since 90-ties. This is mainly caused by complicated interpretation of spectroscopy and relatively low informational contents of photometry of contact binaries. Some observational achievements were, however, obtained mainly by the comprehensive radial velocity program at the David Dunlap Observatory leading to determination of precise spectroscopic orbits for 149 contact binaries, indicating that many of contact binaries are in triple or multiple systems, and challenging Roche model for low mass-ratio systems. Another important source of information are all-sky surveys (e.g. ASAS or NSVS) enabling statistical investigations of contact binaries which could provide the clues for their origin and evolution. More theoretical studies and numerical modelling aimed at the formation, evolution and mass flow in the components are needed.

MOST satellite photometry of eclipsing binaries

P

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High-precision and continuous satellite photometry of the MOST satellite (Microvariability and Oscillations of STars) lead to the detection of 15 new eclipsing binaries. Part of them have photometric amplitudes smaller than 0.1 mag and at the same time orbital periods longer than 10 days making them virtually inaccessible by the ground-based observations. Several known eclipsing binaries were also observed with unprecedented photometric precision leading to the determination of precise geometric elements and to detection of low-amplitude pulsations possibly caused by dynamical tides.

Multiple dataset fitting: final solution of Delta Velorum A

P

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Nine years after discovery of eclipses in the brightest ($V_{\rm max} = 1.96$) southern eclipsing binary Delta Velorum A the reliable parameters of the components are virtually unknown. Up to now, only interferometric observations of the component A were carried out at only four phases; there is no high-dispersion spectroscopy and photometric data are only fragmentary. The system was, however, covered by the Solar Mass Ejection Imager (SMEI) resulting in high-precision continuous photometry enabling reliable determination of the geometric elements.

V2491 Cyg - a possible recurrent nova

P

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We present spectroscopic and photometric observations for V2491 Cyg obtained in Torun Observatory shortly after the maximum brightness. The star is suspected to be a recurrent nova. The spectra and the light curve of V2491 Cyg are compare with spectra and light curve of other recurrent novae.

FM Leo – the tale of twins

P

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First spectroscopic and new photometric observations of the eclipsing binary FM Leo are presented. The results of the orbital solution from radial velocity curves are combined with those derived from the light-curve analysis (V-band ASAS-3 photometry and supplementary observations of eclipses) to derive orbital and stellar parameters. JKTEBOP, Wilson-Devinney binary modelling codes and two-dimensional cross-correlation (TODCOR) method were applied for the analysis. With masses determined better than 1% we compared the observations with current stellar evolution models interpolated for this system and find the evolutionary status and age of FM Leo.

Thomson scattering: probing nebulae of symbiotic stars

P

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We introduce modeling the extended wings of the strongest emission lines observed in the spectra of symbiotic stars by the electron-scattering process. We apply the method to the broad wings of the OVI 1032 and 1038 resonance lines measured by the Far Ultraviolet Spectroscopic Explorer in the spectra of symbiotic stars Z And, AG Dra and V1016 Cyg. Synthetic profiles fit well the observed wings. By this way it is possible to determine the optical depth and electron temperature of the layer of electrons, throughout which the line photons are transferred on the line of sight. Quantities of electron temperature agree well with those obtained independently by a different approach. Model parameters depend on the properties of the scattering environment, which are a function of the star activity. Therefore the Thomson scattering process can diagnose the symbiotic nebula during different levels of the star activity.

KU Cyg - the Algol-type binary with an eccentric accretion disk

P

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In this work we present and discuss the results from analysis of the Hα emission line observed at the primary minimum, at phases in the 0.0058 - 0.0209 range. The profile of this line, originating in the accretion disk, observed when the approaching part of the disk was partly eclipsed by the secondary, the mass losing star, was modelled. The results indicate that the double peaked emission profile can be explained as being emitted in a large, eccentric disk around the primary component. This confirms the previous suggestions, based on photometric and spectroscopic data, that the disk in KU Cyg occasionally becomes very large, eccentric, and possibly precessing.

Light Curve Analysis of BUL-SC16 335 from B and I photometry

P

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The eclipsing binary BUL-SC16 335 is one of the by-products of the OGLE survey (Optical Gravitational Lensing Experiment) in the direction bulge. Its light curve shows a very short period (P = 0.125 days), strong reflection effect and a sharp primary eclipse suggesting this is a pre-cataclysmic variable like HW Vir, the prototype of a group of detached binaries containing a hot SdB type primary component and a cool stellar companion. We analysed the light curve in the I and B bands with the Wilson-Devinney code and using both a genetic code and the Downhill Simplex method to search for an optimum solution. We discuss the results of both methods and present the set of parameteres obtained for the best fits.

Spectroscopic Investigation of TW Dra: Improved Orbital Solution and System Parameters

P

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We present first results of the application of a new computer program called SHELLSPEC_TLS to the well-known oscillating Algol-type star TW Dra. SHELLSPEC_TLS combines the capabilities of the synthetic spectrum codes SynthV and Shellspec. The investigation is based on time-series of high-resolution spectra of TW Dra obtained at Thueringer Landessternwarte in 2007 and 2008. We find that the eclipsing binary system can be described by modeling only the spectra of the two stars, including the Roche lobe filling shape and gravity darkening for the cool secondary. We conclude that TW Dra was in a quiet phase during all epochs of our observations, no hints to phases of rapid mass-transfer could be detected. We derive preliminary system and atmospheric parameters of the components.

Distance to U Pegasi by the DDE Algorithm

P

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A direct distance estimation is made for the W UMa-type eclipsing binary using a DDE algorithm and available light and velocity data.

Orbital analysis of two triple systems in the open cluster NGC2516.

P

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We report the discovery of two triple systems in the open cluster NGC2516. As a result of our long term project on radial velocity monitoring of stars in open

clusters we have detected in NGC 2516 three double lined spectroscopic binaries, two of which have shown variation of the center-of-mass velocity in a time scale of a few years. We present here the orbital analysis of these two systems which are hierarchical triples. System BDA2 consists of a spectroscopic binary formed by two chemically peculiar stars orbiting each other in a period of 11.2 days and a third body in a wider orbit with a period of about 3990 days. System BDA19 consist of an eccentric spectroscopic binary of P=8.7 days and a third body orbiting with a period of 3362 days.

Low-mass eclipsing binaries as constraints for stellar structure models

P

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In recent years, eclipsing binary systems have revealed that models predict 10% smaller stellar radii and 5% hotter effectives temperatures for low-mass stars (below 1 solar mass).These differences are commonly attributed to the magnetic activity present in these stars, which is enhanced by its high spin velocity due to the synchronization with the orbital motion. This activity may produce several changes to the structure of stars due to the modification of the efficiency of convection or the appearance of surface spots. Here we compare the effect that these two features as well as metallicity/opacity differences produce on stellar structure models. Furthermore, systematic effects on fits to light curves due to photospheric spots are also checked.

Ellipsoidal effect in the symbiotic star YY Her

P

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A new estimation of the orbital period of YY Her on the base of our and published observations is present. Phased light curves in R I bands show evidently ellipsoidal effect connected with the tidal distortion of the giant surface.

Low-Mass Eclipsing Binary NSVS 10653195

P

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We present system parameters of newly discovered low-mass eclipsing binary NSVS 10653195 based on our new photometric observations.

Variable Star and Exoplanet Section of Czech Astronomical Society

P

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We present activities of Czech variable star observers organized in the Variable Star and Exoplanet Section of the Czech Astronomical Society. For the last 85 years, the Section has been supporting amateur astronomers in obtaining photometry of variable stars by the means of visual estimates, CCD measurements and in the past also photographic observations. The Section has also been promoting collaboration with professional astronomers. More than 900,000 of measurements / visual estimates obtained by 1200 observers during the last hundred years are stored in our database. We are working in four observing projects: B.R.N.O. – eclipsing binaries, MEDUZA – intrinsic variable stars, TRESCA – transiting exoplanets and candidates thereof, HERO – objects of high energy astrophysics. Our internet portal *http://var.astro.cz* supplies all necessary information to observers worldwide.

ETD - Exoplanet Transit Database

P

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We present a recently developed internet portal for exoplanet transit observers and researchers - Exoplanet Transit Database (ETD). The portal consists of three parts. Transit predictions for observers and on-line algorithm for photometric data processing, which determines the mid-transit time, duration and depth of a transit by fitting the data with a model light curve while removing systematic trends at the same time. The last part is a database of all observed transits published in literature and in some on-line resources (like AXA and TRESCA databases). The Exoplanet Transit Database can be found at *http://var.astro.cz/etd.*

Jastrocam a new tool for data gathering with CCD

P

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We present a new acquisition program for observations with CCD. The code is written in the java language, currently supports Photometrics S300, SBIG, APOGEE and Andor CCDs. New hardware support can be extended by adding new plugins for either a new type of CCD or a filter wheel. The software is capable of performing an on-line reduction of frames coming in real time either on non-processed or reduced for bias/dark/flat frames.

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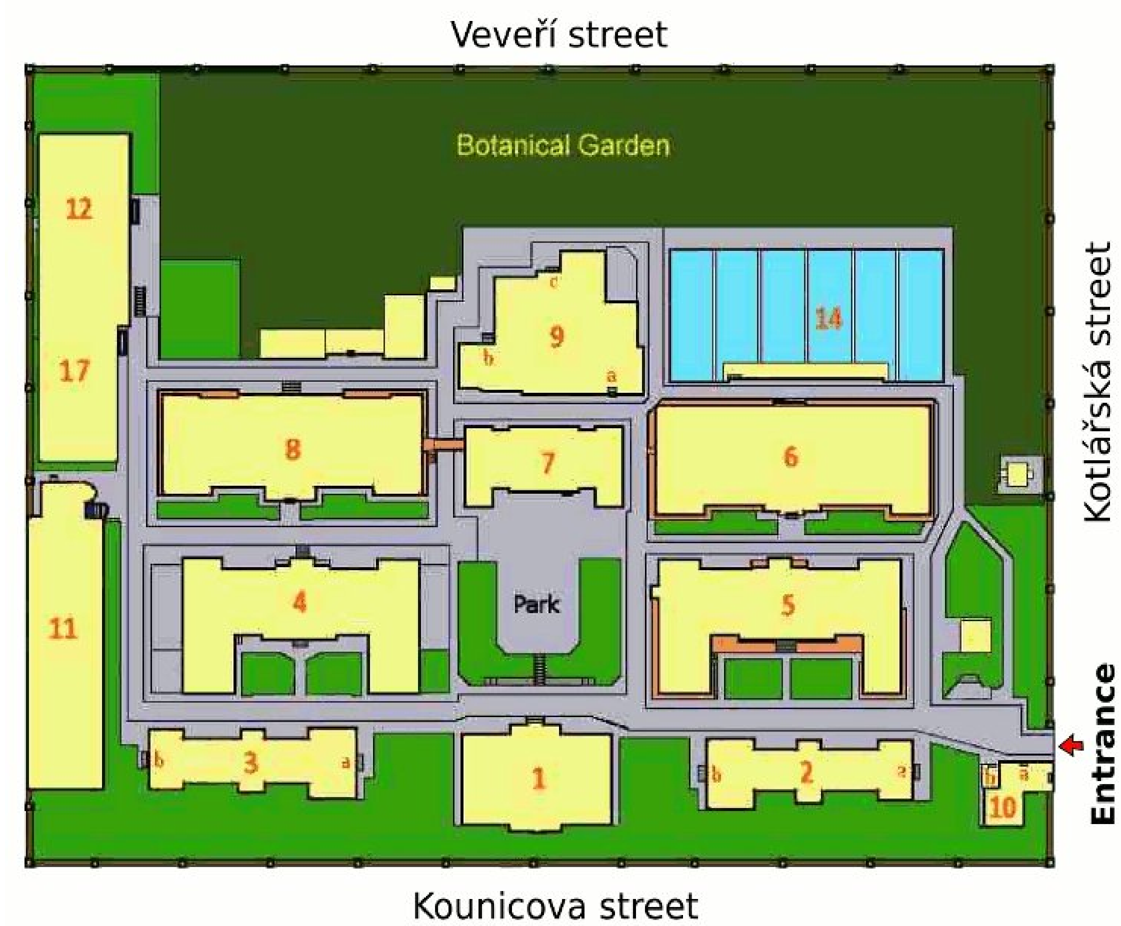

1 Dean's Office

2 3 Department of Geological Sciences

4 **Student's Canteen**, **"Malé centrum" Bookshop**, Department of Geography, Labs of Botanical Garden

5 Department of Geography

6 **Department of Theoretical Physics and Astrophysics**, Department of Physical Electronics, Workrooms

7 Department of Physical Electronics, Junction Exchange Station

8 Department of Mathematics and Statistics, Department of Parasitology, Department of Genetics

9 a Department of Condensed Matter Physics
b/c Unused Entrances

10 a **Entrance Office**
b **Beverage Vending Machines**, Technical Services Division

11 Department of Biostatistics and Bioanalysis, Department of Geological Sciences

12 **Auditorium**, Department of Languages

14 Greenhouses of Botanical Garden

17 Library

Abstract Book for the conference
Binaries — key to comprehension of the Universe
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