BALTIC ASTRONOMY Vol. 24, No. 4 (2015), ABSTRACTS

Baltic Astronomy, vol. 24, 345–352, 2015

Early photometric and spectral evolution of Nova Cygni 2014 (V2659 Cyg)

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We present optical spectroscopic and UBVRI photometric observations of Nova Cygni 2014 (V2659 Cyg) from its rebrightening to the nebular stage. After the first maximum, the nova underwent several irregular flare-like rebrightenings, with amplitudes up to two magnitudes, accompanied with spectral changes. During the bright state, forbidden lines became weaker; the absorption components of Balmer, He I, Fe II, N I, N II, O I lines strengthened, indicating an increase in the density and mass-loss rate in the form of a wind.

Key words: novae, cataclysmic variables – stars: individual: V2659 Cyg

Baltic Astronomy, vol. 24, 353–359, 2015

Recurrent symbiotic Nova V407 Cygni: before and after outburst in 2010

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We present the results of our $UBVJHKLM$ photometric and spectroscopic observations of V407 Cyg obtained in 2003–2015. No fast brightness variations of V407 Cyg have been detected since its RS Oph-type outburst in 2010. Now the binary demonstrates a low-excitation emission spectrum with Hα weaker than the [N II] 6584 Å line. It is a typical spectrum on the way to the passive state.

Key words: binaries: symbiotic – stars: variables: Miras – stars: individual: V407 Cyg

Baltic Astronomy, vol. 24, 360–366, 2015

A search for new open clusters hosting cepheids

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We analyze yet-unknown genetic links between open star clusters (OSC) and galactic Cepheids and report the results of the new search for Cepheids – probable OSC members. A sample of 25% of the stars from a new catalog by Berdnikov (published in Melnik et al. 2015) which lists 674 Cepheids with reliable parameters was investigated. Based on photometric and kinematic data, we selected 17 Cepheids that are likely to be related to star clusters, four of which being new OSCs discovered by us.

Key words: stars: variables: Cepheids – open clusters and associations: general

Baltic Astronomy, vol. 24, 367–378, 2015

Statistical analysis of a comprehensive list of visual binaries

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. Visual binary stars are the most abundant class of observed binaries. The most comprehensive list of data on visual binaries compiled recently by cross-matching the largest catalogues of visual binaries allowed a statistical investigation of observational parameters of these systems. The dataset was cleaned by correcting uncertainties and misclassifications, and supplemented with available parallax data. The refined dataset is free from technical biases and contains 3676 presumably physical visual pairs of luminosity class V with known angular separations, magnitudes of the components, spectral types, and parallaxes. We also compiled a restricted sample of 998 pairs free from observational biases due to the probability of binary discovery. Certain distributions of observational and physical parameters of stars of our dataset are discussed.

Key words: binaries: visual – astronomical databases: miscellaneous – catalogues

Baltic Astronomy, vol. 24, 379–386, 2015

A study of double- and multi-mode RR Lyrae variables

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We present the results of our new study of known RR Lyrae variable stars. All observations available for these stars in the Catalina Surveys were analyzed, and double-mode variations were identified. We studied the Petersen diagram and the period distribution for the double-mode RR Lyrae variables in the Galactic field, pulsating in the first-overtone and fundamental modes. The double-peaked character of the period distribution was detected for Galactic RR(B) stars, corresponding to Oosterhoff's classes of globular clusters, which indicates that the age and evolution stage of RR(B) stars in the field and RR Lyrae variables in globular clusters are probably the same. Besides, we discovered five RRC stars with two simultaneously excited non-radial pulsations (equidistant triplets).

Key words: stars: variables: RR Lyrae

Baltic Astronomy, vol. 24, 387–394, 2015

On the possibility of determining the distance to the Galactic center from the geometry of spiral arm segments

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. A new approach to determining the solar galactocentric distance, R_0, from the geometry of spiral-arm segments is proposed. Geometric aspects of the problem are analyzed and a simplified three-point method for estimating R_0 from objects in a spiral segment is developed in order to test the proposed approach. An estimate of $R_0 = 8.44 \pm 0.45$ kpc is obtained by applying the method to masers with measured trigonometric parallaxes, and statistical properties of the R_0 estimation from spiral segments are analyzed.

Key words: Galaxy: structure – Galaxy: fundamental parameters – masers

Baltic Astronomy, vol. 24, 395–402, 2015

Binary star database: binaries discovered in non-optical bands

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. The Binary star Database (BDB) is the world's principal database of binary and multiple systems of all observational types. In particular, it should contain data on binaries discovered in non-optical bands, X-ray binaries (XRBs) and radio pulsars in binaries. The goal of the present study was to compile complete lists of such objects. Due to the lack of a unified identification system for XRBs, we had to select them from five principal catalogues of X-ray sources. After cross-identification and positional cross-matching, a general catalogue of 373 XRBs was constructed for the first time. It contains coordinates, indication of photometric and spectroscopic binarity, and extensive cross-identification. In the preparation of the catalogue, a number of XRB classification disagreements were resolved, some catalogued identifiers and coordinates were corrected, and duplicated entries in the original catalogues were found. We have also compiled a general list of 239 radio pulsars in binary systems. The list is supplied with indication of photometric, spectroscopic or X-ray binarity, and with cross-identification data.

Key words: binaries: close – X-rays: stars – pulsars: general – catalogs

Baltic Astronomy vol. 24, 403–407, 2015

Potential of a spheroid with generalized exponential density distribution

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. The internal potential of an inhomogeneous layered spheroid with a small ellipticity and general exponential density distribution is derived in an analytical form. The results are presented in the form of standard Gauss hypergeometric function and validated numerically. The computing time when using this formula is noticeably smaller than the time required by numerical integration.

Key words: gravitation – layered inhomogeneous ellipsoid, gravitational potential

Baltic Astronomy, vol. 24, 408–420, 2015

Equilibrium figures inside the dark-matter ring and the shapes of elliptical galaxies

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We solve the general problem of the theory of equilibrium figures and analyze two classes of liquid rotating gravitating figures residing inside a gravitating ring or torus. These figures form families of sequences of generalized oblate spheroids and triaxial ellipsoids, which at the lower limit of the tidal parameter $\alpha = 0$ have the form of the Maclaurin spheroids and the Jacobi ellipsoids. In intermediate cases $0 < \alpha \leq \alpha_{\max}$ each new sequence of axisymmetric equilibrium figures has two non-rotating boundary spheroids. At the upper limit $\alpha_{\max}/(\pi G\rho) = 0.1867$ the sequence degenerates into a single non-rotating spheroid with the eccentricity $e_{\rm cr} \approx 0.96$ corresponding to the flattening limit of elliptical galaxies (E7). We also perform a detailed study of the sequences of generalized triaxial ellipsoids and find bifurcation points of triaxial ellipsoids in the sequences of generalized spheroids. We use this method to explain the shapes of E-galaxies. According to observations, very slowly rotating oblate E-type galaxies are known that have the shapes, which, because of instability, cannot be supported by velocity dispersion anisotropy exclusively. The hypothesis of a massive dark-matter outer ring requires no extreme anisotropy of pressure; it not only explains the shape of these elliptical galaxies, but also sheds new light on the riddle of the ellipticity limit (E7) of elliptical galaxies.

Key words: celestial mechanics – equilibrium figures – galaxies: elliptical – dark matter

Baltic Astronomy, vol. 24, 421–425, 2015

Details of the spatial structure and kinematics of the Castor and Ursa Major streams

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. A list of the Castor stream members is compiled based on the data from various authors. The membership probabilities for some stars are revised based on the individual apex, multiplicity, observational errors, and peculiarity. The apex of the Castor moving group is determined using the apex diagram method. The parameters of the Castor and Ursa Major streams are compared and the positions of the two streams on the apex diagram are found to differ by 225 degrees, implying that the two groups move in almost opposite directions. Stars of both moving groups are intermixed in space, the Castor stream occupies a smaller volume than the UMa stream and is located inside it. Our results can be useful for understanding the morphology of the Galactic disk in the Sun's vicinity.

Key words: Galaxy: solar neighborhood – open clusters and associations – moving groups: individual: Castor, Ursa Major

Baltic Astronomy, vol. 24, 426–430, 2015

Current star formation in the outer rings among early-type disk galaxies

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We use ARRAKIS, the atlas of stellar rings in galaxies (Comerón et al. 2014), based on data of the S4G survey, to compile a list of early-type, S0-Sb, disk galaxies with outer stellar ring-like features ('pure' rings, R, or pseudorings, R′). We searched for current star formation signatures within these features through the NUV-maps of the galaxies provided by the ultraviolet space telescope GALEX. We found that current star formation, with the mean age of the young stellar population of less than 200 Myr, is present in about a half of all 'pure' rings; and within the pseudorings it is observed almost in all cases.

Key words: galaxies: evolution – galaxies: structure – ultraviolet: galaxies

Baltic Astronomy, vol. 24, 431–434, 2015

Simulation of the motion of stars escaping from the Galactic center

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. Motions of stars escaping from the Galactic center are simulated. It is shown that the Galactic bar reduces the initial velocity needed to escape from the Galaxy.

Key words: methods: numerical – stars: kinematics and dynamics

Baltic Astronomy, vol. 24, 435–445, 2015

Minor planet databases

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We cast a retrospective look at the mankind's acquaintance with minor bodies of the Solar System, at the explosive growth in their discoveries resulting from the technological progress, and at gradual understanding of the danger to our very existence that some of them might actually pose. Then, we review current effort, of the astronomical community in general and of its Russian part in particular, to integrate our rapidly expanding knowledge of the potential Earth impactors and to make it readily available online.

Key words: astronomical databases – minor planets, asteroids: general – minor planets, asteroids: NEOs – comets – meteoroids – ephemerides

Baltic Astronomy, vol. 24, 446–452, 2015

Astronomical data resources for binary and multiple stars

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. Binary stars form a significant part of stellar population. They are registered and observed by a number of methods. This is the reason for variety of present-day resources of astronomical data dealing with binaries and multiples. The review of observational types of binary stars and of basic data resources for them is presented. The properties of stars within these types and possible relationships between them are discussed. The Binary star DataBase, BDB (http://bdb.inasan.ru), is presented as the resource joining data for all observational types of binaries. The problem of correct cross-identification of objects within binary and multiple stars is being solved in the frame of the Identification List of Binaries (ILB).

Key words: astronomical catalogues and databases – binaries

Baltic Astronomy, vol. 24, 453–461, 2015

Archives of astronomical spectral observations and atomic / molecular databases for their analysis

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We present a review of open-source data for stellar spectroscopy investigations. It includes lists of the main archives of medium-to-high resolution spectroscopic observations, with brief characteristics of the archive data (spectral range, resolving power, flux units). We also review atomic and molecular databases that contain parameters of spectral lines, cross-sections and reaction rates needed for a detailed analysis of high resolution, high signal-to-noise ratio stellar spectra.

Key words: atomic data – line: identification – molecular data – instrumentation: spectrographs – astronomical databases: miscellaneous – surveys – atlases

Baltic Astronomy, vol. 24, 462–468, 2015

Databases of publications and observations as a part of the Crimean Astronomical Virtual Observatory

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Received: 2015 November 2; accepted: 2015 November 30

Abstract. We describe the main principles of formation of databases (DBs) with information about astronomical objects and their physical characteristics derived from observations obtained at the Crimean Astrophysical Observatory (CrAO) and published in the "Izvestiya of the CrAO" and elsewhere. Emphasis is placed on the DBs missing from the most complete global library of catalogs and data tables, VizieR (supported by the Center of Astronomical Data, Strasbourg). We specially consider the problem of forming a digital archive of observational data obtained at the CrAO as an interactive DB related to database objects and publications. We present examples of all our DBs as elements integrated into the Crimean Astronomical Virtual Observatory. We illustrate the work with the CrAO DBs using tools of the International Virtual Observatory: Aladin, VOPlot, VOSpec, in conjunction with the VizieR and Simbad DBs.

Key words: general: publications, bibliography – astronomical databases: miscellaneous – virtual observatory tools