High-Resolution Spectroscopy of the Hydrogen-Deficient Binary Upsilon Sgr

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Abstract. The high resolution spectra of hydrogen-deficient binary υ Sgr are analyzed. The atmospheric parameters are $T_{\mathrm{eff}} = 12300\pm200$ K, $\log g = 2.5\pm0.5$ and $\xi_{\mathrm{t}} = 5 - 15$ km s^{-1} depending on the element. For Fe II $\xi_{\mathrm{t}} = 9.3 \pm 0.3$ km s^{-1}. Iron is slightly underabundant (–0.2 dex). Nitrogen is overabundant with [N/Fe] ≈ 1.0, carbon and oxygen are underabundant with [C/Fe] $\approx$ –1.6 and [O/Fe] $\approx$ –1.1. The s-process elements Y, Zr and Ba are overabundant about 0.5 dex. Quite large number of emission lines, both permitted and forbidden, originating from low excitation levels of neutral and ionized metals, are identified. Radial velocities of these emission lines indicate that an accretion disk in the system is present.

Key words: stars: atmospheres – stars: individual: υ Sgr

Revised Line Profile Function for Hydrogenic Species

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Abstract. Analytical series expansions for the hydrogenic spectral line profile functions are derived starting from the three single expressions, obtained by integrating twice the convolution of the Holtsmark, Lorentz and Doppler line profile functions. We get well converging series expansions for the line wings and centers by reducing the number of arguments in the profile function by one, introducing the module of the Holtsmark and Lorentz profiles as a new argument. In the intermediate part of the line, the parabolic cylinder functions expressed via the confluent hypergeometric series, are used. The multi-component Stark splitting of the hydrogenic spectral lines and the modeled stochastic electron transitions in the electric field of the adjacent ions generate wide Doppler plateaux at the line centers, with the characteristic widths estimated from the fit to the characteristic width of the Holtsmark profile. This additional Doppler broadening of the line profile function removes the central dip typical to the Holtsmark profile.

Key words: atomic processes – line: profiles – opacity – radiative transfer – stars: atmospheres

A Study of Long-Term Solar Activity at 37 GHz

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Abstract. In this paper we investigate the solar activity at the radio frequency (37 GHz) using an extensive data series (solar radio maps) from the Metsähovi Radio Observatory. This paper aims to present this unique solar radio map collection to the public knowledge. The data set covers the years from 1978 to 2011 (solar cycles 21–24). We investigate the long-term solar activity on the ground of the distribution of solar radio brightenings and the differential rotation of the Sun.

Key words: Sun: activity, radio radiation, differential rotation

Discovery, Observational Data and the Orbit of the Amor Group Asteroid 2010 BT3

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Abstract. A project devoted to astrometric and photometric observations of asteroids at the Molėtai Observatory is described. One of its most important results is the discovery of the asteroid 2010 BT3 belonging to the Amor group of the near-Earth objects. The results of astrometric and photometric observations of the asteroid are presented. The brightness variations of the asteroid are found to be about 0.2 mag in R. The orbit of the asteroid was computed from 96 observations. This orbit, combined with the apparent brightness, gives the absolute magnitude 21.34 mag and the diameter between 160 m and 360 m, taking albedos of S-type and C-type asteroids, respectively.

Key words: asteroids: astrometry, photometry, orbits – asteroids: NEO: individual (2010 BT3)

L₃ Dynamics and Poincaré Maps in the Restricted Full Three Body Problem

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Abstract. Poincaré maps are a basic dynamical systems tool yielding information about the geometric structure of the phase space of the system. Poincaré maps are however time consuming to compute. In this paper we have analysed and compared two different schemes to compute Poincaré maps in the context of accuracy versus computation time: a Runge-Kutta method of 7th and 8th order and a time transformed geometric method of 6th order. The dynamical system used is the Restricted Full Three Body Problem, with the primaries, an elongated body and a sphere, in a short axis relative equilibrium configuration. Using these Poincaré maps we have studied the dynamics near the collinear Lagrange point L₃, located on the outer side of the elongated body. We present evidence that the L₃ point in this system can have saddle-center, stable or complex unstable behaviour depending on system parameters. We further show that when a low accuracy regime that still captures the correct structure of the Poincaré map is considered, the geometric method clearly outperforms the Runge-Kutta method being up to 4 times faster to compute and free from accumulating local errors that smear the structure of the Poincaré maps.

Key words: methods: numerical – celestial mechanics – minor planets, asteroids

Science Initiatives of the US Virtual Astronomical Observatory

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Abstract. The United States Virtual Astronomical Observatory program is the operational facility successor to the National Virtual Observatory development project. The primary goal of the US VAO is to build on the standards, protocols, and associated infrastructure developed by NVO and the International Virtual Observatory Alliance partners and to bring to fruition a suite of applications and web-based tools that greatly enhance the research productivity of professional astronomers. To this end, and guided by the advice of our Science Council (advisory committee), we are focusing on five science initiatives in the first two years of VAO operations: (1) scalable cross-comparisons between astronomical source catalogs, (2) dynamic spectral energy distribution construction, visualization, and model fitting, (3) integration and periodogram analysis of time series data from the Harvard Time Series Center and NASA Star and Exoplanet Database, (4) integration of VO data discovery and access tools into the IR AF data analysis environment, and (5) a web-based portal to VO data discovery, access, and display tools. We are also developing tools for data linking and semantic discovery, and have a plan for providing data mining and advanced statistical analysis resources for VAO users. Initial versions of these applications and web-based services are being released over the course of the summer and fall of 2011, with further updates and enhancements planned for throughout 2012 and beyond.

Key words: virtual observatory, cross-matching, spectral energy distributions, periodograms, data-mining

The New Version of the Binary Star Database (BDB)

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Abstract.   The Binary star database contains data on about 100 000 stellar systems of multiplicity 2 to 22, taken from a large variety of published catalogues for all types of binary stars: visual, orbital, astrometric, interferometric, spectroscopic, photometric, eclipsing, etc. Positional, kinematic, photometric, spectroscopic, orbital and astrophysical parameters are provided when available. The database can be queried by identifier, coordinates, catalogue and stellar/orbital parameters (including binary type) of objects. Lists of objects can be submitted as well. Also, the database provides links to some other online services, both of general purpose and on binary stars. A pilot version of BDB can be accessed at http://bdb.inasan.ru

Cross Catalogue Matching with Virtual Observatory and Parametrization of Stars

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Abstract. Virtual Observatory facilities allow users to make a fast and correct cross-matching of objects from various surveys. They yield multi-color photometry data (color indices) on registered objects and make it possible to determine stellar parameters. A method of catalogue cross-matching, as well as its application to various areas in the sky and preliminary results of stellar parameterization, are discussed in the paper. We also make a critical analysis of modern stellar spectral atlases.

Key words: stars: fundamental parameters – photometric surveys – cross-matching – virtual observatory – spectral atlases – unresolved binaries

Large Astronomical Surveys, Catalogs and Databases

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Abstract. We review the status of all-sky and large astronomical surveys
and their catalogued data over the whole range of electromagnetic spectrum,
from gamma-ray to radio, such as ROSAT in X-ray, GALEX in UV, SDSS
and several POSS1/2 based catalogs (APM, MAPS, USNO, GSC) in optical,
2MASS and WISE in NIR, IRAS and AKARI in MIR/FIR, NVSS and FIRST
in radio range and others. Present astronomical archives contain billions of
objects, Galactic as well as extragalactic, and the vast amount of data in them
permit new studies and discoveries. Cross-correlations result in revealing new
objects and new samples. Very often, dozens of thousands of sources hide a few
very interesting ones that are needed to be discovered by comparison of various
physical characteristics. Most of the modern databases currently provide VO
access to the stored information. This permits not only open access but also
fast analysis and managing of these data.

Key words: surveys – catalogues – archives – databases

Spectral Analysis via the Virtual Observatory: the Service TheoSSA

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Abstract. In the framework of the Virtual Observatory, the newly developed service TheoSSA provides access to theoretical stellar spectral energy distributions. In a pilot phase, this service is based on the well-established Tübingen NLTE Model-Atmosphere Package for hot, compact stars. We demonstrate its present capabilities and future extensions.

Key words: methods: data analysis – stars: atmospheres – stars: fundamental parameters

VAMDC: the Infrastructure

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Abstract. The Virtual Atomic and Molecular Data Centre (VAMDC; `http://www.vamdc.eu`) is a European-Union-funded collaboration between several groups involved in the generation, evaluation, and use of atomic and molecular data. VAMDC aims at building a secure, documented, flexible and interoperable *e*-Science environment-based interface to existing atomic and molecular databases. The global infrastructure of this project uses technologies derived from the International Virtual Observatory Alliance (IVOA). The infrastructure, as well as the first database prototypes will be described.

Key words: astronomical databases: virtual observatory tools – physical data and processes: atomic data, molecular data

UkrVO Joint Digitized Archive and Scientific Prospects

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Abstract. The UkrVO (Ukrainian Virtual Observatory) database consists of about 200 000 astronomical photographic plates and 500 000 CCD frames containing unique astronomical information for formulating important scientific tasks. This database is compiled from observations conducted in 1898–2011 at the observing sites of 8 Ukrainian observatories, with about 60 instruments. This paper deals with some principal scientific projects where the UkrVO databases are used, namely, the creation of the Joint Digitized Archive (JDA); compilation of new stellar catalogues; search for optical counterparts of gamma-ray bursts; spectroscopic study of solar flares and solar active formations; development of software for searches for new small bodies of the solar system.

Key words: virtual technologies, virtual observatory, astronomical databases

Digital Archive of the Astrograph Plates Stored at the INASAN Zvenigorod Observatory

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Abstract. The plate collection of the Zvenigorod 40-cm Carl Zeiss astrograph, obtained in 1972–2003, contains direct photographs of star fields, comets, asteroids, Pluto, and Mars. The electronic library of images from photographic plates was created from scanning the astronomical negatives. We present information on programs scheduled at the telescope and the structure and maintenance of the plate stacks. We also list the plates with images of asteroids and comets. Access to all our plate lists is provided at the web sites of the Institute of Astronomy (INASAN) and WFPDB. It is possible to select plates by the date of observation, by the coordinates of the sky area, by the object type. Preview images can be inspected.

Key words: astronomical databases – techniques: digitizing – asteroids – comets

Multiband Study of Radio Sources of the RCR Catalogue with Virtual Observatory Tools

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Abstract. We present early results of our multiband study of the RATAN Cold Revised (RCR) catalogue obtained from seven cycles of the "Cold" survey carried with the RATAN-600 radio telescope at 7.6 cm in 1980–1999, at the declination of the SS 433 source. We used the 2MASS and LAS UKIDSS infrared surveys, the DSS-II and SDSS DR7 optical surveys, as well as the USNO-B1 and GSC-II catalogues, the VLSS, TXS, NVSS, FIRST and GB6 radio surveys to accumulate information about the sources. For radio sources that have no detectable optical candidate in optical or infrared catalogues, we additionally looked through images in several bands from the SDSS, LAS UKIDSS, DPOSS, 2MASS surveys and also used co-added frames in different bands. We reliably identified 76% of radio sources of the RCR catalogue. We used the ALADIN and SAOImage DS9 scripting capabilities, interoperability services of ALADIN and TOPCAT, and also other Virtual Observatory (VO) tools and resources, such as CASJobs, NED, Vizier, and WSA, for effective data access, visualization and analysis. Without VO tools it would have been problematic to perform our study.

Key words: astronomical databases: miscellaneous – methods: virtual observatory, statistical – galaxies: radio sources, AGN, variability

Science with the VO: Spectroscopic Studies of Herbig Ae/Be Stars

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Abstract. The Virtual Observatory (VO) is opening up new ways of exploiting the huge amount of data provided by the ever growing number of ground-based and space facilities. Using VOSpec, a multi-wavelength spectral analysis tool developed by the ESA-VO Team at ESAC, and new developments on scripting with VOSpec (VOScript), we have started to undertake a comprehensive study of spectroscopic and photometric data in the VO on Herbig Ae/Be stars. By studying line strengths, variabilities and spectral energy distributions, from the X-ray to sub-millimeter ranges, we aim to gain insights into processes and disk properties of a large sample of these objects. This paper presents initial findings of the spectroscopic analysis and initial spectral energy distribution classifications.

Key words: stars: variables: Herbig Ae/Be – techniques: spectroscopic – virtual observatory tools

The Lower Main Sequence of Stars in the Solar Neighborhood: Model Predictions versus Observation

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Abstract. We have used the Simbad database and VizieR catalogue access tools to construct the observational color–absolute magnitude diagrams of nearby K–M dwarfs with precise *Hipparcos* parallaxes ($\sigma_\pi/\pi \leq 0.05$). Particular attention has been paid to removing unresolved double/multiple stars and variables. In addition to archival data, we have made use of nearly 2000 new radial-velocity measurements of K–M dwarfs to identify spectroscopic binary candidates. The main sequences, cleaned from unresolved binaries, variable stars, and old population stars which can also widen the sequence due to their presumably lower metallicity, were compared to available solar-metallicity models. Significant offsets of most of the model main-sequence lines are seen with respect to observational data, especially for the lower-mass stars. Only the location and slope of the Victoria-Regina and, partly, BaSTI isochrones match the data quite well.

Key words: astronomical databases: miscellaneous – stars: late type – C–M diagrams – solar neighborhood