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High-Resolution Spectroscopy of Cool Carbon-Rich and Metal-Poor Star HD 209621

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Abstract. Element abundances for HD 209621 obtained earlier display significant discrepancies, especially in the case of CNO and neutron-capture elements. Therefore we performed a detailed analysis of chemical composition of this star using a new high-resolution spectrum. Atmospheric parameters and abundance pattern are updated, and the mechanism of nucleosynthesis is examined. Abundances for 11 elements are calculated for the first time. The method of atmospheric models and spectral synthesis was used. The following values of atmospheric parameters are derived: $T_{\rm eff}$ = 4400 K, log g = 1.0 (cgs) and ξ_t = 1.9 km s^{-1}. The iron abundance of the star was found to be low, at [Fe/H] = –1.91 ± 0.10. The carbon to oxygen ratio is high, C/O ≃ +2.0. Low carbon to nitrogen ratio, [C/N] ≃ –0.8, and low carbon isotopic ratio, ^{12}C/^{13}C = 17 ± 5, are in agreement with the theory of nucleosynthesis of intermediate-mass AGB stars. The barium to europium ratio is high, [Ba/Eu] = +0.28, and is typical for carbon-enhanced metal-poor CEMP-r/s stars. The observed abundance pattern of neutron capture elements is reproduced well by the scaled solar system abundances.

Key words: stars: abundances, atmospheres, spectroscopic binaries, carbon, individual: HD 209621

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Chemical Composition of a Young Star HD 377

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Abstract. A high resolution spectrum of a pre-main sequence star HD 377 is analyzed. The atmospheric parameters are found to be: $T_{\rm eff} = 5875$ K, $\log g = 4.25$ and the microturbulent velocity $\xi_{\rm t} = 1.40$ km s^{-1}. The metallicity of HD 377 is slightly higher than of the Sun, [Fe/H] = 0.21. The lithium abundance is very high $\log \varepsilon({\rm Li}) = 3.02$.

Key words: stars: atmospheres – stars: individual: HD 377

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A New Approach to the Long-Term Activity Behavior of DM UMa

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Abstract. A long-term activity character of DM UMa (K0-1 IV-III), which is one of the most active members of the RS CVn type variables, is examined using the multicolor photometric observations which spread to the time interval between 1980 and 2009. In this work, we present a new approximation for the long-term light and color variation of DM UMa using data obtained by combining our own observations obtained in the Johnson broad-band *U,B,V,R* filters between the years 1997 and 2008 and data published in literature. Available light and color data were examined for the long-term and seasonal variations using PERIOD04 program. The period analysis of the V-band data reveals the period estimations of 51.2 ± 2.8 years and 15.1 ± 0.7 years superposed on it. The U–B, B–V and V–R colors do not show correlation with the longer period, but they show variations with a period similar to the shorter one, except for B–V color. The amplitude variation also does not exhibit any correlation with the V light and color curves. It is found that the movement of the spot minima phases in years also indicates the migration period of nearly 15 years, similar to the period derived from the analysis of the long-term photometric observations in V-band.

Key words: techniques: photometric – stars: late-type – stars: activity: starspots – stars: individual: DM UMa

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The Effect of an Inert Solid Reservoir on Molecular Abundances in Dense Interstellar Clouds

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Abstract. The question, what is the role of freeze-out of chemical species in determining the molecular abundances in the interstellar gas is a matter of debate. We investigate a theoretical case of a dense interstellar molecular cloud core by time-dependent modeling of chemical kinetics, where grain surface reactions deliberately are not included. That means, the gas-phase and solid-phase abundances are influenced only by gas reactions, accretion on grains and desorption. We compare the results to a reference model where no accretion occurs, and only gas-phase reactions are included. We can trace that the purely physical processes of molecule accretion and desorption have major chemical consequences on the gas-phase chemistry. The main effect of introduction of the gas-grain interaction is long-term molecule abundance changes that come nowhere near an equilibrium during the typical lifetime of a prestellar core.

Key words: astrochemistry – molecular processes – ISM: molecules

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Discovery, Observational Data and the Orbit of the Centaur Asteroid 2012 DS85

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Abstract. A project for astrometric and photometric observations of asteroids at Mt. Graham Observatory with the VATT telescope is described. One of the most important results is a discovery of the Centaur 2012 DS85. Astrometric and photometric data on the asteroid are presented. The orbit of the asteroid was computed from 67 observations. Combined with its apparent brightness, the orbit gives an absolute magnitude of 9.43. Using a typical albedo value of 0.08 for Centaurs and TNOs (Moullet et al. 2011), we get a diameter of 2012 DS85 at about 61 km.

Key words: asteroids: astrometry, photometry, orbits – asteroids: Centaurs: individual (2012 DS85)

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Photometry and Classification of Stars in the Direction of Clusters NGC 7129 AND NGC 7142 in Cepheus. I. Magnitudes, Color Indices and Spectral Types of 2140 Stars

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Abstract. In a 1.5 square degree area, centered at RA = 21:44:30, DEC = +65:58, we have determined magnitudes and color indices for 2140 stars in the *Vilnius* seven-color system down to $V = 17$ mag. This area includes a star-forming region with the open cluster NGC 7129 embedded in a dense dust cloud TGU 645 (LDN 1181), close to the Cepheus Flare, and a distant old open cluster NGC 7142 seen through a semi-transparent window. For most of the stars spectral and luminosity classes in the MK system, determined from the photometric data, are given.

Key words: stars: fundamental parameters, classification – Galaxy: open clusters (NGC 7129, NGC 7142) – ISM: clouds: individual (TGU 645, LDN 1181)

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Isolated Sunspot with a Dark Patch in the Coronal Emission

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Abstract. On the base of the 17 GHz radio maps of the Sun taken with the Nobeyama Radio Heliograph we estimate plasma parameters in the specific region of the sunspot atmosphere in the active region AR 11312. This region of the sunspot atmosphere is characterized by the depletion in coronal emission (soft X-ray and EUV lines) and the reduced absorption in the a chromospheric line (He I 1.083 μm). In the ordinary normal mode of 17 GHz emission the corresponding dark patch has the largest visibility near the central solar meridian. We infer that the reduced coronal plasma density of about $\sim 5 \times 10^8$ cm^{-3} is the characteristic feature of the dark patch.

Key words: Sun: radio emission, corona, magnetic fields

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The Use of Multiwavelength Archival Observational Data for Scientific Discoveries: a Case of the Supernova Remnant Cassiopeia A

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Abstract. Most of the high-quality astronomical data after a proprietary period of typically one year are provided to open access, allowing researchers to complement their observations with the archival data in other wavelength bands, thus improving quality of the data analysis. This paper presents one example of such a use – studies of the reverse shock front passing through an oxygen-rich material in the young supernova remnant Cassiopeia A. The paper is based on the contribution to the "Baltic Applied Astroinformatics and Space Data Processing" conference, held on 2012 May 7–8 in Ventspils, Latvia.

Key words: astronomical databases: miscellaneous – supernovae: individual: Cas A

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Kinematic Modeling of Distant Galaxies

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Abstract. Evolution of galaxies is one of the most actual topics in astrophysics. Among the most important factors determining the evolution are two galactic components which are difficult or even impossible to detect optically: the gaseous disks and the dark matter halo. We use deep Hubble Space Telescope images to construct a two-component (bulge + disk) model for stellar matter distribution of galaxies. Properties of the galactic components are derived using a three-dimensional galaxy modeling software, which also estimates disk thickness and inclination angle. We add a gas disk and a dark matter halo and use hydrodynamical equations to calculate gas rotation and dispersion profiles in the resultant gravitational potential. We compare the kinematic profiles with the Team Keck Redshift Survey observations. In this pilot study, two galaxies are analyzed deriving parameters for their stellar components; both galaxies are found to be disk-dominated. Using the kinematical model, the gas mass and stellar mass ratio in the disk are estimated.

Key words: galaxies: kinematics and dynamics – galaxies: structure

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Variability Survey of Massive Stars in OB-Associations: Preliminary Results on the Cygnus Region

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Abstract. We present V- and I-passband photometry of massive stars in the Cyg OB1 and Cyg OB2 associations, based on about 80 observing nights spanning 300 days in the 2011 season. The variability of 22 supergiants and 48 OB-stars with luminosity classes III–V is analyzed. We report two new variable OB stars and 15 variable supergiants of which four are new discoveries. The light variations of Schulte 12 are interpreted as microvariability. We also present light curves of the red supergiants BC Cyg and BI Cyg which exhibit brightness drop of more than 0.4 mag during the season.

Key words: surveys – stars: massive – open clusters and associations – stars: individual: Schulte 12, BC Cyg, BI Cyg