

BALTIC ASTRONOMY Vol. 25, No. 2 (2016), ABSTRACTS

Revealing the network of periodic orbits in galaxy models with a prolate or an oblate dark matter halo component

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Abstract. Locating the position of periodic orbits in galaxies is undoubtedly an issue of paramount importance. We reveal the position and the stability of periodic orbits of stars moving in the meridional plane (R, z) of an axially symmetric galactic model with a disk, a spherical nucleus, and a biaxial dark matter halo component. In particular, we study how all the involved parameters of the dynamical system influence the position and the stability of all resonant families. To locate the position and measure the stability of periodic orbits we use a highly sensitive numerical code which is able to identify resonant periodic orbits of the type $n : m$. Two cases are studied for every parameter: (i) the case where the dark matter halo component is prolate and (ii) the case where an oblate dark matter halo is present. Our numerical exploration reveals that all the dynamical quantities affect, more or less, the position and the stability of the periodic orbits. It is shown that the mass of the nucleus, the mass of the disk, the halo flattening parameter, the scale length of the halo, the angular momentum, and the total orbital energy are the most influential quantities, while the effect of all other parameters is much weaker.

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

Classifying orbits of low and high energy stars in axisymmetric disk galaxies

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Abstract. The ordered or chaotic character of orbits of stars moving in the meridional (R, z) plane of an analytic axisymmetric time-independent disk galaxy model with an additional spherically symmetric central nucleus is investigated. Our aim is to determine how the total energy influences the orbital structure of the galaxy. For this purpose we monitor how the percentage of chaotic orbits as well as the rates of orbits composing the main regular families evolve as a function of the value of the energy. In order to distinguish with certainty between chaotic and ordered motion we use the SALI method in extensive sets of initial conditions of orbits. Moreover, a spectral method is applied for identifying the various regular families and also for recognizing the secondary resonances that bifurcate from them. Our numerical computations suggest that for low energy levels the observed amount of chaos is high and the orbital content is rather poor, while for high energy levels, corresponding to global motion, regular motion dominates and many secondary higher resonances emerge. We also compared our results with previous related work.

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

Luminosity-environment relation in the LOWZ sample of the SDSS-III

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Abstract. In this work, we examine the environmental dependence of the u -, g -, r -, i - and z -band luminosities in the LOWZ sample of the Sloan Digital Sky Survey Data Release 10 (SDSS DR10). To decrease the radial selection effect, we divide the LOWZ sample into subsamples with a redshift bin size of $\Delta z = 0.01$ and analyze the environmental dependence of luminosities for these subsamples in each redshift bin. It is found that all five band luminosities of the LOWZ galaxy sample in the redshift region $z=0.16$ – 0.23 show substantial correlation with the local environment, especially in the redshift bins 0.19 – 0.20 and 0.20 – 0.21 . The environmental dependence of all five band luminosities in the LOWZ galaxy sample becomes weak with increasing redshift, like the one in the apparent-magnitude limited Main galaxy sample.

Key words: galaxies: fundamental parameters – galaxies: statistics

Observational data and orbits of the asteroids discovered at the Molėtai Observatory in 2005–2007

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Abstract. The paper presents statistics of the asteroids observed and discovered at the Molėtai Observatory, Lithuania, in 2005–2007 within the project for astrometric observations of the near-Earth objects (NEOs), the main belt asteroids and comets. CCD observations of asteroids were obtained with the 35/51 cm Maksutov-type meniscus telescope and the 1.65 m Ritchey-Chretien reflector. In the Minor Planet Circulars and the Minor Planet Electronic Circulars (2005–2007) we published 17 003 astrometric positions of 2980 asteroids. Among them 112 were new normal asteroids and one NEO (2006 SF77) discovered at Molėtai; a few NEOs were found by our team independently. For the asteroids discovered at Molėtai their precise orbits were calculated. Because of short observational arc, a few asteroids have low-precision orbits and some asteroids have been lost. For three of them with low-precision orbital elements (NEO 2006 SF77 and two Mars crossers – 2006 SN368 and 2007 VM315), we present their ephemerides for 2016–2018.

The potentially hazardous asteroid 2000 SG344

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Abstract. We computed impact solutions for the potentially dangerous asteroid 2000 SG344, based on 31 optical observations from 1999 May 15.20482 UTC to 2010 October 29 03.60723 UTC. Using the freely available OrbFit Software Package, we can follow its orbit forward in time searching for close approaches to the Earth, which can lead to possible impacts up to 2113. The asteroid 2000 SG344 belongs to the class of the so-called possible recovery Near Earth Asteroids and can be recovered in 2028. Its ephemerides for observational window in 2028 are presented.

Key words: minor planets, asteroids: individual: 2000 SG344

Discovery, observational data and the orbit of the Transneptunian object (420356) Praamžius

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Abstract. A project for astrometric and photometric observations of asteroids with the VATT telescope on Mt. Graham is described. One of the most important results is the discovery of the Transneptunian object (420356) Praamžius. We computed its orbit applying 198 optical observations from 2003 February 1 to 2016 January 30. We also followed its orbit searching for minimal distances to Neptune between the years 17 000 and –13 000. Combined with the apparent brightness, the orbit gives the absolute magnitude $M_R = 5.59 \pm 0.37$ mag. Using a typical albedo value of 0.08 for Centaurs and TNOs, we get a diameter of (420356) Praamžius in the range 302–425 km.

Key words: minor planets, asteroids: astrometry, photometry, orbits – minor planets, asteroids: Transneptunian objects: individual: (420356) Praamžius)

The surface density of haloes

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Abstract. We study the correlation between the central surface density and the core radius of the dark matter haloes of galaxies and clusters of galaxies. We find that the surface density within the halo characteristic radius r_* is not a universal quantity as claimed by some authors (e.g., Milgrom 2009), but it correlates with several physical quantities (e.g., the halo mass M_{200} , and the magnitude M_B). The slope of the surface density-mass relation is 0.18 ± 0.05 , leaving small room to the possibility of a constant surface density. Finally, we compare the results with MOND predictions.

Key words: cosmology: theory – large-scale structure of universe – galaxies: formation

Improvements on a unified dark matter model

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Abstract. We study, by means of a spherical collapse model, the effect of shear, rotation, and baryons on a generalized Chaplygin gas (gCg) dominated universe. We show that shear, rotation, and the presence of baryons slow down the collapse compared to the simple spherical collapse model. The slowing down in the growth of density perturbation is able to solve the instability of the unified dark matter (UDM) models described in previous papers (e.g. Sandvik et al. 2004) at the linear perturbation level, as also shown by a direct comparison of our model with previous results.

Key words: cosmology: theory, large scale structure of universe – galaxies: formation

Depressed emission between magnetic arcades near a sunspot

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Abstract. The locations of the depressed emission in microwaves, EUV and soft X-rays are compared with each other and with the location of the plasma outflow in the active region (AR) 8535 on the Sun. We found that two open-field regions overlap the regions of depressed emission near the AR's sunspot. These two open-field regions are simulated with the potential-field source-surface (PFSS) model under radial distances of $R_{SS} = 1.8 R_{\odot}$ and $R_{SS} = 2.5 R_{\odot}$. Each open-field region is located between the arcades of the loops of the same magnetic polarity. The former open-field region covers the region of the plasma outflow, which is thus useful for the tests on connection to the heliosphere. The utmost microwave depression of the intensity in the ordinary mode (the Very Large Array 15 GHz observations) also overlaps the region of the plasma outflow and thus indicates this outflow. The lasting for eight days depression in soft X-rays and the SOHO EIT 2.84×10^{-8} m images are attributed to the evacuation of as hot coronal plasma as $T \geq 2 \times 10^6$ K from the extended in height (“open”) magnetic structures. We conclude that the AR 8535 presents the sunspot atmosphere affected by the large-scale magnetic fields.

Key words: Sun: sunspots, radio radiation, EUV, X-rays, magnetic fields

The study of radio flux density variations of the quasar OJ287 by the Wavelet and the Singular spectrum methods

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Abstract. We present the analysis of radio flux density variations of the extragalactic radio source OJ287 using the Singular spectrum and the Wavelet methods. The analysis was performed using the long-term monitoring data at 14.5, 8.0 and 4.8 GHz obtained with the University of Michigan radio telescope during 40 years. Despite the large number of papers dedicated to this radio source, this monitoring has no analogs, and it significantly supplements the episodic VLBI data. The Wavelet analysis at all three frequencies revealed the presence of quasi-periods within the intervals 6.0–7.4 and 1.2–1.8 years. The Singular spectrum analysis revealed the presence of quasi-periods within the intervals 6–10 and 1.6–4.0 years. For each quasi-period the time interval of its existence was determined.

Key words: quasars, BL Lacertae objects: individual (OJ287)