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New observations of the old magnetic nova GQ Muscae

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Abstract. Photometric observations of GQ Mus performed between 1992 and 2011 are reported. We find that the total amplitude of the orbital modulation of its brightness decreased from ~ 0.9 mag in 1992 to ~ 0.2 mag in 2010, becoming comparable to the amplitude of chaotic flickering on a time scale of several minutes. Optical spectra obtained in 2001 and 2012 indicate continuing activity of GQ Mus. The spectra show broad emission lines of He II and H I typical for magnetic cataclysmic variables. The nova was found to be an UV-bright object in 2001 and 2012. We also show that the orbital period of GQ Mus has been constant between 1989 and 2010–2011.

Key words: stars: individual: GQ Mus – novae – cataclysmic variables

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Correlations in relaxed clusters of galaxies

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Abstract. The correlations among different quantities in galaxy clusters, observed by Newman et al. (2013a,b), are investigated. We find an anti-correlation among the slope α, the effective radius, $R_{\rm e}$, and a correlation among the core radius $r$core and Re. Moreover, the mass inside 100 kpc (mainly dark matter) is correlated with the mass inside 5 kpc (mainly baryons). The listed correlations can be understood in a two phase formation model: the first dissipative phase forming the brightest cluster galaxies, and the second dissipationless phase in which the inner density profile is flattened by the interaction of baryonic clumps and the dark matter halo through dynamical friction.

Key words: cosmology: theory, large-scale structure of Universe – dark matter – galaxies: clusters, formation

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IO Com: is it a non secondary minimum star?

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Abstract. Four-color photometry of IO Com, a detached eclipsing binary with a long period ($\sim$53 d), was accomplished in 2004–2008. The absolute astrophysical and orbital parameters of the system were determined by the analysis of the light and radial velocity curves. No secondary minima in the light curves were detected. It was revealed that IO Com is the system with a highly eccentric orbit consisting of the components of mid-F spectral types. The calculated masses and radii of the primary and secondary components are: 1.32 $M_{\odot}$ and 1.21 $M_{\odot}$, and 2.45 $R_{\odot}$ and 1.51 $R_{\odot}$, respectively. In the HR diagram, both components of the system are in agreement with the PARSEC isochrones for the ages between 1.5 and 2.2 Gyr and the metallicities Z between 0.01 and 0.02.

Key words: binaries: eclipsing – stars: individual: IO Com – techniques: photometry

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How does the structure of spherical dark matter halos affect the types of orbits in disk galaxies?

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Abstract. The main objective of this work is to determine the character of orbits of stars moving in the meridional (R, z) plane of an axially symmetric time-independent disk galaxy model with a central massive nucleus and an additional spherical dark matter halo component. In particular, we try to reveal the influence of the scale length of the dark matter halo on the different families of orbits of stars, by monitoring how the percentage of chaotic orbits, as well as the percentages of orbits of the main regular resonant families evolve when this parameter varies. The smaller alignment index (SALI) was computed by numerically integrating the equations of motion as well as the variational equations to extensive samples of orbits in order to distinguish safely bet ween ordered and chaotic motion. In addition, a method based on the concept of spectral dynamics that utilizes the Fourier transform of the time series of each coordinate is used to identify the various families of regular orbits and also to recognize the secondary resonances that bifurcate from them. Our numerical computations reveal that when the dark matter halo is highly concentrated, that is when the scale length has low values the vast majority of star orbits move in regular orbits, while on the oth er hand in less concentrated dark matter halos the percentage of chaos increases significantly. We also compared our results with early related work.

Key words: galaxies: kinematics and dynamics – galaxies: structure – chaos – dark matter

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On the mass dependence of the inner slopes of dark matter density profiles

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Abstract. We study through a semi-analytic model how the inner slopes of relaxed ΛCDM dark matter halos with and without baryons depend on the halo mass. We find that the inner logarithmic density slope, $\alpha \equiv d\log\rho/d\log r$, of dark matter halos with baryons has a significant dependence on the halo mass with slopes ranging from $\alpha \simeq 0$ for dwarf galaxies to $\simeq 1$ for clusters of galaxies. In the case of density profiles constituted just of dark matter, the mass dependence of slope is very slight. In the presence of baryons, the universality of the dark matter density profiles is no longer valid, in agreement with the results of several other authors, including the recent Di Cintio et al. (2014) simulations.

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