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HALO-BASED RECONSTRUCTION OF THE COSMIC MASS DENSITY FIELD

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We present the implementation of a halo-based method for the reconstruction of the cosmic mass density field. The method employs the mass density distribution of dark matter haloes and its environments computed from cosmological N-body simulations and convolves it with a halo catalogue to reconstruct the dark matter density field determined by the distribution of haloes. We applied the method to the group catalogue of Yang et al. built from the Sloan Digital Sky Survey (SDSS) Data Release 7. As a result we obtain reconstructions of the cosmic mass density field that are independent of any explicit assumption of bias. We describe in detail the implementation of the method, present a detailed characterization of the reconstructed density field (mean mass density distribution, correlation function and counts in cells) and the results of the classification of large-scale environments (filaments, voids, peaks and sheets) in our reconstruction. Applications of the method include morphological studies of the galaxy population on large scales and the realization of constrained simulations.

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OBSERVATIONAL CONSTRAINTS ON A COUPLED QUINTESSENCE MODEL WITH A GENERALIZED DE EOS

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In this work we put constraints on a quintessence dark energy model that interacts with the dark matter fluid. By assuming a DE model described by the parameterization $w(a) = w_0 + w_1 \ln_\beta(a)$ and that the dark fluids follows the relation $\rho_m/\rho_x = a^{-\xi}$ we use the most recent data of SN Ia, BAO, CMB and H(z) to put constraints on the EoS parameters w_0, w_1 and $\Omega_{m,0}$ for selected values of β and ξ parameters. Although the standard ΛCDM model is in good agreement with our results, we show that scenarios with interaction in the dark sector can not be ruled out by currently available data.

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GRAVITATIONAL WAVES AND STABILITY OF COSMOLOGICAL SOLUTIONS IN THE MODIFIED STAROBINSKY INFLATION

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We consider the dynamics of metric perturbations in the gravity theory with anomaly-induced quantum corrections. Our first purpose is to derive the equation for gravitational wave in this theory on the most general homogeneous and isotropic background, and then explore the stability of such background with respect to metric perturbations. Our first purpose is to explore the stability of the classical cosmological solutions in the theory with quantum effects taken into account. There is an interesting literature about stability of Minkowski and de Sitter spaces and here we extend the consideration also to the radiation and matter dominated cosmologies. The consideration was based on explicit derivation of gravitational wave equations in the theory with anomaly-induced quantum corrections and on the use of both analytical and numerical methods to perform the detailed analysis of these equations. The main conclusion of our work is that the stability conditions are essentially related to the sign of the Weyl-squared term in the *classical* action of vacuum and do not manifest any essential dependence on the quantum contributions. Furthermore, we analyze the behavior of metric perturbations during inflationary period, in the stable phase of the Modified Starobinsky inflation.

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MEASURING GALAXY MORPHOLOGIES IN THE CFHT STRIPE 82 SURVEY

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We present the determination of galaxy structural parameters in the CFHT Stripe 82 Survey (CS82) stacked images. The CS82 survey covered an area of ~ 170 square degrees with the CFHT $3.6m$ telescope in a field determined by $-40 < RA < 45$ and $-1 < DEC < 1$ (within the SDSS stripe-82 region) in i-band to a depth of $mag_{AB} \sim 24$. Its excellent image quality (mean seeing of ~ 0.6) and uniformity makes CS82 specially suitable for applications involving gravitational lensing and galaxy morphology. The determination of galaxy structural parameters has applications to galaxy evolution studies, weak lensing, and the improvement of the photometry in other surveys (e.g. SDSS), through the "forced photometry" method. The morphological analysis of galaxies is performed through a profile-fitting method implemented with a combination of SExtractor v2.14.7 (which has model-fitting features) and PSFEx. First, we use SExtractor to perform the detection and obtain basic measurements of objects, then we use PSFEx to model the PSF across the field, and finally, we run SExtractor again to perform the model-fitting of objects. In particular we use 4 models implemented in SExtractor: Sérsic, de Vaucouleurs, exponential and 2-component de Vaucouleurs+exponential. In this work we outline the procedure described above and focus on a quality assessment of the determination of the ellipticities, through a comparison with the CS82 weak lensing catalogue obtained with the state-of-the-art code lensfit (Miller et al. 2007).

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IDENTIFICATION AND EXTRACTION OF PHOTOMETRIC REDSHIFTS OF QUASARS WITH NARROW-BAND FILTERS

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Although quasars are valuable targets for many cosmological applications, imaging surveys employing optical broad-band filter systems are unable to obtain accurate photometric redshifts for these objects. Broad-band imaging surveys also have some difficulty in distinguishing quasars from stars and HII regions of galaxies. However, the construction of a high-purity catalog of quasars, with accurate photometric redshifts, can be much more efficient with medium or narrow-band surveys, such as the upcoming J-PAS. In this work we discuss how to overcome the degeneracies in the color-color and color-magnitude diagrams that hamper the efficient detection of quasars, and how to obtain very good (near spectroscopic) photometric redshifts for these objects. In particular, we discuss how to include quasars in some of the most popular redshift codes, and the parallel need for the inclusion of spectral libraries for stars. We also discuss the importance of a good modeling of the distribution of point-sources in the sky, and the need for reliable luminosity functions that can inform the Bayesian estimation of types and photometric redshifts.

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GRAVITATIONAL WAVES FORMULATION FOR THE BRANE UNIVERSE AND POSSIBLE INDUCED CORRECTIONS ON AN OBSERVATIONAL LEVEL

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The observation of gravitational waves and their effect on different physical systems constitute one of most searched for proofs of the theory of general relativity. In this work, a brief summation on their construction based on general relativity and its observational consequences is presented with the intention of later extending the analysis to obtain the wave equation from the field equations that describe the brane universe. With the obtained results, a discussion is opened around the possibility of distinguishing observationally between general relativity and the brane universe theory. Since brane theory considers that gravity can spread to the extra dimensions (thus appearing weaker than the rest of interactions), it is possible to argue that the expected amplitude of gravitational waves according to the theory differs from the one expected in relativity.

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