X3), considering the model above and leptonic and hadronic processes.

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HIGHLIGHTS ON γCAS-LIKE STARS

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The number of Be stars with unusually hard-thermal and variable X-ray emission like that of γ-Cassiopeiae increased from one to ten in seven years. It is possible that they could be progenitors of magnetars or account for the missing number of Be/WD binaries observed, and this can be further tested through careful characterization of the parameter space in which the X-ray emission occurs. Here, we present a compendium of the optical and X-ray properties of a sample of this new class of X-ray emitters and some very recent results presented by our group. We discuss the current understanding and emphasize results that strengthen the interpretation of magnetic activities near the Be star as being the source of the X-ray emission.

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PROPERTIES OF GALAXY GROUPS SELECTED FROM CHANDRA X-RAY OBSERVATIONS OF THE BOÖTES FIELD

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Galaxy groups are not simply scaled down versions of rich clusters (e.g. Mulchaey 2000, Voit 2005). Due to a group's shallow gravitational potential, feedback processes play an important role in the group's evolution. It is important to understand galaxy groups since, in hierarchical clustering, they are the building blocks of large scale structure. Thus, in addition to determining the characteristics of groups, it is important to determine the mass function over the range that includes poor clusters and groups. We present the properties of the galaxy groups selected in the Chandra X-Boötes survey (Kenter et al. 2005). Group redshifts are measured from the AGES (Kochanek et al. 2012) spectroscopic data. We use photometric data from the NOAO Deep Wide Field Survey (NDWFS) (Jannuzi & Dey 1999) to estimate the group richness (N_{gals}) and the optical luminosity (L_{opt}). Our final sample comprises 32 systems at $z < 0.80$, with 14 below $z = 0.35$. For these systems we estimate velocity dispersions (σ_{gr}) and perform a virial analysis to obtain the radius (R_{200} and R_{500}) and mass (M_{200} and M_{500}) for groups with at least five galaxy members. We use the Chandra X-ray observations to derive the X-ray luminosity (L_X). We examine the performance of the group properties σ_{gr}, L_{opt} and L_X, as proxies for the group mass. Understanding how these observables measure the total mass is important to estimate how well the cluster/group mass function is determined. By extending the mass function to the group regime, we predict the number of groups that new X-ray surveys, eROSITA, will detect.

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COSMOLOGY

GAUSSIAN ANALYSES ON PLANCK CMB MAPS

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Extremely precise cosmic background radiation (CMB) data from *Planck* satellite confirmed the cosmological model ΛCDM and established tight constraints for several features of the primary and secondary CMB temperature fluctuations. Possible non-Gaussian (NG) contributions to the CMB field could be originated during (or soon after) primordial cosmic inflation, where the types, scale dependences, and intensities expected depend on the inflationary models. For this, the robust detection –or not– of primordial NG in the CMB signify a unique probe to the early universe, allowing to distinguish between competing models. Recent analyses from *Planck* CMB data strongly limit the level of NG and show consistency with the Gaussian hypothesis although they do not exclude the presence of weak Gaussian deviations. A problem inherent with the confidence of a positive detection is the possibility that any non-primordial contamination could be

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mixed with primary contributions leading to qualitative and/or quantitative imprecise detections.

A variety of methods are being used to search for different NG signals in CMB data because one does not expect that a single statistical tool can be able to identify all possible forms of Gaussian deviations. Using two directional large-angle NG indicators based on skewness and kurtosis statistical momenta of patches of the CMB sphere, we analyze the three nearly full sky foreground-cleaned *Planck* maps: SMICA, NILC, and SEVEM.

Our results show that these foreground-cleaned *Planck* maps exhibit different levels of NG at large angles, depending on the cut-sky mask used (all of them released by the *Planck collaboration*). The separation component minimum mask, termed M82, and the U73 mask appear to be equally efficient to Gaussianize all these CMB *Planck* maps.

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CENTRAL DOMINANT GALAXIES AND THE EVOLUTION OF THEIR HOST CLUSTERS

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We have studied a sample of 50 galaxy clusters, all with more than 100 spectroscopically confirmed member galaxies, from all Bautz-Morgan types, in order to determine the importance of the brightest cluster members (BCMs) and their relation to the structure and dynamical state of their host clusters. Strict tests for membership and for the presence of substructures were applied. Near-infrared data were used for photometry and astrometry, which allowed us to rank the member galaxies in order of their stellar mass content. The large spectroscopic sampling, the broad range of morphologies, masses and intra-cluster medium properties, beyond the improved analyses for membership and substructuring, make this sample an especially suitable reference of nearby optical clusters ($0.005 < z < 0.150$) for the study of cluster evolution and environment effects on member galaxies. Only 35% of the clusters revealed to be unimodal, 50% to be substructured and other 15% to be multi-modal. Also, for about 20% of the sample, the Central Dominant Galaxy (CDG) of the main structure is not the first-ranked BCM, but the CDG of a substructure. More massive clusters present more than one dominant galaxy, while the less massive ones present only one, if any. This correlation goes in the sense that most of the evolution of CDGs occurs in groups that are doomed to merge and form clusters.

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NEW CATALOGUES OF SUPERCLUSTERS OF ABELL/ACO GALAXY CLUSTERS UP TO $z \sim 0.15$

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We present two new catalogues of superclusters of galaxies within a redshift of $z = 0.15$, constructed using the Abell/ACO cluster redshift compilation by one of us (H.A.). One is the all-sky Main SuperCluster Catalogue (MSCC), based on 3410 A-clusters (92% with spectroscopic redshifts), containing 601 superclusters with multiplicities from 2 to 42; the other is the Southern ($\delta < -17°$) SuperCluster Catalogue (SSCC) based on 1227 A-clusters and 1177 S-clusters (90% with spectroscopic redshifts), containing 425 superclusters with multiplicities from 2 to 39. These are currently the deepest all-sky supercluster catalogues based on optical data. By comparing both catalogues, we found the following effects (expressed as percentages of the total number of superclusters in SSCC): new superclusters with S-clusters around A-cluster cores (12.6%), the formation of bridges of S-clusters between A-clusters (1.2%), and the addition of new superclusters formed by S-clusters only (25.4%). We determined morphological parameters for the superclusters, based on ellipsoid fits and Minkowski functionals, obtaining that 39% of the rich (multiplicity >5) superclusters are prolate ellipsoids and 61% are oblate ones. The cumulative multiplicity functions of both catalogues follow very closely a power law with an exponent of −2.0 for MSCC and −1.9 for SSCC. This power law is clearly inconsistent with the same function we derived for supercluster catalogues based on simulated samples of randomly distributed clusters. It is also inconsistent, though less significantly, with similar analyses we applied to the Bolshoi cosmological sim-