WINGS: a Wide–field Imaging Nearby Galaxy clusters Survey

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Abstract. We present a two-band, wide-field imaging survey of an X–ray selected sample of 78 clusters in the redshift range z=0.03–0.07. The aim of the project is to provide the astronomical community with a complete set of homogeneous, CCD–based, surface photometry and morphological data of the nearby cluster galaxies located within 1.5Mpc from the cluster center.

1. Motivation

In all statistical studies concerning photometric and morphological evolution of galaxies in clusters, the only reference sample available in the nearby universe is the historical one of Dressler (1980) who lists the positions, the visual morphological classifications and the approximate magnitudes of galaxies in 55 clusters at z=0.011–0.066. It is obvious that a local reference sample with quality adequate to the modern technologies is missing and is crucial both for studying the morphological content of nearby clusters in a systematic way and for setting the zero-point for evolutionary studies.

This project is aimed at filling in this gap through a complete CCD surface photometry (in the B and V bands) of galaxies in a well-defined sample of low–z clusters.

2. Cluster sample and status of observations

The growing availability of efficient and reliable Wide–Field Imaging CCD Cameras (WFICs) has opened for the first time the possibility of gathering in a reasonable time a large amount of CCD data on galaxies in nearby clusters. We have exploited this opportunity in both the north (INT, La Palma) and the south (ESO–2.2) hemispheres, by taking observations of clusters selected from an essentially complete X-Ray flux limited sample of Abell clusters (XBACs,
Ebeling et al. 1996) compiled from ROSAT All–Sky Survey data. The redshift range (0.04<z<0.07) is the only selection criterion applied, resulting in a total sample of 78 clusters (36 in the northern hemisphere and 42 in the southern one) over a broad range in X-Ray luminosity. Since now a total of 14 observing nights have been already devoted to this project, resulting in the complete imaging of 61 clusters.

3. Immediate objectives and techniques

The data will be used to produce, for each cluster of the sample, the following outputs:

- a deep (V_{lim} \sim 22.5; B_{lim} \sim 23.5) photometric catalog of galaxies containing coordinates, integrated V and B magnitudes, concentration index, rough ellipticity and position angle estimates of each object;
- a surface photometry catalog, relative to a sub-sample of bright/large enough galaxies of the previous, deep list. In this catalog we will include the whole photometric and morphological information extracted from the luminosity and geometrical profiles (color profile, isophotal twisting, disky/boxy c_4 profile, Bulge/Disk decomposition, etc..), as well as the global parameters (effective radius and average surface brightness, total magnitude, Sersic’s index, morphological type, etc..) of each galaxy;

The reduction procedures are clearly crucial to achieve these scientific objectives. In particular, automatic pipelines for data reduction and surface photometry are required, together with a fast computing capability.

The deep catalogs will be produced running SExtractor (Bertin and Arnout, 1996) onto the co-added frames in the two filters, whereas the surface photometry catalogs will be produced by using a tool for Galaxy Automatic Surface PHOTometry in wide and/or deep fields (GASPHOT, Pignatelli and Fasano 1999) we are presently developing at the Padova Observatory. It consists of four main tools:

a) STARPROF produces a careful (space varying) representation of the PSF profile;

b) SEXISOPH exploits some capabilities of SExtractor to quickly produce luminosity and geometrical profiles of the galaxies;

c) GALPROF fits the equivalent luminosity profiles of galaxies by using both a Sersic law and a three component \((r^{1/4} + \exp + \text{PSF})\) profile convolved with the proper PSF and produces unbiased estimates of total magnitudes, effective radii, Sersic’s indices, etc.;

d) MORPHOT exploits some characteristic features of the luminosity and geometrical profiles to estimate the morphological type of individual galaxies.

References

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