

The Galaxy Luminosity Functions down to $M_R = -10$ in the Coma Cluster

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The galaxy luminosity function (LF) is a useful measure to describe fundamental statistical properties of galaxy populations and serves as a clue to study the history of galaxy formation and evolution. However, our knowledge of the faint part of the LF ($M_R > -19$), which is dominated by dwarf galaxies, is still very limited. The aim of the present study is to investigate the properties of the very faint dwarf population and their possible environmental dependence, if any, in terms of LF, color, and surface brightness.

We construct the LFs at three fields located at the center, intermediate, and outskirts in the Coma Cluster [1]. Deep and wide images are obtained with the Suprime-Cam mounted on the Subaru Telescope. Contamination from background galaxies is subtracted statistically using the number counts of galaxies in a blank field, the Subaru Deep Field.

The LF ($-19 < M_R < -10$) shows no significant differences among the different three fields in this cluster (Figure 1). It shows a clear dip at $M_R \sim -13$, and is composed of two distinct components of different slopes; the bright component with $-19 < M_R < -13$ has a flatter slope than the faint component with $-13 < M_R < -10$ which has a steep slope. The bright component ($-19 < M_R < -13$) consists of mostly red extended galaxies including few blue galaxies whose colors are typical of late-type galaxies. On the other hand, the faint component ($-13 < M_R < -10$) consists of largely PSF-like compact galaxies (Figure 2). We found that both these compact galaxies and some extended galaxies are present in the center while only compact galaxies are seen in the outskirts. In the faint component, the fraction of blue galaxies is larger in the outskirts than in the center. We suggest that the dwarf galaxies in the Coma Cluster, which make up the two components in the LF, are heterogeneous with some different origins.

References

- [1] Yamanoi, H., et al.: 2012, *AJ*, **144**, 40.
- [2] Marn-Franch, A., Aparicio, A.: 2002, *ApJ*, **568**, 174.
- [3] Harris, W., et al.: 2009, *AJ*, **137**, 3314.

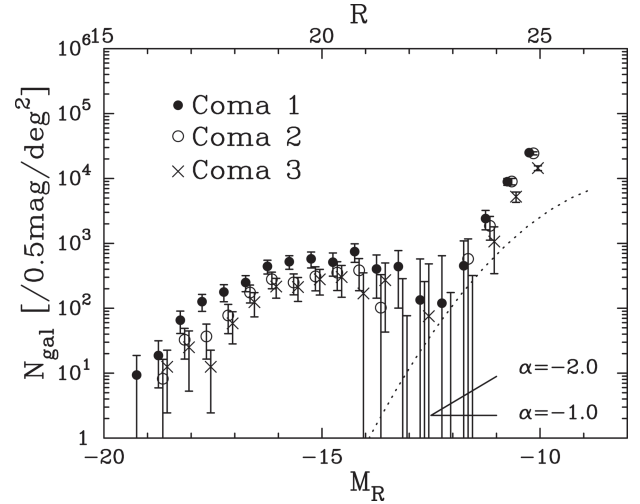


Figure 1: The R -band LFs of the center (Coma 1), intermediate (Coma 2) and outskirts (Coma 3) fields, respectively. The error bars are based on Poisson statistics. The broken curve indicates the LF of globular clusters in the Coma 1 field calculated using the previous results of [2] and [3].

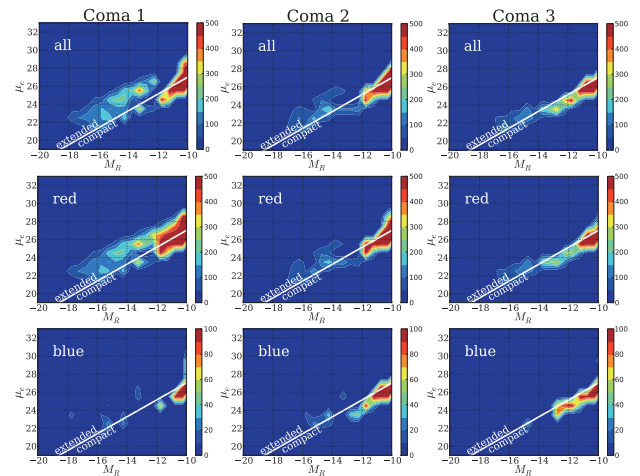


Figure 2: The color-coded number density contours of estimated member galaxies (all galaxies: top row, red galaxies: middle row, blue galaxies: bottom row) in the R absolute magnitude versus effective surface brightness plane. The white solid line indicates the discrimination between the extended (upper) and the compact (lower) objects.