



ESA/Hubble Astronomy Research Group
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Abstract

CFHT wide field imaging data (taken in 1999) of Virgo cluster's central region in V- and I-band were reduced using the THELI reduction pipeline. A visual inspection was applied to search for dwarf galaxies and further low surface brightness objects. Known background galaxies were additionally analyzed to exclude likely background objects from the sample which have similar properties like position in CMD or deVaucouleur profile for small and faint objects. This enabled us to investigate structural properties of the galaxies and the color-magnitude relation of the cluster down to an absolute magnitude of $M_V = -9$ mag.

In a final step it is foreseen to investigate the luminosity function and discuss whether there is a 'missing satellite' problem in dense regions like galaxy clusters.

Analysis

Initially 369 objects were chosen. After an accurate investigation 32 objects were excluded because they were saturated or next to a star or had a too low S/N. 43 further objects were found having spiral structure or any disturbance. Excluding them lead to a sample of 294 objects. Models of all these galaxies were created using IRAF ellipse.

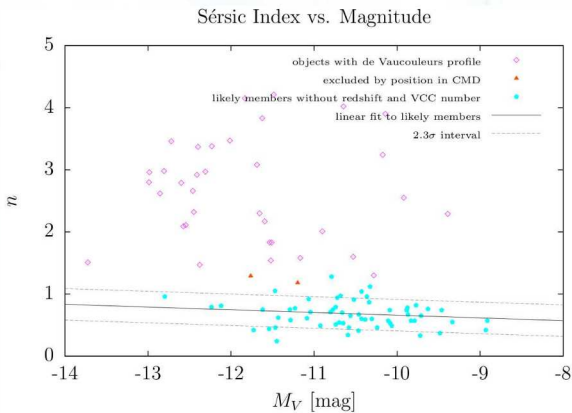
Redshift data excluded 47 objects. Sérsic fits of 110 unknown objects (unknown redshift and no VCC number) have been applied to get parameter for distinction between likely cluster members and likely background objects. This method excluded 35 objects. Further uncertain likely cluster members were defined by their position in the CMD which turned out 8 objects. So the cluster sample contained 209 objects.

Adopted values in our calculations:

Virgo cluster distance modulus: $m - M = 31.09$ mag

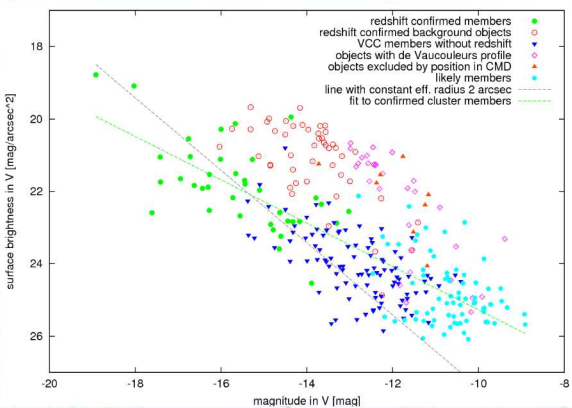
Virgo cluster membership redshift: $z < 0.009$

Background objects



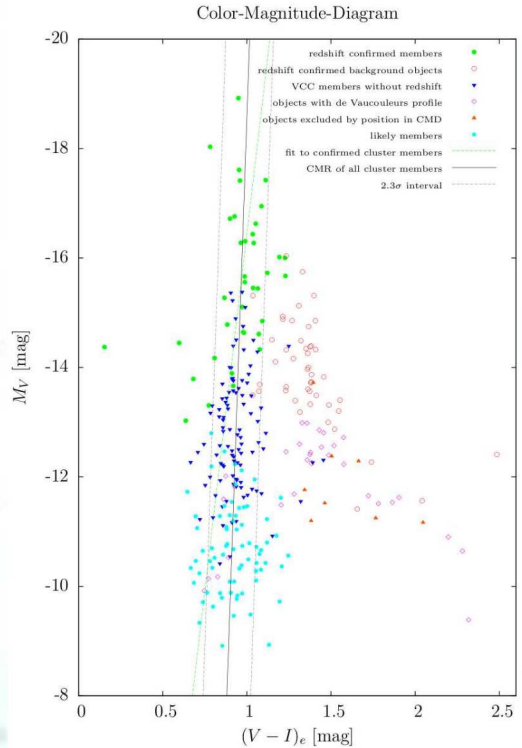
Sérsic fits were applied to all unknown objects. Objects whose fit converged to $n \geq 4$ are not included. To separate between background objects we applied $n=1.6$ corresponding to the 5σ level.

Surface brightness



The effective surface brightness increases with luminosity. This is in agreement with other cluster investigations like Misgeld, Mieske and Hilker (2008). Fainter objects follow the relation of the confirmed cluster sample (green dotted line).

Color-magnitude relation



Having a color which is redder than 1.3, 8 objects were excluded from the likely member sample. This corresponds to a 5σ level. Also a very blue object (dIrr, VCC 1313) was excluded from statistics. In the magnitude range $-19 < M_V < -8.9$ mag this leads to the color-magnitude relation:

$$(V - I)_0 = -0.011 \cdot M_V + 0.79$$

with an rms of 0.12. The relation deviates from the relation of the confirmed cluster members. The slope of this relation is -0.036 which is in good agreement with the relation found by Lisker et al. 2008.

Conclusion

The results from our analysis of the Virgo cluster galaxy sample are:

- We find dwarf galaxies down to absolute magnitudes $M_V = -9$ mag.
- Confirmed background galaxies clearly deviate from the CMD of Virgo cluster. Objects with de Vaucouleurs profile follow this sequence so that the Sérsic index is a good instrument to distinguish background galaxies from cluster members at fainter magnitudes ($M_V > -14$ mag).
- Our sample of ≈ 200 Virgo cluster galaxies reveals a CMD that differs from the relation of confirmed members, shifted to the red region. Since dwarf galaxies are brighter in red wavelengths (thus more easy to find) this shifting could be observed due to selection effects.
- We find that the dwarf galaxies follow the $\mu_e - M_V$ relation which is given by the cluster confirmed sample. This suggests that dwarf galaxies are not a separate class of objects.