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THE STRUCTURE OF THE UNDERLYING STELLAR HOST IN BLUE COMPACT DWARF GALAXIES

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Nowadays it is well established that BCDs are mostly old systems, as the vast majority of them have an extended low-surface brightness (LSB) stellar host underlying their central starburst component. This host generally extends several kpc from the star-forming (SF) regions, shows regular elliptical isophotes, and displays red colors indicative of an evolved stellar population (Papaderos et al. 1996a; Cairós et al. 2001a,b, 2003).

The assessment of the properties of the LSB stellar host in BCDs is a fundamental prerequisite for establishing the evolutionary status and the star formation history of these galaxies. The comparison of the structural parameters and colors of the LSB with those of other dwarf galaxy classes is crucial to test evolutionary scenarios that link those galaxies with BCDs (Papaderos et al. 1996b) and for advancing our view of dwarf galaxy formation and evolution. Furthermore, the stellar LSB host is, together with the gaseous component, primarily responsible for the gravitational potential within which the starburst phenomenon takes place (Papaderos et al. 1996b).

Not much in-depth work has been done so far on the properties of the hosts in BCDs: due to their faintness, such a study requires a great deal of observational and analysis effort. We are currently carrying out the first comprehensive analysis of the properties of the host in a sample of BCD galaxies. Preliminary results for eight objects are presented here.

Deriving the structural parameters of the LSB host in BCDs

In BCDs, stellar and ionized gas emission from the starburst overshines the LSB component in its inner part, so the study of the host relies entirely on the outer regions (typically $\mu_B \geq 24$ mag arcsec^{-2}). It is necessary to reach very deep surface brightness levels ($\mu_B \geq 28$ mag arcsec^{-2}) so as to have a radial range extended enough for a robust structural study.

In addition, a meaningful study of the properties of the underlying stellar host must rely on a suitable analytical model: whether the exponential model, widely used to describe the light profile of the LSB host, is the most appropriate fitting function is currently matter of debate (Cairós et al. 2001a, 2003; Noeske et al. 2003).

Deriving the structural parameters of the host in such complex systems as BCDs requires:

- Deep and extended surface brightness profiles.
- Proper determination of the fit radial range.
- Use of a suitable analytical model for the light distribution of the host

And these three requirements have been taken into account in our work.

We took long exposure times images at 2.5-4m class telescopes, and did a careful flat-field correction and sky background subtraction. To avoid contamination from the starburst, we defined an $R_{\mathrm{transition}}$ outside which the starburst emission is practically absent, using color and Hα emission maps, and fit the host in the interval $R > R_{\mathrm{transition}}$. Additionally, bearing in mind that surface brightness profiles systematically deviate from the commonly adopted exponential model in their outer part we preferred to use Sérsic models to fit the light of the stellar LSB host.

The drawbacks of fitting a Sérsic law

Though the Sérsic law certainly provides a more physically meaningful description of the light profile of the host galaxy, it is subject to a number of sources of uncertainty:

1. Sensitivity to radial range: for small radial and surface brightness intervals ($\Delta\mu \leq 4$ mag), the results may depend significantly on the choice of the fitted radial range (especially true if it includes some of the starburst region).
2. Sensitivity to sky-subtraction errors: even small errors on the determination of the sky background level can change dramatically the derived Sérsic parameters.

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TABLE 1

SÉRSIC PHOTOMETRIC PARAMETERS FOR THE LSB HOST GALAXY[a]

Galaxy	Band	$R_{\rm tran}$	R_{max}	$\mu_{\rm min}$	$\mu_{\rm max}$	n	$R_{\rm e}$	$\mu_{\rm e}$	m_{host}
Tol 127	B	7.22	19.74	24.22	29.06	0.95	4.86	23.32	17.21
	V	7.16	17.50	23.54	27.42	0.83	5.27	22.88	16.66
	R	7.20	19.87	23.15	28.09	0.77	5.54	22.61	16.32
Mrk 370	B	35.65	84.77	24.72	28.36	0.97	24.70	23.89	14.25
	V	35.62	75.03	23.95	26.85	1.01	24.16	23.09	13.47
	R	35.50	91.22	23.42	27.65	0.98	24.12	22.56	12.96
Mrk 5	B	13.78	34.58	23.99	27.63	2.83	3.35	20.23	14.39
	V	13.67	34.00	23.56	26.92	2.46	4.89	20.97	14.38
	R	13.64	35.65	23.15	26.76	2.70	4.60	20.46	13.96
Mrk 86	B	45.97	97.93	24.15	27.24	0.87	32.69	23.42	13.21
	V	45.52	122.35	23.29	26.81	1.46	30.78	22.44	12.11
	R	46.33	128.71	22.89	26.52	1.81	27.84	21.74	11.53
Mrk 35	B	24.57	59.24	23.86	28.33	1.11	12.90	22.26	13.96
	V	24.37	63.82	23.09	28.15	0.93	14.98	21.99	13.45
	R	24.08	63.10	22.73	27.67	1.30	12.10	21.01	12.77
Mrk 36	B	12.18	23.92	24.93	27.60	0.95	8.24	24.05	16.80
	V	12.39	33.03	24.53	28.89	0.95	8.30	23.60	16.33
	R	12.07	26.44	24.04	27.09	1.21	7.48	22.92	15.76
I Zw 123	B	9.17	25.49	24.03	24.48	2.61	2.07	19.95	15.19
	V	9.07	24.07	23.29	26.82	3.01	2.74	20.26	14.84
Mrk 314	B	16.85	39.40	23.69	26.93	1.42	9.98	22.49	14.62
	V	16.15	38.10	23.50	26.71	1.21	11.03	22.69	14.69

[a]Columns 3, 4, 5, 6: radial ($''$) and surface brightness (mag arcsec^{-2}) interval for the Sérsic fit; col 7: n shape parameter; cols 8, 9: effective radius ($''$) and surface brightness (mag arcsec^{-2}); col 10: total magnitude of the host derived from the fit (mag).

3. In a less important way, derived Sérsic parameters may depend on whether the fit is done weighting the datapoints or not, or whether the profile is resampled to constant step, or, for instance, whether the major axis or equivalent radius profile is fitted.

In order to assess the validity and reliability of Sérsic models in studies of multi-component extragalactic systems, such as BCDs, several consistency checks should be made. First, it is important to plot the resulting values of n, R_e and μ_e as a function of the fitted radial range, and check whether the parameters are stable or show a strong dependence on the fitting interval. Also, as we expect that the LSB host has flat color profiles, n and $R_{\rm e}$ should be the same, within the errors, in all passbands.

Our analysis

For each galaxy, we derived the light profile of their LSB host by fitting ellipses to the isophotes, after masking out foreground and background objects, and other disturbances. Then, they were fitted by a Sérsic law, excluding the star formatio region and those outermost datapoints affected by large uncertainties.

The inspection of the table with Sérsic parameters shows that in general the Sérsic fit to the LSB hosts give parameters consistent in the three bands here explored. Also, in the majority of the galaxies n is very close to 1 (the host is well approximated by an exponential). In two galaxies, however, n is about 2.5-3, which indicates that not all the hosts share the same structure.

An investigation of the correlations among the LSB host structural parameters, as well as the comparison with those of other dwarf types, based on a larger galaxy sample, is in progress.

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