The Environment of Late Type Low Surface Brightness Galaxies

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Using the SDSS DR6 we investigated the environment properties of a complete and volume limited sample of 1072 low surface brightness galaxies (LSBs) and 48487 high surface brightness galaxies (HSBs) in the redshift interval 0.02 < z < 0.06 with $M_r \le -18.5$. We observe a significant deficit of neighbours around LSBs at small scales, while at larger radii, both distributions tend to merge. Our result supports the scenario in which the isolation of LSBs at intermediate and small scales must have affected their evolution since tidal encounters acting as a trigger for star formation would have been rarer in these galaxies than in HSBs.

0.05

0.04

0.03

0.03

0.0

What are Low Surface **Brightness Galaxies (LSBs)?**

LSBs are characterized by a central disk surface brightness (SB) in the blue band μ_0 (B) > 22.5 mag arcsec⁻². They present low star formation rate, low metallicity (usually sub-solar), higher gas fractions compared to HSBs and most of the gas under the form of HI, among others characteristics.

Why study LSBs environment?

Because their properties suggest that LSBs are some sort of unevolved systems as a result of a history traced by the lack of gravitational instabilities in their gas disks (van der Hulst et al 1993).



oncentration Index, r_{50}/r_{90} in r band, in cold $\mu_0(B)$ information from Kniazev et al. 2004.

Fig 2.- Pie slice Diagram for a section of the full galaxy sample. Target LSB galaxies are in red, and tracer galaxies are in black. Green circles correspond to redshift of 0.02, 0.04 and 0.06 respectively

How we select LSBs?

We use as SB indicator the Petrosian half-light SB, $\mu_{50}(g)$. In order to establish a relation between $\mu_0(B)$ and $\mu_{50}(g)$, we use the galaxy fitted SB profile performed by Kniazev et al. 2004 and compared it to their respective $\mu_{50}(g)$ for a sample of late type galaxies (Concentration index c > 0.375), resulting:

 $\mu_0(B) = 1.08\mu_{50}(g) - 2.05$

LSB cut: $\mu_0(B) \ge 22.5 \iff \mu_{50}(g) \ge 22.73$

The Sample:

The target sample consist of 1072 LSB and 48487 HSB spectroscopic late type galaxies between $0.02 \le z \le$ 0.06, $\mu_{50}(r) \le 23.00$ mag arcsec⁻² and $M_r \le -18.5$.

The tracer sample contains 74754 galaxies with $M_r \leq -18.5$ and $0.0195 \leq$ $z \le 0.0605$.

Low Surface Brightness galaxies tend to have a lack of nearby companions compared to High Surface Brightness galaxies

Sphere Count

We count the number of tracer galaxies included in spheres of fixed radius centred in every of the target sample galaxies. We vary the radius from 0.5 to 5 Mpc in steps of 0.5 Mpc.

Fig. 3 shows the mean volume Mpc_1 density of neighbours for LSB (red) and HSB (blue) galaxies. We observe a significant deficit 🖁 of neighbours around LSBs at small scales, while at larger radii, both distributions tend to merge.

The results listed above supports the scenario presented for Bothun et al. 1997, in which the isolation of LSBs at intermediate and small scales must have affected their evolution since tidal encounters acting as a trigger for star formation would have been rarer in these galaxies than in HSB galaxies.

References



Fig 3.- Mean volume density of neighbours for LSB (in red) and HSB (in blue) galaxies as a function of radius bin.

Table 1 summarizes the results obtained from the sphere count and the neighbour distance analysis graphically shown in Figures 3 and 4.



Distance to the First and **Fifth Nearest Neighbour**

We calculated the distance to the first and the fifth nearest neighbour for every target galaxy. A velocity difference lower than 1000 km s $^{\rm 1}$ was required between the target and the tracer galaxy in order to avoid projection effects.

Fig. 4 shows the cumulative distribution of the distance to the fifth nearest neighbour for LSB (red) and HSB (blue) galaxies

Inhabit dense environments its not only restricted to HSBs. Following the classification by Bothun et al. 1993, a popular LSB galaxy is defined as one having 8 or more companions within a radius of 2 Mpc. In our LSB ple, a 13% classify as popular, in trast to the 21% for the HSB

(in blue) galaxies.	cont
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Galaxy Classification	Number of Galaxies	Mean distance to the nearest neighbour (Mpc)	Mean distance to the fifth neighbour (Mpc)	Galaxies without neighbours within 0.5 Mpc	Galaxies with 8 or more neighbours within 2 Mpc
LSB	1072	0.99 ± 0.02	1.88 ± 0.04	<mark>86</mark> %	13 %
HSB	48487	0.81 ± 0.01	1.62 ± 0.01	76 %	21 %

Bothun, G. D., Impey, C. D., McGaugh, S. S. 1997, PASP, 109, 745. Kniazev, A.Y., Grebel, E.K., Pustilnik, S.A., Pramskij, A.G., Kniazeva, T.F., Prada, F., Harbeck, D. 2004, AJ, 127, 704. van der Hulst, J.M., Skillman, E.D., Smith, T.R., Bothun, G.D., McGaugh, S.S., de Block, W.J.G., 1993, AJ, 106, 548.

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