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A large sample of low surface brightness disk galaxies from SDSS

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Abstract. We present the properties of a large sample (12,282) of nearly face-on low surface brightness disk galaxies selected from the main galaxy sample of SDSS-DR4. Those properties includes B-band central surface brightness $\mu_0(B)$, scale lengths h, distances D, integrated magnitudes, colors and some resulted relations. This sample has $\mu_0(B)$ from 22 to 24.5 mag arcsec^{-2} with a median value of 22.44 mag arcsec^{-2}. They are quite bright with M_B taking values from -18 to -23 mag with a median value of -20.08 mag. The disk scale lengths h are from 2 kpc to 19 kpc. There exist clear correlations between $\log h$ and M_B, $\log h$ and $\log D$. Both the optical-optical and optical-NIR color-color relations show most of them have a mix of young and old stellar populations.

Keywords. Galaxies: distances and redshifts, galaxies: fundamental parameters, galaxies: photometry, galaxies: spiral, galaxies: stellar content

1. Introduction

Low surface brightness galaxies (LSBGs) are galaxies that emit much less light per area than normal galaxies. Yet, owing to their faintness compared with the night sky, they are hard to find. Hence their contribution to the local galaxy population has been underestimated for a long time. With the improvements of modern digital sky survey, such as the Sloan Digital Sky Survey (SDSS), the numbers of the detected LSBGs could be greatly improved. Therefore, we propose to search for a large sample of LSBGs from the SDSS database, which could help to understand the properties of LSBGs in details.

2. The Sample

The sample used in this work is selected from the main galaxy sample (Strauss *et al.* 2002) of SDSS-DR4 following the next steps:

(*a*) $fracDev_r < 0.25$: this requires the galaxy having an exponential light profile since the parameter $fracDev_r$ indicates the fraction of luminosity contributed by the de Vaucouleurs profile to exponential profile in the r-band.

(*b*) $b/a > 0.75$: this is selecting the nearly face-on galaxies, and a and b are the semi-major and semi-minor axes of the fitted exponential disk, respectively.

(*c*) $M_B < -18$ mag: keeping $M_B < -18$ in mind is to exclude few dwarf galaxies contained in our sample.

(*d*) $\mu_0(B) \geqslant 22.0$ mag arcsec^{-2}, which is following Impey *et al.* (2001) and is a bit lower than the first suggestion of 21.65 mag arcsec^{-2} by Freeman (1970) for LSBGs.

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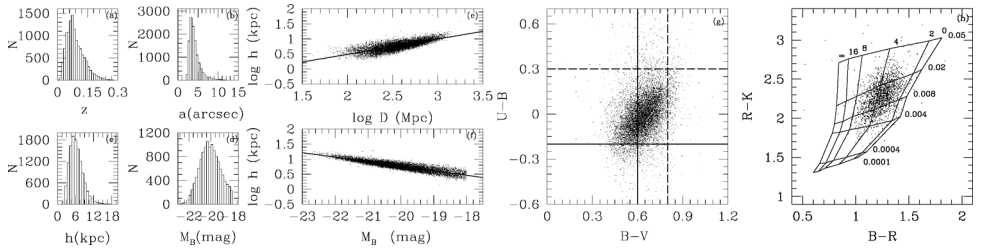

Figure 1. (a–d): histogram distributions for **Sample-L**: (a). the redshift, (b). the disk semi–major axis, (c). the disk radius, (d). the M_B; (e–f): correlations for **Sample-L**: (e). between log$h$ and log D, (f). between log h and M_B; (g). optical colur-color diagram of **Sample-L**; (h). optical-NIR color-color diagram of **Sample-L2**.

(e) Cross-correlation with 2MASS NIR photometry: after doing cross-correlation with 2MASS photometry, 1,878 galaxies are selected.

With step (a–d), we have selected a large sample of nearly face-on low surface brightness disk galaxies (12,282 galaxies, named **Sample-L**). Figure 1(a–d) show the histogram distributions of some property parameters of **Sample-L**. The sample selected by cross-correlation with 2MASS was named as **Sample-L2**.

3. Results and conclusions

In Fig. 1e, we show the correlation between log$h$ and log$D$ for **Sample-L**, which can be fitted by a least-square fit as: log$h = 0.511(\pm0.004)logD - 0.536(\pm0.010)$, with standard deviation of 0.10 dex. This relation obviously show the selection effect of observations. Fig. 1f shows the correlation between M_B and log$h$ for **Sample-L**. It can be fitted by a least-square fit as: log$h = -0.150(\pm0.0007)M_B - 2.245(\pm0.014)$, with small standard deviation of 0.070 dex. This correlation suggests there are limits on both low luminosity and large scale length galaxies, otherwise such LSBGs are very rare (Impey *et al.* 2001).

Figure 1g shows $U-B$ vs. $B-V$ diagram of **Sample-L**, the solid and dashed lines are suggested by O'Neil *et al.* (1997a, b) to define the "very blue" and "very red" LSBGs. Figure 1f shows the trends in $B-R$ and $R-K$ optical-NIR diagram for **Sample-L2**. The overplots are the stellar population synthesis grids obtained by Bell *et al.* (2000) using the models of Bruzual & Charlot (2003), where the horizontal lines refer to the different metallicities and the vertical lines refer to the different characterized e-folding time scale of their star formation. Both the optical-optical and optical-NIR color-color relations show that most of the sample LSBGs have a mix of young and old stellar populations.

Acknowledgements

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References

Bell, E. F. & de Jong, R. S. 2000, *MNRAS* 312, 497
Bruzual, G. & Charlot, S. 2003, *MNRAS* 344, 1000
Freeman, K. C. 1970, *ApJ* 160, 811
Impey, C., Burkholdert, V., & Sprayberry, D. 2001, *AJ* 122, 2341
ONeil, K., Bothun, G. D., & Cornell, M. 1997a, *AJ* 113, 1212
ONeil, K., Bothun, G. D., Schombert, J., Cornell M. E., & Impey, C. D. 1997b, *AJ* 114, 2448
Strauss, M., *et al.* 2002, *AJ* 124, 1810

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