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## Properties of bars in the local universe

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**Abstract.** We studied the fraction and properties of bars in a sample of about 3000 galaxies extracted from SDSS-DR5. This represents a volume limited sample with galaxies located between redshift  $0.01 < z < 0.04$ , absolute magnitude  $M_r > -20$ , and inclination  $i < 60^\circ$ . Interacting galaxies were excluded from the sample. The fraction of barred galaxies in our sample is 45%. We found that 32% of S0s, 55% of early-type spirals, and 52% of late-type spirals are barred galaxies. The bars in S0s galaxies are weaker than those in later-type galaxies. The bar length and galaxy size are correlated, being larger bars located in larger galaxies. Neither the bar strength nor bar length correlate with the local galaxy density. On the contrary, the bar properties correlate with the properties of their host galaxies. Galaxies with higher central light concentration host less and weaker bars.

### 1. Detection and characterization of bars

Large galaxy surveys allows to study the bar properties in the local universe for a statistically significant sample of galaxies. We selected in SDSS-DR5 a volume-limited sample of about 3000 galaxies with redshift  $0.01 < z < 0.04$ , absolute magnitude  $M_r > -20$ , and inclination  $i < 60^\circ$ . They were selected to no show evidence of interaction. Bars were detected using two different methods: ellipse fitting and Fourier analysis. They were calibrated and tested using mock barred and non-barred galaxies similar to the observed ones. We present here the results obtained with the ellipse fitting method, since it resulted to be more efficient than Fourier analysis in detecting bars. We found a bar in 45% of our disk galaxies, in good agreement with Barazza et al. (2007). As far as the morphological type concerns, 32% of S0s, 55% of early-type spirals, and 52% of late-type spirals are barred galaxies. The bar length was measured either as the radius corresponding to the maximum isophotal ellipticity or as the radius where the isophotal position angle changes more than  $5^\circ$ . It correlates with the galaxy size, which was defined as  $2.5 \times r_{90}$  where  $r_{90}$  is the radius enclosing 90% of the total flux. The bar strength was calculated using the parameter  $f_{bar}$  (Whyte et al. 2002). Bars in S0s galaxies are weaker than those in later-type galaxies.

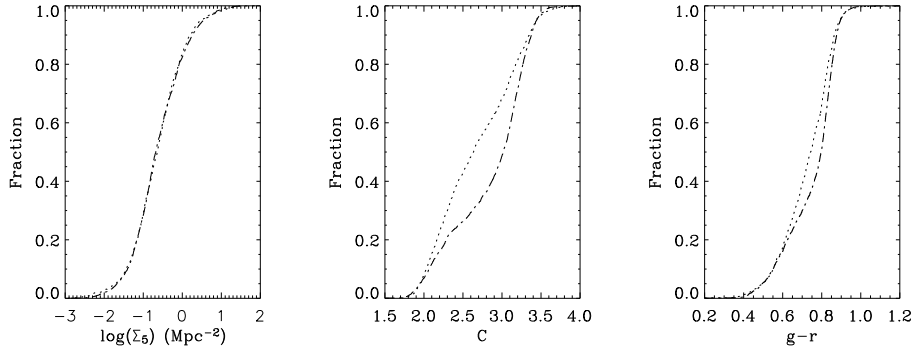


Figure 1. Cumulative fraction of barred (dotted line) and non-barred (dashed-dotted line) as function of the local density (left panel), light concentration (central panel) and  $g-r$  galaxy color of the galaxies (right panel).

## 2. Internal versus external processes

The local galaxy density  $\Sigma_5$  was estimated using the method of the distance to the fifth nearest neighbor. There is no correlation between the presence (Fig. 1, left panel), strength, and length of a bar with  $\Sigma_5$ . We also investigated the relation of the different bar properties with the light concentration index  $C = r_{90}/r_{50}$ . We found that bars were preferentially hosted in galaxies with lower light concentration (Fig. 1, central panel). Moreover, bars are preferentially hosted by bluer galaxies (Fig. 1, right panel)

## 3. Conclusions

Bars were observed in 45% of our disk galaxies, being more common in early- and late-type spirals than in S0s galaxies. We found that larger bars are located in larger galaxies, indicating the interplay between the bar and disk components. No difference between the local galaxy density of barred and non-barred galaxies was found, in addition, neither the length nor strength of the bars are correlated with the local environment. These results suggest that local environment does not play an important role in bar formation and evolution. A statistical significant difference between the central light concentration of barred and non-barred galaxies was found. The former were located in less concentrated galaxies. This difference could explain the lower fraction and the weakness of bars detected in S0 galaxies in comparison with the other types.

## References

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