

FULL KINEMATIC PROFILES OF NEARBY GALAXIES

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Abstract. We describe our new sample of nearby galaxies extracted from the Sloan Digital Sky Survey. It consists of 573 galaxies (243 early-type and 330 late-type galaxies). This is the largest sample obtained to date which contains full kinematic profile (of the inner region) of each galaxy; we have calculated: velocity, velocity dispersion, and Gauss-Hermite parameters h_3 and h_4 which describe asymmetric and symmetric departures from the Gaussian, respectively.

1. INTRODUCTION

This work presents a new sample of nearby galaxies which includes all Hubble types. The sample has been compiled from two separate sources: the late-type galaxies (spirals) were taken from the paper by Ho (2007) and the early-type galaxies (ellipticals and lenticulars) were taken from the Nearby Optical Galaxy (NOG) sample presented in Giuricin et al. (2001).

2. DESCRIPTION OF THE SAMPLE

The primary source for the Ho sample comes from HyperLeda¹ but three different sources were also used (see Ho (2007) for details). The galaxies from the NOG sample were also taken from HyperLeda database and the extraction of the galaxies with a morphological classification was performed using the following selection criteria: *i*) galactic latitudes $|b| > 20^\circ$; *ii*) recession velocities (evaluated in the Local Group rest frame) $cz \leq 6000$ km/s; *iii*) corrected total blue magnitudes $B \leq 14$ mag (see Giuricin et al. 2001 for details). Our sample includes only the galaxies from these two sample for which we have Sloan Digital Sky Survey (SDSS) spectroscopic data: in total we have 573 galaxies (243 early-type and 330 late-type galaxies). The spectra were obtained using fibres with an entrance diameter of $3''$ (see Strauss et al. 2002). They extend out to the redshift $z \leq 0.06$.

In Fig. 1 we present a distribution of morphological type index T for 573 galaxies in our sample. From this Figure it is obvious that the largest number of galaxies per bin belong to the Sb/Sbc class, but note that we also have a significant number of early-type galaxies ($T < 1.5$). With such a sample we have the opportunity to study more massive systems (galaxies with large velocity dispersion).

¹<http://leda.univ-lyon1.fr>

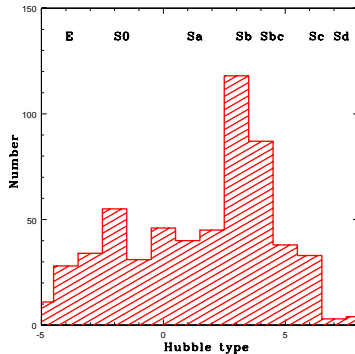


Figure 1: Distribution of morphological type index T for the 573 galaxies in our sample.

3. RESULTS

We have tested various libraries of stellar templates; Vazdekis (1999), ELODIE (Prugniel and Soubiran 2001), MILES (Sánchez-Blázquez et al. 2006) and Valdes (2004) libraries were all used (see a detailed discussion in Lalović (2010)). We show in Fig. 2 the spectrum of the galaxy NGC 4102 (Hubble type $T = 3$) which was taken from the SDSS database; in the same Figure we also show two representative stellar templates. We have used pPXF code (Cappellari and Emsellem 2004) to extract the full kinematic profiles of the galaxies in our sample. We model the line-of-sight velocity distribution (LOSVD) as a truncated Gauss-Hermite series (Gaussian multiplied by a polynomial):

$$F_{\text{TGH}}(v_{\text{los}}) \propto e^{-\frac{1}{2}w^2} \left[1 + \sum_{k=3}^n h_k H_k(w) \right] \quad (1)$$

where $w \equiv (v_{\text{los}} - \bar{v})/\sigma$. We study: σ (velocity dispersion), h_3 (*asymmetric departure*) and h_4 (*symmetric departure from Gaussian*) (see van der Marel and Franx 1993). For the galaxy NGC 4102 we show our results obtained using the MILES library in Fig. 3: velocity dispersion ($\sigma = 158.3 \pm 6.2$ km/s) and Gauss-Hermite parameters ($h_3 = 0.003 \pm 0.006$ and $h_4 = 0.002 \pm 0.04$). The quality of the fit is: $\chi^2 = 0.16$.

In Fig. 4 we show the distribution of the velocity dispersions for our sample of galaxies. The full kinematics (the velocity dispersion and the Gauss-Hermite parameters were extracted using ELODIE library and G+K stars as the templates). It can be seen that the maximum value of $\sigma = 100$ km/s is valid for the spirals, while the early-type galaxies show the values of the velocity dispersion which are more evenly distributed. One can also see that in the bins with the largest velocity dispersion ($\sigma \gtrsim 200$ km/s, more massive galaxies) the early-type galaxies are much more numerous than the spirals.

For the discussion regarding anisotropies we refer the reader to the contribution by Samurović in these Proceedings. We briefly note here that both h_3 and h_4 are small in the central regions for both early- and late-type galaxies.

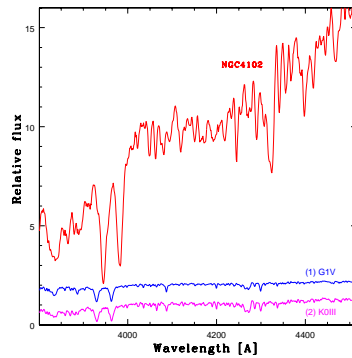


Figure 2: SDSS spectrum of the galaxy NGC 4102 (upper part). The spectra of the two different template stars are plotted below: the upper line is for the G1V star and the lower line is for the K0III star. Note the effects of velocity dispersion and redshift in the case of the galaxy; y-axis is in arbitrary units.

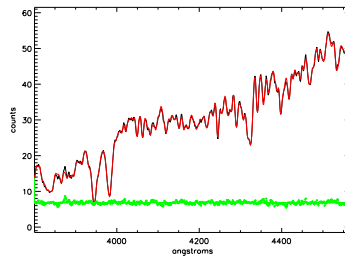


Figure 3: The fit (grey line) of the observed spectrum (black line) of the galaxy NGC 4102 shown in Fig. 2 obtained using the MILES stellar template database. Note almost perfect overlapping of the two spectra as evidenced with the dots in the lower part which represent the residual differences between the spectrum and the fit (the zero level of these differences is shifted to $y = 7$ for better visibility).

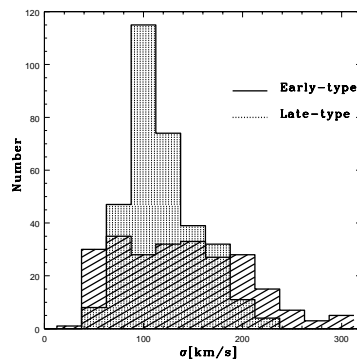


Figure 4: Distribution of the velocity dispersion for the 573 galaxies in our sample. The early-type galaxies are plotted using full lines and the late-type galaxies are plotted using dotted lines.

4. CONCLUSIONS

- 1) We briefly presented our new sample of nearby galaxies extracted from the SDSS catalog: it consists of 573 galaxies (243 early- and 330 late-type galaxies). This is the largest sample obtained to date which contains full kinematic profile (of the inner region) of each galaxy. The sample will be fully presented in Samurović, Lalović and Vince (2010).
- 2) We have calculated: velocity, velocity dispersion, and Gauss-Hermite parameters h_3 and h_4 which describe asymmetric and symmetric departures from the Gaussian, respectively.
- 3) Early-type galaxies show larger velocity dispersions for $\sigma \gtrsim 200$ km/s. It is shown that both early- and late-type galaxies do not show large departures from the Gaussian in their central parts.

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