Stellar Populations as Building Blocks of Galaxies
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Techniques for quantifying the Star Formation Morphology of Galaxies at increasing redshift

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Abstract. We present a brief, comparative, study of the morphology of a sample of 9 late type, star forming, local galaxies, as seen in different bands. The objects are present in the "The Hα Galaxy Survey" by James *et al.*, 2004 (J04 hereafter), in the Sloan Digital Sky Survey ("SDSSS", York *et al.*, 2000), and also in data from GALEX (Martin *et al.* 2005). We tested the pixel to pixel proportionality v. Hα of images in broad bands from FUV to NIR. We also analyzed the differences in the radial profiles of light in different bands. Finally, we also measured several parameters of the morphology of the distributions of light, as detected in bands of SDSS (u,g,r,i,z), GALEX (NUV, FUV) and in R and Hα from J04, aiming to test which bands better mimic the spatial distribution of the SF as traced by Hα. Our goal is to acquire as accurate a determination as possible of the spatial distribution of the massive star formation in local galaxies, to compare with the analogous distribution in galaxies at increasing redshift.

Keywords. galaxies: stellar content, galaxies: structure, galaxies: evolution

1. Summary

In this study we have worked with 9 local, late type galaxies. The data come from J04 (R$\sim$300sec and H$\alpha\sim$200sec), SDSS (u,g,r,i,z; 54 sec), and GALEX (NUV, FUV; $\sim$130sec). The spectral range covered spans from 2200 to 9000 A.

We have tested the pixel to pixel proportionality to Hα of images in different broad bands. From this kind of analysis, we see that the pixel quotients of intensities in NUV to Hα have a smaller dispersion around the quotient of the total fluxes. This is consistent with this band being morphologically, and in an statistical way, more similar to Hα than the others.

We also performed radial surface brighness profiles of the flux-normalizated images in every band, for all galaxies, and compared them to Hα profiles. In 6 cases the NUV profile is closer to the Hα profile than those in the other bands, and for the 3 other cases it is comparable. FUV is not as close to Hα as is NUV. In 4 cases we see that the ratio of FUV and NUV to Hα increases from centre to edge. This is consistent with the well known trend of larger dust absorption in the inner parts of galaxies.

Finally, we have also measured key morphological parameters of the galaxies in all bands. The parameters are: Concentration ("C", Bershady *et al.*, 2000), Asymmetry ("A", Abraham *et al.*, 1996), Clumpiness ("S", Conselice 2003), Gini (Abraham *et al.*, 2003) and M20/90, which is a slight modification of the M20 parameter by Lotz *et al.*,

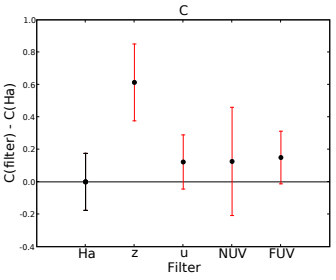

Figure 1. Average difference in the "C" parameter between different bands and Hα, for all galaxies. Error bars mean standard deviation in differences. For Hα means standard deviation in Hα values amongst galaxies.

2004. M20/90 is a measure of how disperse are the pixels which contain the brightest 20% of the flux, relative to the brightest 90%, by means of 2nd order moments.

As an example, for "C" (Fig. 1), we see that galaxies appear more centrally concentrated in z than in Hα. Values in u, NUV and FUV are quite similar to each other, objects being also more concentrated in these bands than in Hα, but less than in z. This is due to a larger contribution from old stars to the flux in the inner part of galaxies in z than in the other bands.

From this kind of analysis, and considering all the parameters, we draw the conclusions than in general, u, NUV, and FUV give morphological parameters significatively more similar to those in Hα, than z, as would be expected. Of these 3, NUV and FUV are better proxies than u, and between NUV and FUV, the latter is slightly better.

2. Conclusions

• Hα is intrinsically the ideal SF morphology tracer in galaxies, but images in Hα at arbitrary redshift are in general unavailable, so we have tested proxy broad band tracers.

• In the broad bands considered, we have implemented a set of quantitative tests for the morphological similarity of the images to that in Hα, using nearby galaxies.

• The results of these tests, detailed in this poster, show that the NUV and FUV bands defined and used in GALEX, are good proxies (better than longer wavelength bands), and will clearly be useful for the comparison of the distribution of SF in nearby and more distant galaxies.

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