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Morphology and photometry of isolated Seyfert galaxies

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Abstract. We present preliminary results about morphological and photometric analysis of a sample of 35 nearby (z<0.035) and isolated or partially isolated Seyfert galaxies, observed through broad-band BVR filters at the 1.8m Vatican Telescope and the 2.2m ESO-La Silla Telescope. We plotted radial profiles of surface brightness, ellipticity, position angles and deviations of axisymmetry for all galaxies. We also calculated magnitudes and colours and morphological parameters by means of 2D decomposition technique.

Key words. Galaxy: photometry – morphology – Seyfert – isolated galaxies – AGN

1. Introduction

An important unresolved problem about active galactic nuclei (AGN) is the determination of the mechanism responsible for the nuclear activity. In particular, matter needs to lose angular momentum to fall into the galaxy nucleus and fuel the supermassive black hole (SMBH).

Many authors proposed a lot of different solutions: circumnuclear star clusters, bars, disk or nuclear spirals, interactions between galaxies, and mergers. All of these mechanisms generate a non-axisymmetrical potential which can trigger nuclear activity, but none of them seems to completely explain all observed AGN types.

This work is part of a larger project focused on the study of the possible causes of AGN triggering. In particular we analysed morphological and photometric properties of 35 nearby (z<0.035) and isolated or partially isolated (Rafanelli et al. 1995) Seyfert galaxies. Our images were obtained with broad-band BVR filters at the 1.8 m Vatican Telescope and the 2.2 m ESO-La Silla Telescope.

2. Data analysis

We used standard procedures for data reduction and calibration. With IRAF task ELLIPSE we obtained morphological parameters, by fitting elliptical isophotes to galaxy images and we plotted center, position angle (PA), ellipticity and B_4 (Bender et al. 1988) versus the semi-major axis. Significant ($\gtrsim$ seeing) variations of center positions indicate an asymmetrical distribution of light, a constant PA in correspondence to increasing ellipticity may indicate the presence of a bar, while the B_4 coefficient determines the deviation of isophotes from a pure elliptical shape.

Using BMODEL, we built a model image based on the isophotal analysis, then we subtracted the model from the original image obtaining a residual image, showing all the structures that cannot be reproduced by elliptical isophotes (i.e. spiral arms, star forming regions, dust lanes,...). With ELLIPSE output data we also plotted surface brightness profiles and we determined disk and bulge parameters (central intensity I_0, disk scale radius h, effective radius r_e, and intensity at effective radius I_e) using monodimensional multicomponent fit.

For a more precise analysis of both photometric and morphological parameters we made 2D decompositions using GALFIT software (Peng et al. 2002). We used Sérsic law for bulges, exponential law for disks, and PSF for nuclear sources. GALFIT takes into account seeing effects, by convolving models with PSF, but in order to converge, it needs a good guess for starting parameters (we used the parameters obtained from mono-dimensional fit as first guess).

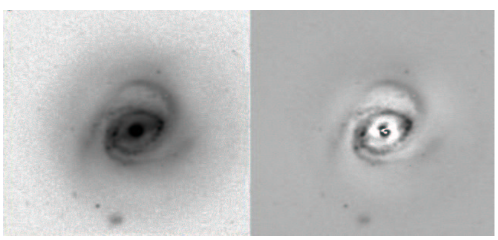

Fig. 1. Original image and the residual one, for IC1816 in the B-band obtained with GALFIT.

We also obtained colour maps to interpret the structures observed in residual images.

3. Preliminary results

By means of previous analysis, we found that our sample of galaxies may be divided into three different classes: objects without particular structures; objects showing residuals such as spiral arms or dust lanes (which are expected in late type spirals); objects with features that can be associated with interactions: tails, open spiral arms, X-shaped central structures, etc.

We calculated calibrated absolute magnitudes and colours for all the galaxies and their morphological components. We obtained good agreement between our values and those found in literature, even if other samples were selected with different criteria. Therefore, we find no evidence of an environment influence on photometric parameters.

We calculated the B/T ratio between the bulge flux (B) and the total one (T) and from these values we determined the morphological type, following Simien & De Vaucouleurs (1983). We found most of the values around B/T ~ 0.1-0.2, indicating a large amount of late type spirals. This is a somehow strange result, because it is generally thought that Seyfert nuclei are hosted more frequently in early type spirals. It may be an effect of the isolated environment, but observational biases cannot be excluded. We estimated morphological types also using Sérsic index n, because higher values of n correspond to earlier type objects; Aguerri & Balcells (2001) showed that n increases also as consequence of mergers. In our sample we find low values of n, on average (<2.15), that confirm our previous results.

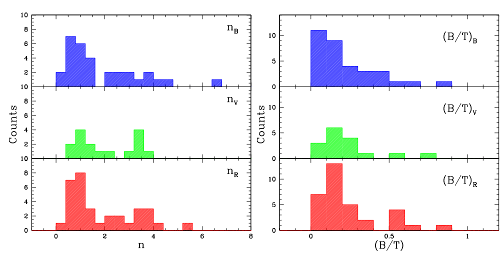

Fig. 2. Results obtained for our isolated sample for Sérsic index (on the left) and for the B/T ratio (on the right).

References

Aguerri, J. A. L. & Balcells, M. 2001, A&A, 367, 428
Bender, R. et al. 1988, A&AS, 74, 53
Rafanelli, P. et al. 1995, AJ, 109, 1546
Simien F. & De Vaucouleurs G. 1983, ApJ, 302, 564
Peng C. Y. et al. 2002, AJ, 124, 266