

PHOTOMETRIC PROPERTIES OF BOX-SHAPED GALAXIES

S. DOS ANJOS¹, R. E. DE SOUZA¹

1 IAG-USP, São Paulo, Brazil

ABSTRACT. A bulge/disk decomposition technique using a thin and a thick disk model is applied to a sample of 11 objects. In the thick disk modeling, the profiles are obtained in five different radial directions. The results show that the model of thick disk is more realist.

1. Introduction

The photometric and dynamical properties of box-shaped galaxies are still poorly known. Recent studies about box-shaped bulges indicate that this morphology is a common phenomena in spiral galaxies and tends to occur in S0 and Sab-Sb galaxies (Jarvis, 1986). De Souza and dos Anjos (1987), published a complete sample ($m_{lim} < 13.2$) of this kind of objets with 74 galaxies and concluded that among lenticulars 33% shows this effect, indicating that these objects correspond probably to edge-on view of barred galaxies. They also statistically analysed if the environmental influence can affect the morphology of the galaxies by verifying if the galaxies are isolated or in groups or clusters. Information about the general structure of the environmental influence can be obtained by using the photometric technique of decomposition of brightness profile. In this present work our goal is to obtain the structural parameters of a sample of box-shaped galaxies using CCD photometry, and adopting two models (thin and thick disk) for the decomposition of the brightness profile into components. The objects were selected from de Souza and dos Anjos (1987) sample and observed with 1.60m Perkins-Elmer telescope of National Laboratory of Astrophysics (LNA-Brazil), at Pico dos Dias (lat.-23°). Each object was observed on B and V filters of Johnson system with mean exposure time of 1200 and 900 seconds, respectively. The detector used was a GEC CCD with 400x600 pixels (22 μ), corresponding to 0.57 arcsec projected on the sky. The CCD frames were processed according to the standard rules : bias subtraction, flatfielding and sky subtraction, using the eVe package. The galaxies reduced are: NGC0128, NGC1381, NGC1596, NGC3115, NGC4565, NGC4594, NGC4958, NGC5253, NGC5864, NGC7041, A23-48. The comparison of the observed and estimated brightness profile indicate that both the thin and thick models fit the observational data. Because thick model provides a better fit of the small deviations of the observed profile than thin model, we present here the results concern to thick model.

2. Photometric Decomposition

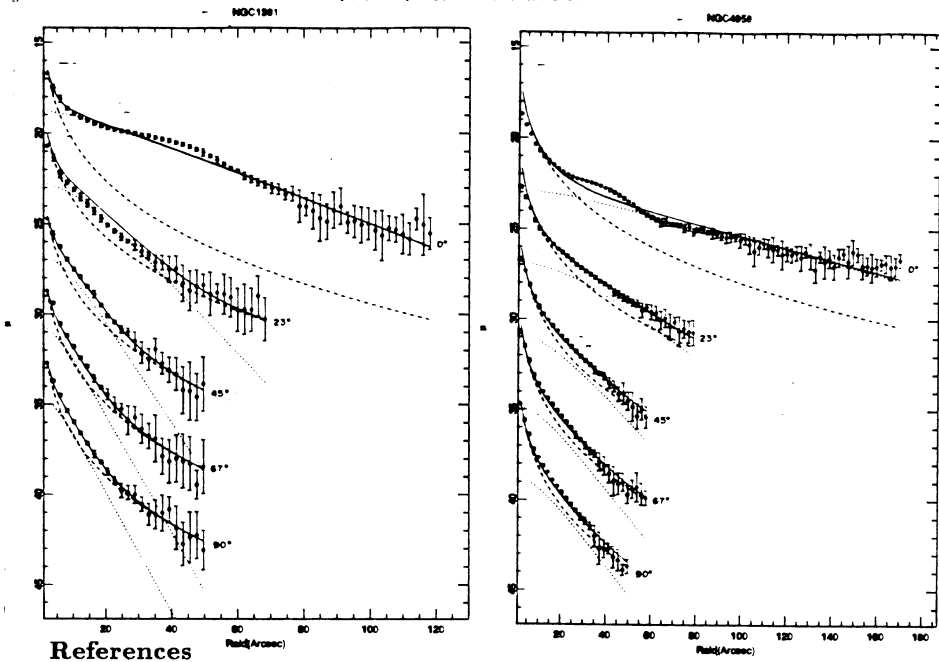
In this model the disk is represented by an exponential law and has a transversal thickness (z_0) obtained from the solution of equation of hydrostatic equilibrium, $g(z/z_0) = \text{sech}^2(z/z_0)$, given by van der Kruit (1981). The exponential disk

presents a brightness distribution along the major axis given by

$$E(y) = \int_{-\infty}^{\infty} e^{-(x^2+y^2)^{1/2}/r_d} dx.$$

Considering the transversal thickness we obtain, $I(y, z) = I_{0d}g(z/z_0)E(y)$, or in terms of modified Bessel function $K_1(s)$, $E(s) = 2sK_1(s)$.

The profiles used to test this model were obtained along the 5 directions, ($\theta = 0^\circ, 23^\circ, 45^\circ, 67^\circ$ and fitting parameters 90°), and $\mu_{0d}, \mu_{0b}, r_d, r_b, z_0, q_{b23}, q_{b45}, q_{b67}, q_{b90}$ were simultaneously determined. The results indicates that thick model fit the brightness profile of the observed galaxies except for NGC5864 for which no possible fitting was obtained with thick model. In the Figure below we can see, for example, the comparison of the observed (\bullet) and calculated (solid curve) brightness profiles in several directions of the NGC1381 and NGC4958. The dotted and dashed curves represents the contribution of thick disk and bulge, respectively. We can see that the agreement of observed and calculated brightness profiles is very good, with exception of direction along major axis, where we can see an excess of luminosity between radius 25" to 60" for NGC1381 and 15" to 50" for NGC4958. It could indicate the presence of a subsystem with ring morphology, as suggested by Buta and de Vaucouleurs (1983) for NGC4958.



- Buta, R., Vaucouleurs, G de 1983, ApJS 51, 149
 Jarvis, B.J. 1986, AJ 91, 65
 Kruit, P.C. van der, Searle, L. 1981, A&A 95, 105
 Souza, R.E. de, Anjos, S. dos 1987, A&AS 70, 465