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SPHERICAL GALAXIES

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RESUMEN. Presentamos fotometría fotográfica de 8 objetos y espectroscopía para 3 galaxias, las cuales son buenos candidatos para galaxias esféricas. Los resultados fotométricos se presentan en la forma de isofotas y de perfiles radiales promedio, de los cuales se derivan parámetros estructurales. Estas observaciones combinadas con parámetros dinámicos obtenidos de observaciones espectroscópicas, son consistentes con el plano fundamental derivado por Djorgovski y Davis (1987).

ABSTRACT. We present photographic surface photometry for 8 objects and spectroscopy for 3 galaxies which are good candidates for spherical galaxies. Photometric results are presented in the form of isophotes and mean radial profiles from which we derived structural parameters. These observations combined with dynamical parameters obtained from spectroscopic observations are consistent with the fundamental plane derived by Djorgovski and Davis (1987).

Key words: GALAXIES-ELLIPTICAL

. INTRODUCTION

The identification of spherical galaxies constitutes a good test for models which :y to represent the formation and structure of elliptical galaxies. Most of these models 1mit spherical symmetry and distribution of mass following the distribution of light, obeying 1 empyrical $r^{1/4}$ law. Therefore, observable parameters for these galaxies may be directly ɔmpared to intrinsic properties obtained by these models.

In the recent years, various programs of surface photometry have provided a large :ound of information (Schombert, 1986; Djorgovski and Davis, 1987; Jedrzejewski, 1987; Dressler t al., 1987; de Carvalho and da Costa, 1988). Considerable progress has also been achieved by inematical observations (Illingworth, 1977; Davies et al., 1987; etc.). These data have raised ıe problem of the manifold of galaxies. Recently Djorgovski and Davies (1987) and Dressler et l. (1987) have extended the Faber-Jackson relation (FJ, Faber and Jackson, 1976) by introducing second parameter named the mean surface brightness <SB>, thus improving previous attempts ɔ explain the residuals of this relation.

In section II we describe the observations and present our photometric and ɔectroscopic results. In section III we discuss the extended FJ relation in terms of a natural ɔnsequence of the Virial Theorem and suggest that the uncertainties must be well understood efore one can confidently use it as an alternative method for determining distances.

I. OBSERVATIONS AND RESULTS

Photographic plates (short and long exposures) in the V bandpass of 8 galaxies, elected by Telles (1989), were obtained using the 1.6 m telescope of Laboratorio Nacional de strofisica (LNA) in Brazil. The plates were digitalized using the PDS microdensitometer of he Observatorio Nacional. Scans of 200 x 200 pixels (0.64 "/pixel) were obtained. Copies of he ESO-B films were also used, when available, to extend the study to the outer regions of he galaxies. Confident data reduction was done with a new package developed for the use in icrocomputers and is fully described by Telles (1989). Comparisons of the mean radial profiles btained in this work with profiles of Jedrzejewski (1987) show that our photometry is accurate ɔ 0.1-0.2 mag. Figure 1 shows radial mean profiles and isophotal maps of the galaxies and able 1 presents the results from the $r^{1/4}$ law fits.

Spectroscopic data were obtained for 4 galaxies using a CCD camera at the Coudé focus. The spectra covered ∿ 230 Å centered at 8600 Å, in the region of Calcium triplet. We hav used a variation of the Fourier Quotient Method to reduce our data (Telles, 1989; and references therein). The results are also presented in Table 1.

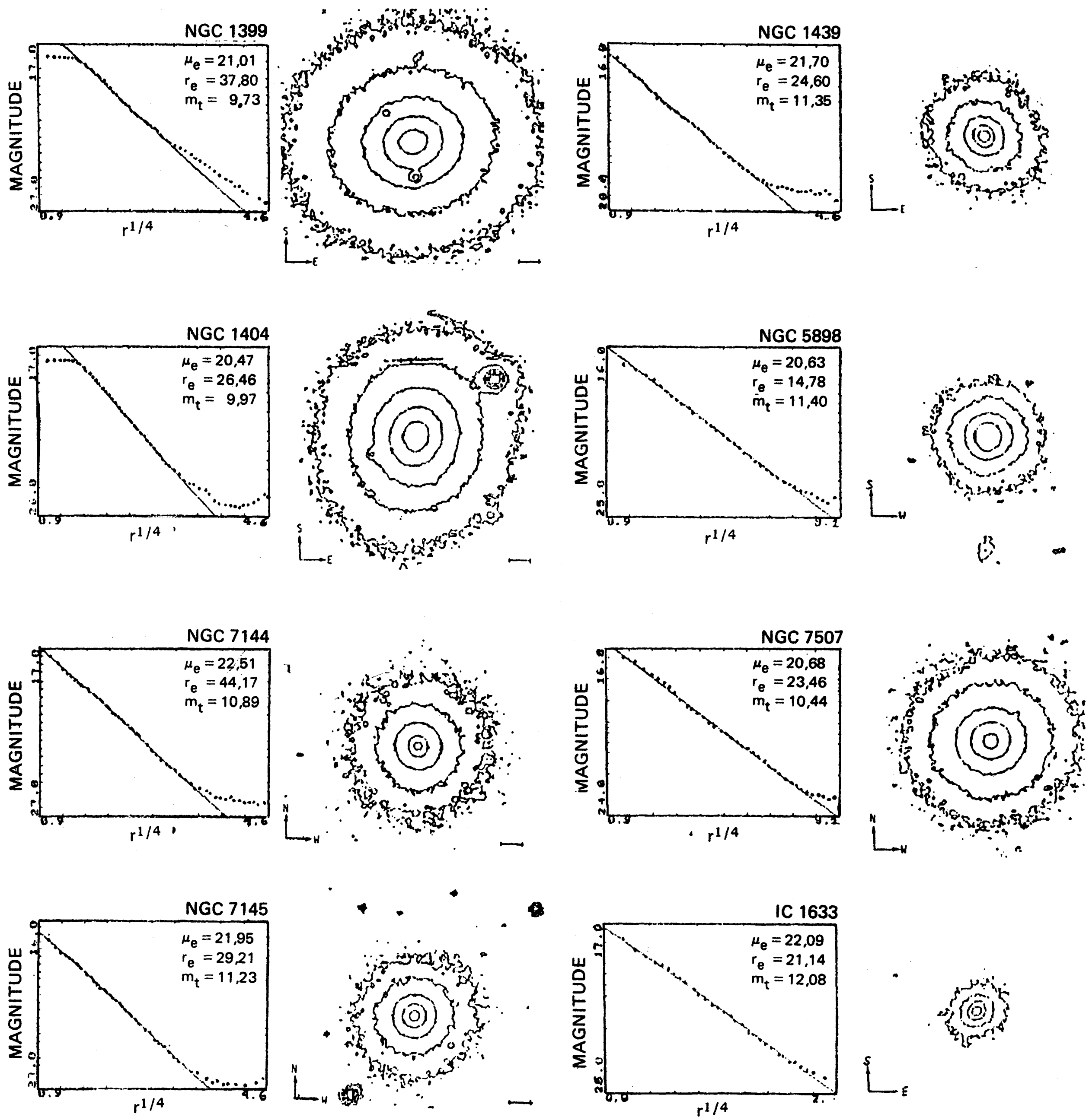

Fig. 1. Mean Radial Profiles vs. $r^{1/4}$ with photometric parameters obtained from best fits (solic lines). Isophotal maps are presented for all 8 objects in intervals of 1 V mag. The innermost isophote represents 18 mag/□. Space orientation and scale bar representing 10 arcseconds are also shown.

ASIC DATA OBTAINED IN THIS WORK

(1) name	(2) type	(3) $\log(r_e)$ (")	(4) m_T Vmag	(5) μ_e	(6) $<\mu_e>$ (mag/"^{2})	(7) v km/s	(8) $\log\sigma$ km/s	(9) $-M_V$ Vmag	(10) m/L m_o/L_o
N1399	E1cD	1,577	10,48	21,01	19,61	1300	2,462	21,59	3,89
N1404	E1	1,423	10,72	20,47	19,08	1925*	2,352*	22,21	1,38
N1439	E1	1,391	12,10	21,70	20,30	1670*	2,193*	20,52	2,54
N5898	E-SO	1,170	12,15	20,64	19,25	2103*	2,338*	20,97	2,48
N7144	EO	1,645	11,64	22,51	21,11	2020	2,342	21,39	4,90
N7145	EO	1,466	11,98	21,95	20,56	1874*	2,121*	20,89	1,73
N7507	EO	1,370	11,19	20,68	19,29	1650	2,477	21,40	3,93
IC1633	E-SO	1,325	1,283	22,09	20,70	7261	-----	22,98	----

'ABLE 1 - (1) identification; (2) morphological type; (3), (4), (5) effective radius, total ıagnitude within r_e and effective magnitude at r_e; (6) mean effective magnitude within r_e; 7), (8) radial velocity and velocity dispersion in km/s (* indicates data from Davies et al., 987); (9), (10) absolute magnitude within r_e and mass to luminosity ratios in solar units ısing eq. 2.

II. THE FUNDAMENTAL PLANE AND THE M/L RATIO

The numerical coefficients of the relation found by Djorgovski and Davis (1987), $L \alpha \sigma^{3,45}$ $<SB>^{-0,86}$, are approximately identical to the values expected by virialized systems. From the 'irial Theorem Poveda (1958) has found, for a spherical, isotropic, pure $r^{1/4}$ law galaxy, in 'hich mass follows the light:

$$m = 1.55 \frac{1}{G} \sigma^2 R_e \qquad (1)$$

'here G is the gravitational constant. After transforming eq. 1 and substituting into solar V ınits, we obtain:

$$\log f = 0.2 (M_v + \mu_v) + 2 \log \sigma_{100} + 0.062 \qquad (2)$$

'here f is the M/L ratio, M_v and μ_v are the absolute and mean magnitudes within R_e and σ_{100} .s the velocity in 100 km/s units.

Therefore, one can expect, for a virialized system, a dependence of the type, $\alpha \sigma^4 <SB>^{-1} f^{-2}$, where SB is the mean surface brightness in luminosity units.

We then conclude that the M/L ratio has only a weak dependence on the observable 'arameters,

$$f \alpha \sigma^{0.28} <SB>^{-0.07} \qquad (3)$$

In fact, we have tested this dependence and found, in accordance with other .uthours, that it may be spurious in part or in total.

It is interesting to note that if we admit a dependence on the type $f \alpha \sigma^{\alpha} <SB>^{\beta}$ .hen,

$$L \alpha \sigma^{4-2\alpha} <SB>^{-1-2\beta} \qquad (4)$$

'here the parameters α and β are near zero and lack a more accurate determination than those :vailable from present data base. A more precise definition of these parameters is crucial for . better use of the fundamental plane as a distance indicator and a more accurate discussion of .he basic properties of the local universe as the velocity field and the large concentration 'f mass discussed in the literature (Lynden-Bell et al., 1988).

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