ISOPHOTOMETRY OF BRIGHTEST CLUSTER ELLIPTICALS

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ABSTRACT

What are the two-dimensional distributions of projected luminosity in the brightest ellipticals in Abell clusters (hereafter called "E1"s)? If we treat isophotes as ellipses, how do their properties vary as functions of surface brightness? Are the isophote parameters correlated with a galaxy's global properties? Are they correlated with any properties of the surrounding cluster? Are E1s morphologically similar to other cluster or field ellipticals? This paper describes work in progress to the answers to these questions, and illustrates an interesting result.

1. OBSERVATIONS AND REDUCTIONS

We have obtained Gunn r CCD images of nearly 200 E1s from the samples of Hoessel et al (1980) and Schneider et al (1983). Most of the data were taken with a 500 x 500 Texas Instruments chip and the PFUEI optics (Gunn and Westphal 1981) on the Palomar 1.5 meter reflector. These pictures have a scale of 0.548 arcsec/pixel, giving a 4.5 arcmin field of view. Most were 500 second exposures in good (1") to moderate (2") seeing.

We are presently engaged in the laborious task of removing foreground stars and neighboring galaxies from these images and fitting ellipses to the isophotes of the E1s by standard least squares techniques. Details and limitations of this process will be presented later. Suffice it to say here that for each E1, we derive centroids (x, y), major axes (a), eccentricities (e), and position angles (θ) for isophotes at half magnitude intervals to an average depth of μ_r = 25 magnitudes/arcsec^2.

2. PRELIMINARY RESULTS

47 images have been processed so far. The following results are apparent:
1) Some E1s have complex and interesting eccentricity and position angle curves ($e(\mu)$, $\theta(\mu)$) despite having one-dimensional surface brightness profiles which appear normal.

T. de Zeeuw (ed.), Structure and Dynamics of Elliptical Galaxies, 385–386.

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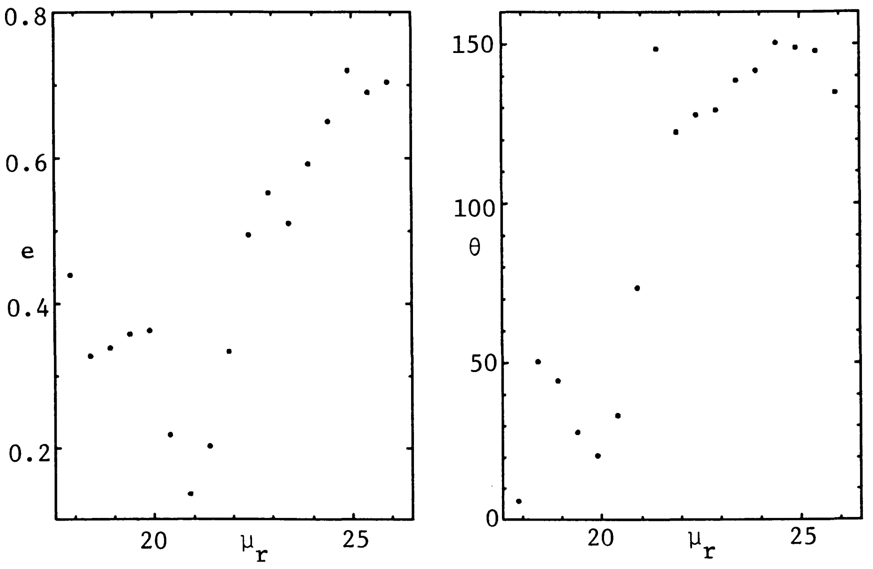

Figure 1. Eccentricity and position angle profiles of A1228.

More specifically, at least 2 galaxies (A1228, A1809) show pronounced rounding of isophotes between regions where the position angle of the galaxy's major axis has changed by significant amounts. The figure above illustrates this behavior in A1228. This suggests that we are observing two superposed, misaligned components of the central "galaxy".

2) Els differ from field ellipticals in that their isophotes become flatter with increasing size. This has been noted before (e.g. diTullio 1979), but we are struck by the generality of the rule: only 4 of the galaxies reduced so far do not have monotonically increasing e(a).

Indeed, the faintest, outermost isophotes of these galaxies are quite elongated. In only 5 galaxies do they remain rounder than e = 0.6, and in 19 galaxies, they have e $\geq$ 0.8. This strongly suggests to us that the outer regions of Els are not spheroidal: for a spheroid to appear flat, it must *be* flat *and* have its axis of symmetry near the plane of the sky. If the outer parts of Els were spheroidal, we would expect their axes to be randomly oriented, causing more of them to look rounder. They must be either extremely prolate, triaxial, or perhaps even irregular.

When the remaining Els have been profiled, we will run quantitative simulations to test these hypotheses. The questions in the abstract will also be reexamined in light of the complete results. The answers will tell us much about the nature and nurture of Els.

REFERENCES

diTullio, G.A. (1979) Ast.Ast.Supp.Ser. 37 591
Gunn, J.E., and Westphal, J.A. (1981) Proc.SPIE 290 16
Hoessel, J.G., Gunn, J.E., and Thuan, T.X. (1980) ApJ 241 493
Schneider, D.P., Gunn, J.E., and Hoessel, J.G. (1983) ApJ 268 476

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