THE ISOPHOTAL STRUCTURE OF ELLIPTICAL GALAXIES

T.B. Williams and Bidushi Bhattacharya
Department of Physics and Astronomy
Rutgers University
P.O. Box 849
Piscataway, NJ 08854, USA

We have obtained photographic surface photometry for a large sample of elliptical galaxies. The plates were obtained using the KPNO 0.9 m telescopes with Carnegie image intensifiers and IIIaJ plates. The f/13.5 secondaries were used to obtain a large plate scale: 0.33 arcsec per 20 micron pixel. In addition to the galaxy images, flat fields on cloudy skies and geometrical distortion calibration images of astrometric clusters were obtained. All plates were calibrated with the standard KPNO spot sensitometers. The sample of galaxies contains 75 ellipticals of total m_B greater than 13 and north of -30^0 declination. The plates were digitized on the KPNO PDS microdensitometer by Dr. E. Malumuth. At the present time about 50% of the sample is reduced.

The reduction procedure consists of converting photographic densities to intensities, flagging plate flaws and foreground stars to be rejected, and fitting the remaining points in elliptical annuli. A least squares fitting procedure is employed which gives the flux, centers, position angle, axis ratio, and flux gradient for each isophotal annulus. We can determine these parameters accurately down to flux levels of about 10% of the sky. At fainter levels, systematic effects begin to enter the results.

The results for 37 galaxies can be summarized as follows:

Normal–No major axis twist, constant axis ratio		
2 of 37 certain,		
3 of 37 uncertain	total	14%
Twists– Change of the major axis position with radius		
8 have no twist,		
9 of 37 uncertain or noisy	total	46%
13 have monotonic twist,		
7 have oscillating twist	total	54%
Axis ratio variations with radius		
4 constant, 1 uncertain	total	14%
10 increase with radius, 4 decrease,		
12 have minima or maxima,		
5 have oscillations,		
1 shows major or minor axis reversal	total	86%

T. de Zeeuw (ed.), Structure and Dynamics of Elliptical Galaxies, 391–392.

Thus we see that most galaxies have dissimilar isophotes. The axis ratio variations could be explained by spheroidal three–dimensional models with changing axis ratios, but those with twists require ellipsoidal structures (or even more complex models). Any models which explain the observed dissimilarities also predict that the isophotes cannot be exactly elliptical. In the simplest models, those of dissimilar three–dimensional ellipsoids, these deviations from exact ellipses are certainly large enough to be observable, and may seriously constrain the range of acceptable structures for elliptical galaxies.

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