LENSES AND LOW SURFACE BRIGHTNESS DISKS

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The 21.65-"law" for disk galaxies has been debated ever since Freeman's (1970) paper in which he found that for 28 out of 36 galaxies the extrapolated central surface brightness of the exponential disk component I_0, follows this rule with little intrinsic scatter. Some people think it significant, while others invoke selection effects. Bosma and Freeman (1982) made a new attempt to clarify this problem by studying ratios of diameters of disk galaxies on the various Sky Surveys in a region of overlap. The limiting surface brightness levels were calibrated to be 24.6 and 25.6 magn/arcsec^2 for the Palomar blue prints and the SRC J films, resp. The distribution of the ratio Γ = diameter (SRC) / diameter (PAL) gives a measure of the true distribution of I_0 if the galaxy has an exponential disk in the brightness interval 24.6 to 25.6; e.g. I_0 = 21.6 corresponds to Γ = 1.32, I_0 = 22.6 to Γ = 1.50 and I_0 = 23.6 to Γ = 1.90, etc.

From micrometric measurements of several hundreds of galaxies the distribution of Γ turned out to be quite different from the one expected on the basis of the 21.65 law, even allowing for measuring errors, plate variations, etc. From a detailed analysis we conclude:
- 55% of the galaxies can indeed follow the 21.65 law with some scatter.
- 25% of the galaxies have Γ's only slightly larger than 1, and have apparently a steep outer edge reminiscent of those found in some edge-on's by Van der Kruit and Searle (1982).
- 20% of the galaxies have Γ's much larger than 1.3 and therefore have a disk of much lower central surface brightness than 21.65. Most of these galaxies are probably giants (they do not look at all like magellanic irregulars, and for several of them we measure high rotational velocities), and most of these giants have a bright inner zone and a faint outer disk.

This variety in photometric properties of disk galaxies is also suggested by e.g. different Γ-distributions for galaxies with sharp edges (i.e size defined by outer spiral or ring structure) or with smooth edges (size defined by the old stellar disk), or between ordinary and barred spirals. A similar result can be inferred from Boroson (1981), who could decompose only 15 out of 27 galaxies into a standard $r^{\frac{1}{4}}$-law bulge and an exponential disk with $I_0 = 21.7 \pm 0.6$. The other 12 have outer cutoffs, and/or bright inner zones, and/or faint outer disks.

E. Athanassoula (ed.), Internal Kinematics and Dynamics of Galaxies, 253–254.

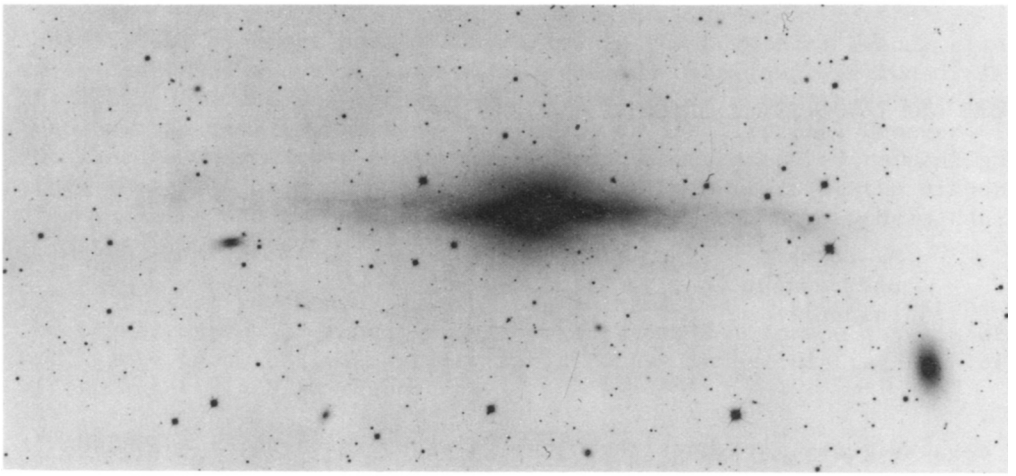

Figure 1. NGC 5084 (Prime focus, CFHT 3.6m by Bosma/Athanassoula)

We have made several follow up observations on the galaxies with the two zone structure. Of particular interest are galaxies like NGC 2090 and NGC 5084. For NGC 2090, a Sc galaxy, comparison of plates in the UV and the red shows that the inner zone is quite a bit redder than the outer zone, similar to the situation in NGC 5963 (cf. Romanishin et al., 1982). In NGC 5084 the outer disk is warped (Figure 1) and tilted slightly with respect to the inner lens. This suggests that the lens is dynamically distinct from the outer disk. The maximum rotational velocity of the stars in the lens of NGC 5084 is $\sim$200 km sec^{-1}, while that of the HI in the outer disk is $\sim$300 km sec^{-1}.

These data suggest the hypothesis that lenses are formed as a primary component relatively early on in the formation of a disk galaxy. Only in some, unknown, circumstances an inner flat component is formed which quickly forms stars out to a radius where the gas density becomes too low. The remaining gas in the protogalaxy settles into an outer disk much later. The formation of an edge in the lens is presumably similar to the formation of a cutoff in the disk à la Van der Kruit and Searle. The connection between bars and lenses as reviewed e.g. by Athanassoula (this volume) arises when the inner disk happens to be unstable to a bar mode.

Further work on these galaxies is in progress.

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