EVIDENCE FOR AN OUTER DISK IN THE PROTOTYPE ‘COMPACT ELLIPTICAL’ GALAXY

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abstract M32 is the prototype for the relatively rare class of galaxies referred to as *compact ellipticals*. It has been suggested that M32 may be a tidally disturbed $r^{1/4}$ elliptical galaxy, or the remnant bulge of a disk-stripped early-type spiral galaxy. This paper reveals that the surface brightness profile, the velocity dispersion measurements, and the estimated supermassive black hole mass in M32 are inconsistent with the galaxy having, and probably ever having had, an $r^{1/4}$ light profile. Instead, the radial surface brightness distribution of M32 resembles an almost perfect (bulge + exponential disk) profile, which is accompanied by a marked increase in the ellipticity profile and an associated change in the position angle profile where the ‘disk’ starts to dominate. Compelling evidence that this bulge/disk interpretation is accurate comes from the best-fitting $r^{1/n}$ bulge model which has a Sérsic index $n = 1.5$, in agreement with the recently discovered relation between a bulge’s Sérsic index and the mass of its supermassive black hole. An index $n=4$ would also be inconsistent with the stellar velocity dispersion of M32. The bulge-to-disk size ratio $r_e/h$ equals 0.20, and the logarithm of the bulge-to-disk luminosity ratio $\log(B/D)$ equals 0.22, typical of lenticular galaxies. The effective radius of the bulge is 27 ($\sim 100$ pc), while the scale-length of the disk is less well determined: due to possible tidal-stripping of the outer profile beyond 220-250, the scale-length may be as large as 1.3 kpc. M32 is a relatively face-on, nucleated, dwarf galaxy with a low surface brightness disk and a high surface brightness bulge. This finding brings into question the very existence of the compact elliptical class of galaxies.