A K-band μ_0–$\log h$ relation for early-type spiral galaxy disks

Alister W. Graham (agraham@ll.iac.es)
Instituto de Astrofísica de Canarias, La Laguna, E-38200, Tenerife, Spain

Keywords: galaxies: spiral, galaxies: structure, galaxies: fundamental parameters

The K-band light-profiles from a diameter-limited sample of low-inclination (de Jong & van der Kruit 1994) and high-inclination (Andredakis, Peletier, & Balcells 1995) disk galaxies have been modelled with a seeing convolved Sersic $r^{1/n}$ bulge and an exponential disk. Rather than a constant central disk surface brightness, in the near-infrared $\mu_{0,K}$ is shown to decrease with the logarithm of the disk scale-length ($\log h$) – with a correlation coefficient equal to 0.78. Galaxy types Scd or later are observed not to partake in this relation.

Measured central disk surface brightnesses are found to be significantly ($>5\sigma$) brighter for the high-inclination disk galaxies than for the low-inclination disk galaxies. Applying the standard surface brightness inclination-correction $C2.5\log(b/a)$, where b/a is the observed disk minor- to major-axis ratio, brings the low- and high-inclination samples into complete agreement when C=1. With no inclination-correction to the disk surface brightness, or allowance for the trend between $\mu_{0,K}$ and $\log h$, the standard deviation for the distribution of $\mu_{0,K}$ is greater than 1 mag – compared to 0.49 mag when these factors are considered.

If, on average, disks have a globally uniform opacity, then the scale-length of the disk will not change with inclination. If, however, the opacity is high in the center and low in the outer parts of the disk, then the scale-length of the disk may appear to increase with inclination. This explanation for the difference between the low- and high-inclination galaxies in the $\mu_{0,K}$–$\log h$ diagram has been explored and found not to be important at near-infrared wavelengths. Furthermore, the above results are free from the selection effects which plagued many previous surface-brightness inclination tests that had used a mean surface brightness within some radius – see Graham (2000) for details.

References

Andredakis, Y.C., Peletier, R.F. and Balcells, M. 1995, *MNRAS* **275** 874
de Jong, R.S. and van der Kruit, P. 1994, *A&ASS* **106** 451
Graham, A.W. 2000, *ApJ* submitted