HALO PARAMETERS OF SPIRAL GALAXIES

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We have made a rotation curve analysis of a sample of spiral galaxies for which both photometric and kinematical data of reasonable quality are available in the literature. From the photometric radial luminosity profile, assuming constant mass-to-light ratios for bulge and disk separately, we calculate a rotation curve due to the luminous mass in a galaxy. Comparison with the observed rotation velocities allows us to derive a halo rotation curve, which can be used to derive characteristic halo parameters. The decomposition into luminous and dark matter is not unique, with as extremes a "minimum" disk (M/L = 0) and a "maximum" disk (M/L as high as possible while requiring a realistic halo mass distribution without a hollow core).

We have narrowed the range of M/L-values by introducing spiral structure constraints. If the ratio of disk mass to halo mass is low the disk may not be responsive enough to allow two-armed spiral structure. Thus the requirement that the swing amplifier be active for m = 2 yields a lower limit for the M/L ratio in the majority of spiral galaxies. On the other hand, if the disk is too massive, a sizeable m = 1 component is allowed, which in nearly all of our galaxies is incompatible with the observed morphology. These considerations restrict the allowed M/L-values for the disk to a range of 0.3 dex.

Comparison of our results with models of galactic evolution indicates that our solutions for the maximum disk, with the m = 1 component inhibited, are in agreement with current knowledge of present and past integrated star formation rates. Their M/L-ratios as function of B-V colour are in reasonable agreement with stellar population models. On the other hand, the solutions involving the lower limit to the M/L ratio lead to unreasonably high gas fractions in Sc galaxies of 50% or more, depending on the adopted conversion for CO to H_2. Hence we consider the maximum disk solutions, with the m = 1 component inhibited, as the most adequate for further study of halo parameters.

In general, the ratio of halo core radius to optical disk radius is smaller for Sa galaxies than for Sc galaxies.

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