MASSIVE HALOS AND THE STABILITY OF HOT STELLAR DISCS

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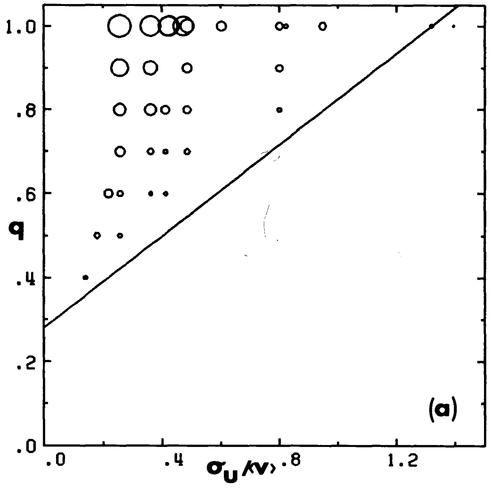
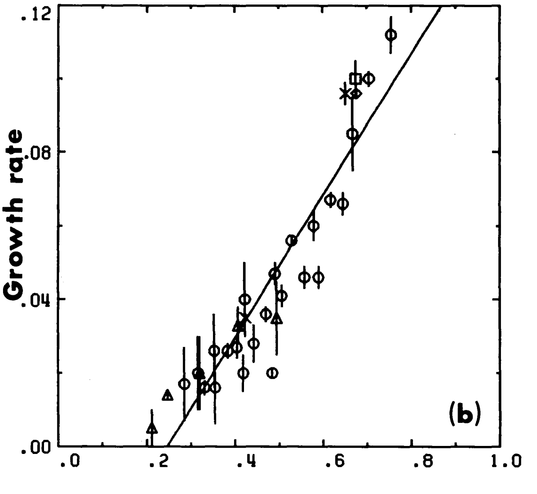
Bulge and halo material is often invoked to explain the absence of bars in the majority of disc galaxies, although the amount required is not known, in general, and is sensitive to the shape of the rotation curve. Here we show that the necessary fraction of spherical material is also affected by the degree of random motion amongst the disc stars. Quite moderate velocity dispersion has a strong stabilising influence and our hottest disc is stable without any halo (see also Kalnajs, this volume).

All our N-body models have the circular velocity rotation curve of a Kuz'min-Toomre disc, but in some only a fraction, q, of the disc mass was responsive. The remaining mass can be thought of as a bulge/halo component having the density distribution of a Plummer sphere.

Our results are summarised in the figure below. The size of each circle in (a) is proportional to the linear growth-rate of the bar mode measured from each simulation. As a measure of the random motion, we use the directly observable, dimensionless ratio $\sigma_u/\langle v\rangle$, i.e. the ratio of the radial dispersion of velocities to the mean tangential streaming speed, both measured at the "turn-over radius" of the rotation curve. The points seem to lie on a simple surface in this space. The quality of fit to a plane is shown in (b). (Error bars are internal estimates.)

The implied line of marginal stability is indicated in (a). If this line is typical of mass distributions giving gently rising rotation curves, it may be used to estimate the minimum fraction of mass in a bulge/halo component needed to account for the absence of a bar in a galaxy, once the velocity dispersion is known. (Steeply rising rotation curves give different stability properties - see Sellwood, this volume.)





J. Kormendy and G. R. Knapp (eds.), Dark Matter in the Universe, 300.