THE GLOBAL STABILITY OF OUR GALAXY

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Many mass models of our Galaxy (see e.g. Schmidt 1985 for a review) assume the disc to be nearly axisymmetric. For consistency, therefore, no such model should possess gross non-axisymmetric instabilities. However, most attribute less than half the central attraction at the Sun to bulge and halo material - a situation where bar forming instabilities are frequently found (see e.g. Sellwood 1983).

Tests of bar stability have, hitherto, been largely confined to models lacking strong central concentration, whereas Toomre (1981) argues that a steeply rising rotation curve should inhibit bar forming modes. Our Galaxy may be just such a case, since the rotation curve appears to rise to an inner peak of some 220 km/sec at a radius of less than 2kpc. Thus more realistic mass distributions might require less spherical material than previous experience seems to indicate.

Accordingly, I have investigated the stability of the Bahcall, Schmidt and Soniera (1982) mass model of the Galaxy, which attributes the high orbital velocities near the centre to a small but dense component. The particles in my N-body simulations represent the disc only - the spheroidal components are included through an unresponsive additional central attraction. A special multiple time-step code was devised to cope with the large dynamic range in the forces acting on the particles.

The most realistic model exhibited faint, largely two-armed spiral structure, but seemed to be otherwise stable. In this case the disc was reasonably warm ($Q \geqq 1.5$), as is consistent with solar neighbourhood data. Other models which were cooler or in which the dense central component was omitted quickly formed bars.

As the central attraction due to the dark halo, in this mass model, begins to dominate only outside the solar circle, it should have little influence on the stability of the disc centre. When this component was removed, the disc did not form a bar, but became extremely lop-sided rather quickly. Apparently, the dark halo inhibits one-armed modes in the disc, but has no effect on bar stability.

These results are reported fully in Sellwood (1985).

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