RICH CLUSTER TIDES AND GENERATION OF ACTIVE SPIRALS

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We have carried out numerical simulations of self-gravitating disks in order to find out the effects of galaxy encounters on the stability of disk galaxies. We use the two-dimensional polar-grid code of Miller (1971, 1974), and study a Mestel disk which has a flat rotation curve. Due to a softening parameter and a finite grid size, the disk is stable to small perturbations, mimicing the effects of velocity dispersion at the level of $Q_T \cong 1.5 - 2$ (Toomre 1964). At sufficiently large perturbations the disk develops global instabilities, a bar, spiral arms and mass inflow towards the center of the disk which may be connected to the origin and maintenance of Seyfert activity in the nucleus of the disk (Byrd et al. 1986, 1987, Sundelius et al. 1987, Thomasson et al. 1989). In rich clusters of galaxies the encounters are generally fast and cannot explain why spiral galaxies in rich clusters are radio sources ten times more powerful than spirals outside clusters (Gavazzi and Jaffe 1987). Gavazzi and Jaffe propose that this results from the ram pressure of the gaseous cluster medium. However, we find that the general tidal field of the cluster is able to trigger instability in the disk of the spiral galaxy when the galaxy falls inside about 700 kpc of the cluster center (Byrd and Valtonen 1990). The instability creates mass inflow to the center of the galaxy, cloud-cloud collisions in the disk and bar formation in the central part of the galaxy. Besides initiating activity in the nuclei of these galaxies (see e.g. Venturi et al. 1990 for the effect in the Coma cluster), the instability may enhance star formation and supernova rate, which may finally lead to cleaning of the spiral disks of their gaseous component. At the same time the instability leads to thickening of the stellar disk and possible change of morphology of the galaxy to an S0.

References

Byrd, G.G., Sundelius, B. and Valtonen, M. 1987, Astr.Ap. **171**, 16.
Byrd, G.G. and Valtonen, M. 1990, Ap.J. **350**, 89.
Byrd, G.G., Valtonen, M., Sundelius, B. and Valtaoja, L. 1986, Astr.Ap. **166**, 75.
Gavazzi, G. and Jaffe, W. 1987, Ap.J. **310**, 53.
Miller, R.H. 1971, Ap. Space Sci. **14**, 73.
Miller, R.H. 1974, Ap.J. **190**, 539.
Sundelius, B., Thomasson, M., Valtonen, M. and Byrd, G.G. 1987, Astr.Ap. **174**, 67.
Thomasson, M., Donner, K.J., Sundelius, B., Byrd, G.G., Huang, T.-Y. and Valtonen, M. 1989, Astr.Ap. **211**, 25.
Toomre, A. 1964, Ap.J. **139**, 1217.
Venturi, T., Giovannini, G. and Feretti, L. 1990, A.J. **99**, 1381.

F. Combes and F. Casoli (eds.), Dynamics of Galaxies and Their Molecular Cloud Distributions, 416.