HYDRODYNAMICAL MODELS OF OFFCENTERED BARRED SPIRALS

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We have studied the flow of gas in barred spirals in which the centers of the bar and the disk do not coincide. This is often observed in late type galaxies like the L.M.C., NGC 1313, NGC 4618 etc...

Starting from the centered barred galaxy model presented by Sanders and Tubbs (1980), we introduced an offset and studied its effects on the gas distribution and velocity field.

When the orbital period of the bar around the disk center is equal to that of rotation around its own center, it is possible to

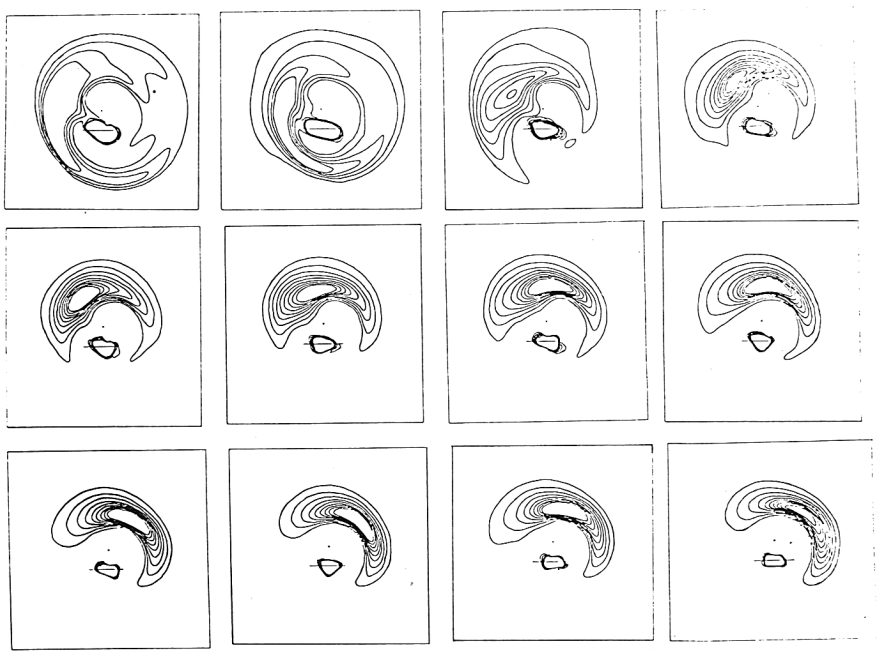

Fig. 1 Evolution of the isodensities of a gas flow in an offcentered bar galaxy.

E. Athanassoula (ed.), Internal Kinematics and Dynamics of Galaxies, 239–240.

obtain a stationary gas flow. An example of this is given in figure 1 which shows the lopsided response to this type of offcentered forcing. The bar is a homogeneous oblate spheroïd of major axis 1 kpc and minor axis 0.4 kpc displaced by 0.8 kpc in the sense perpendicular to its major axis. The corresponding potential is shown in figure 2 a.

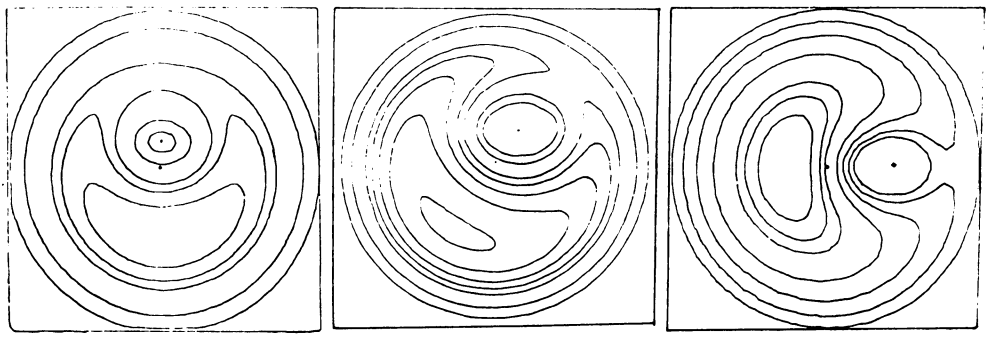

Fig. 2 Isopotentials of offcentered bars
a. displacement along the minor axis of the bar.
b. Displacement in a random direction.
c. displacement along the major axis of the bar.
In all cases, bar is horizontal.

The stationarity in the gas flow was obtained after roughly 3.5 10^8 years. Several other examples of displacements parallel (figure 2c) or perpendicular (figure 2a) to the bar major axis as well as more random orientations (figure 2b) have been studied. For cases where the orbital period of the bar around the disk is not equal to that of rotation around its own center, we find a very complicated gas flow pattern and no stationarity although the short-lived configurations obtained are good representations of late type asymetrical galaxies.

Reference

Sanders, R.H., Tubbs, A.D. : 1980, Astrophys. J., 235,803.