

COMPANION DRIVEN SPIRALS AND BARS

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With the help of a series of N-body simulations made with J. Sellwood's code I have studied the properties of spirals and bars in interacting galaxies. I will give here only a brief summary of the main results. For more information see Athanassoula (1990 and in prep.)

Several properties of the driven disc (like its halo to disc mass ratio, its Toomre parameter Q and the form of its rotation curve) and of the external forcing (like its pattern speed and amplitude) determine whether one will get a spiral or a bar at any given time, and what their properties will be. One example is given in Fig. 1, which compares the response of a given disc under forcings of different amplitudes. For each run a sequence of eight timesteps is shown, and the forcing amplitudes for the three runs in Fig. 1 decrease from top to bottom. Fig. 2 shows a similar comparison with the forcings now having the same amplitude, but pattern speeds which are respectively 1.2 times, 1.8 times and 0.6 times the maximum of the $\Omega - \kappa/2$ curve. Similar sequences were presented showing the effect of the form of the rotation curve.

Whether an interaction accelerates or slows down the development of a bar in bar-unstable discs depends on how far the bar formation has advanced at the time at which the encounter takes place, on its growth rate and on its pattern speed compared to that of the driving. If the mode that will give rise to the bar has not had time to grow by the time of closest approach, then the bar formation is accelerated [2, 3]. On the other hand, if this mode has already developed a sizeable amplitude when the companion arrives, then its nonlinear interaction with the driving may give an unsightly mess which takes some time to evolve to a normal bar.

References :

- [1] Athanassoula E.: 1990, in "Chemical and Dynamical Evolution of Galaxies", Eds. J. Franco and F. Matteucci (World Scientific), in press.
- [2] Gerin M., Combes F. and Athanassoula E.: 1990, *Astr. and Astrophys.* 230, 37.
- [3] Noguchi M. 1987: *Mon. Not. Roy. Astr. Soc.* 228, 535.

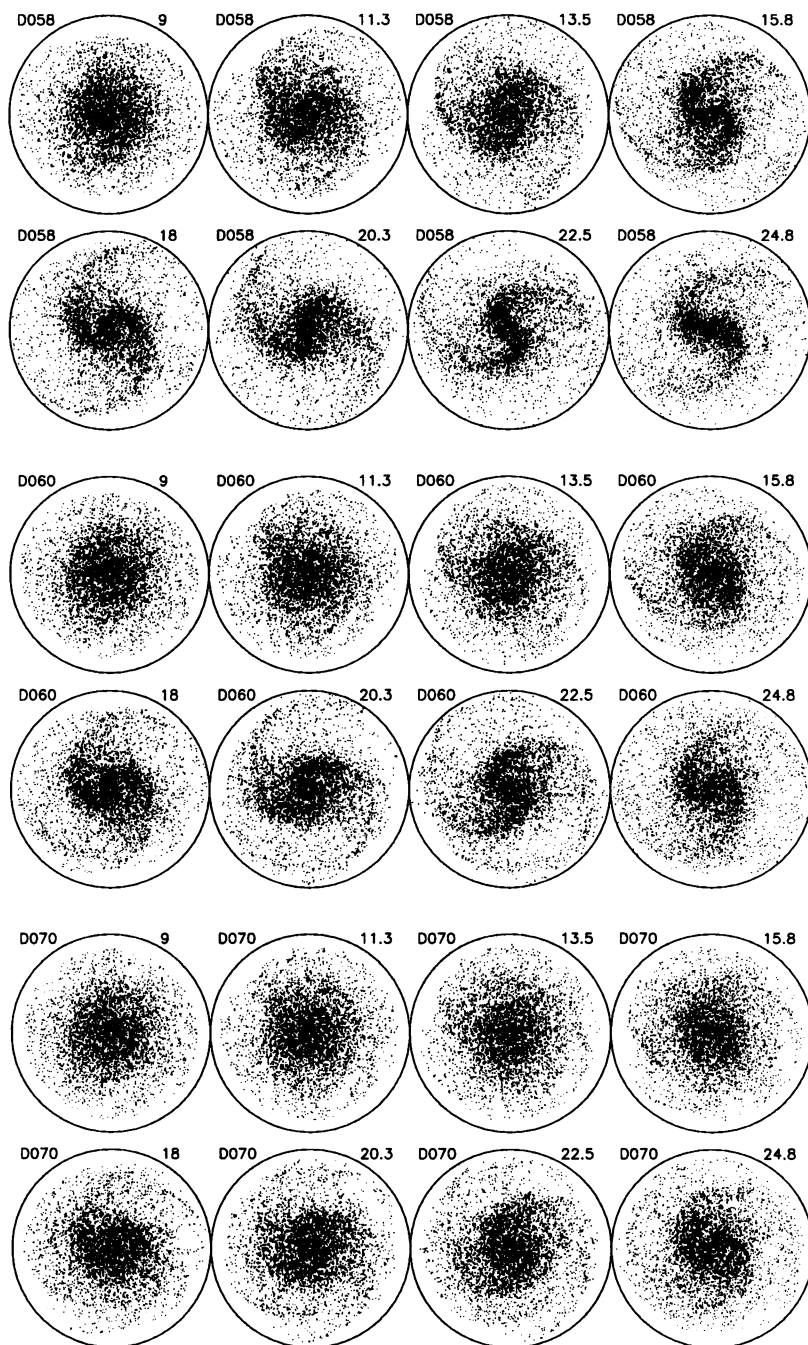


Figure 1. Response of a disc to three forcings with different amplitudes.

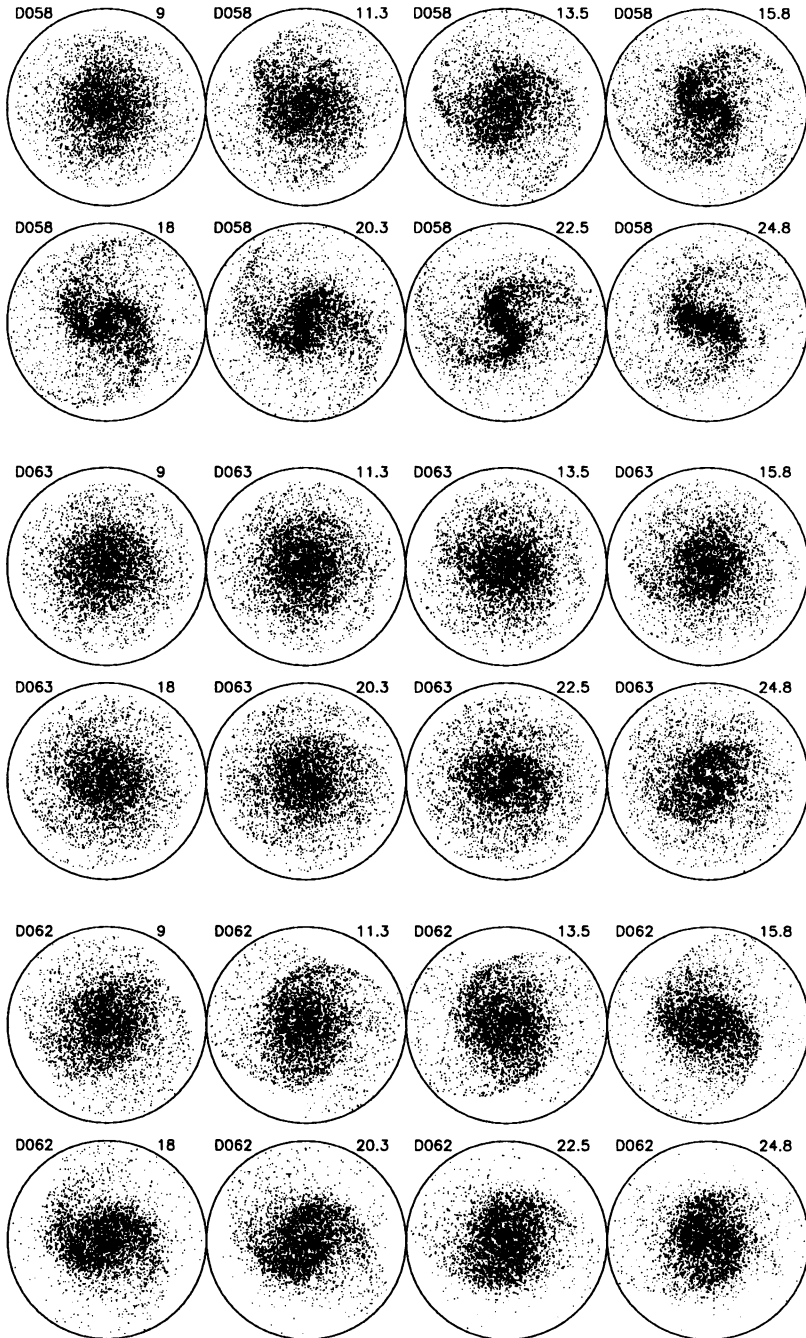


Figure 2: Response of a disc to three forcings with different pattern speeds