ON THE SPIRAL PATTERNS GENERATED IN GALAXY INTERACTIONS - A SURVEY

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ABSTRACT. We present a numerical survey of interactions of galaxies. For the considered disc model there is an almost one dimensional sequence of forms in the time evolution of the perturbed (main) system.

1. Introduction - methods

The motivation for the present investigation was to cover a part of the parameter space that define interactions between galaxies, in our case a main galaxy perturbed by a smaller perturber. We choose to study a perturbing particle on a forced circular, direct, in-plane orbit on a fixed radius, letting the mass of the perturber be Gaussian in azimuthal angle. Our parameters are the (constant) angular velocity (Ω_p) and the maximum mass (m_p) of the perturber. The disc was the same in all experiments, a Kuzmin-Toomre disc, with a scalelength of 1/5 of the radius of the orbit of the perturber. The parameters considered were four values of Ω_p to mimick elliptic, circular, parabolic and hyperbolic passages, and four values of m_p: 0.01, 0.03, 0.10 and 0.30 in units of the total mass of the main galaxy. The most important effects should be related to the angular velocity of the distruber and the duration of the encounter. The use of a variable mass moving on a circular orbit is based on our expectation that the details of the spatial form of the disturbing potential are not essential for understanding the induced patterns.

2. Results

Snapshots of the evolution, all in all 424 pictures were classified into nine classes according to the form of the induced pattern. We find that the main effect is that all models pass through the classes in the same sequence, although some stages may be missing. The main systematic effect is that systems with stronger interactions (measured by m_p/Ω_p) evolve more rapidly and show more developed patterns. The time when a given pattern emerges in characteristic, but unfortunately it is not an observable quantity! The strength and sharpness of the induced pattern depends only weakly on the strength of the perturbation. This is also true of the streaming velocities in the arms. We have argued (Engström et. al., these proceedings) that the main features of the induced pattern can be identified with caustics; in that case we do indeed expect that stronger interactions will lead to more complex patterns, but they will have little effect on the density near the caustics.

F. Combes and F. Casoli (eds.), Dynamics of Galaxies and Their Molecular Cloud Distributions, 131.