SELFPROPAGATING STOCHASTIC STAR FORMATION AND SPIRAL STRUCTURE

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Spiral structure in galaxies can arise from both dynamic and non dynamic phenomena: spiral density waves and stochastic selfpropagating star formation. The relative importance of these effects is still not known. Deficiences of the original selfpropagating star formation model (where only stars are taken into account) are overcome by explicitly considering the stars embedded in and interacting with a two-component gas (Seiden and Gerola, 1979; Seiden, Schulman and Feitzinger, 1982; Seiden and Gerola, 1982). The two-component gas is essential because it is the means by which we get feedback in the interaction between stars and gas. The coupling between stars and gas regulates and stabilizes star formation in a galaxy. Under proper conditions this model can give good grand desigr spirals (Fig. 1).

The inclusion of a realistic radial gas profile eleminates the hard edges of the model galaxies and a smooth fading out of the spiral structure can be observed as in real galaxies (Fig. 2). This means that by a quite natural method problems of the density wave theory,where the spiral structure ends and the difficulties at the resonances, are eliminated. Since the driving mechanism for the stochastic spiral structure is differential rotation trailing spirals are always generated and no mode problems arise. Galactic dynamic is taken into account implicitly in the models via the rotation curve (i.e. the mass distribution).

Propagating star formation can generate the observed galactic forms and realistic color and luminosity distributions. It can generate the SAa - Sm Hubble sequence, two-armed symmetric global structures, flocculent many-armed structures as well as the patchy structure of irregular galaxies like the Large Magellanic Cloud (Feitzinger et al. 1981). Also arm spurs, the irregular interspiral arm structures, can be interpreted as material features built up by stochastic star formation processes (Feitzinger and Schwerdtfeger, 1982).

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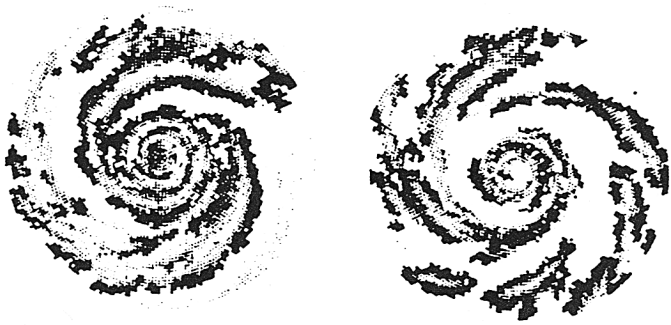

Fig. 1 Examples of two-armed symmetric spiral patterns

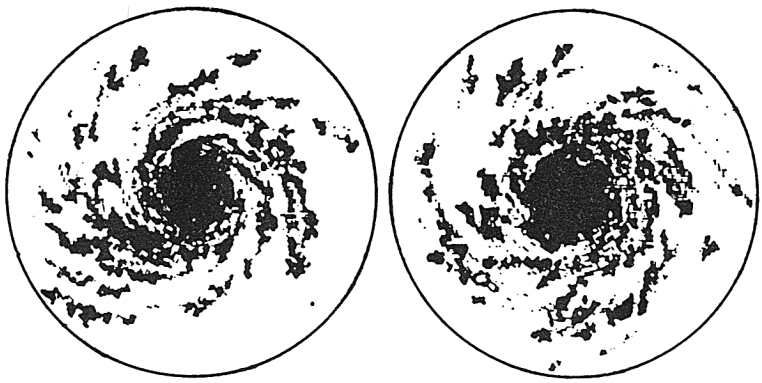

Fig. 2 Examples of galaxies whose gas density decreases exponentially with radius. The circle indicates the size of the simulation array.

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