5. References

Gilmore, G., Reid, N., Hewett, P.C.: 1984, Mon. Not. R. Astr. Soc. (in press).
Schmidt, M.: 1985, IAU Symposium No. 106.

C. SPIRAL STRUCTURE

1. Reviews

The spiral structure of galaxies is probably related to density waves, primarily governed by gravitational forces. Density waves may result from an inherent instability of galaxies against spiral perturbations as conceived in the conventional density-wave theory or may be forced by other internal or external perturbations of the gravitational field, such as neighbouring galaxies or oval distortions and bars in the inner regions of the galaxies. Reviews of recent developments on the various aspects of gravitational theories of spiral structure have been given by Ambastha and Varma (30.151.029), Athanassoula (33.151.051, 1984), Contopoulos (32.151.021, 34.151.103), Donner (30.151.085), Hunter (34.151.053), James and Wilkinson (29.151.023), Kalnajs (33.151.024), Kormendy (32.151.049), Lin (32.151.040, 33.151.025, 33.151.071), Lin and Bertin (30.151.068, 1984), Lin and Roberts (30.151.045), Martinet (30.151.043), McElroy (34.157.160), Norman (33.157.088), Pasha and Tsitsin (34.151.042), Sorensen (29.151.024), Thonnard (31.158.357), and Toomre (30.151.021). Seiden and Gerola (31.151.084) reviewed the theory of formation of spiral structures by stochastic self-propagating star formation in galaxies.

2. Spiral Modes, Origin and Maintenance of Spiral Structure

The conventional density-wave theory has been extended by Bertin (33.157.192), Bertin and Haas (31.151.040), Dzigvashvili and Malasidze (1984), Korchagin and Korchagin (37.151.001), Marochnik and Suchkov (30.151.049), Tang (34.151.076), Terzides (31.151.029), Ting and Zheng (32.151.053), Tong, Wu and Peng (34.151.072), Tong, Zheng and Peng (31.151.088, 31.151.089), Xu (29.151.063, 31.151.074), and Yue (34.151.074).

Global spiral modes in stellar disks have been investigated by Ambastha and Varma (32.151.043, 32.151.044, 32.151.058, 33.151.007, Bertin (33.151.026), Haass (33.151.027, 33.151.072), Iye, Ueda, Noguchi and Aoki (33.151.020), Korchagin and Shevelev (33.151.077), Litvintzev (1984), Pannatoni (33.062.113), and Yue (31.151.085, 31.151.086, 31.151.087).

Further aspects of the excitation and maintenance of spiral density waves, especially regarding to non-linear phenomena have been discussed by Abramyan and Arutyunyan (37.151.041), Ando (37.151.054), Berman and Mark (32.151.023), Chalov (29.151.005, 37.151.039), Eliseev and Stepanov (37.151.078), Fridman, Palous and Pasha (29.151.003), Grivnev (1984), Korchagin and Korchagin (31.151.038, 31.151.069), Litvintsev and Maksumov (34.151.071, 34.151.108), Louise (32.151.059), Maksumov (1982, 33.151.130), Meinel (33.151.078), Renz (31.151.054), and Sugiyama and Mark (33.151.109).

Barred spirals have received much interest in recent years. The formation and properties of stellar bars in the inner regions of galaxies have been studied by Combes and Sanders (29.151.040), Contopoulos (30.151.040, 30.151.058, 30.151.086), Sellwood (29.151.094, 33.151.080), Terzides and Michalodimitrakis (33.151.122), Tohline, Durisen and McCollough (37.151.026), Vandervoort and Welty (30.151.014, 32.151.080), and Weinberg and Tremaine (34.151.029, 34.151.030). The response of stellar disks and interstellar gas to bar forcing has been discussed by van Albada

and Sanders (32.151.035, 33.151.049), Chen, Weng and Xu (29.151.044, 32.151.052, 37.151.099), Colin and Athanassoula (33.151.050), Combes and Gerin (33.151.048), Davoust (37.151.092), Elmegreen and Elmegreen (1984), Huntley and Gerola (30.151.006, 32.151.031), Karchagin and Shevelev (31.151.036), Marcelin and Athanassoula (31.158.014), Matsuda and Isaka (29.151.064), Nishida, Watanabe, Fujiwara and Kato (33.151.096, 37.151.049), Oldershaw (33.151.125), Polzin and Thielheim (30.151.038), Prendergast (33.151.046), Sanders, Teuben and van Albada (33.151.047), Schempp (31.151.077), Sorensen and Matsuda (31.151.008), Thielheim (29.151.073, 31.151.092, 32.151.061, 34.151.114), Thielheim and Wolff (31.151.011, 33.151.042, 37.151.015), Wolff (34.151.105), and Yuan (37.155.124).

The formation and lifetime of spurs in the disks of galaxies have been studied by Byrd, Smith and Miller (34.151.100), and Feitzinger and Schwerdtfeger (32.151.063).

Non-gravitational theories for the formation of spiral structures in galaxies have been pursued as well. The role of stochastic self-propagating star formation on the large-scale structure of galaxies has been investigated by Chiang and Elmegreen (32.151.025), Comins, Statler and Smith (31.151.075, 34.151.002), Freedman and Madore (37.151.090), Feitzinger and Seiden (29.151.088, 33.151.033), Schulman and Seiden (30.151.012, 32.151.037), and Seiden, Schulman and Feitzinger (31.151.010). Ikeuchi and Nozakura (33.151.100, 34.151.116, 34.151.117, 37.151.062, 37.151.067) have developed a model of galactic spiral structure as a self-organized dissipative structure in galaxies. Further alternatives have been suggested by Balbus (37.151.033), Cowie and Rybicki (32.151.020), McCanney (29.151.015), Korchagin and Rakhimov (31.151.070), Morozov (30.151.081), and Pismis and Moreno (31.151.074).

3. Gas Flow and Shocks

Shock calculations for the gas flow in spiral galaxies have been performed by Bogdan (33.151.068), Brand and Heathcote (31.151.005), Hu and Ao (29.151.045, 32.151.039), Ishibashi and Yoshii (33.151.099, 37.151.050), Matsuda (32.151.054), Matsuda, Hachisu and Sawada (37.151.060), Mishurov (31.151.060), Nelson, Matsuda and Johns (1984), Shore (30.151.046), Tang (29.151.043), Tosa (33.151.166, 37.131.159), Yuan (33.151.110), and Yuan and Wang (31.131.010). In particular, the influence of supernovae and shock-induced star formation on the structure of the shock fronts and the multi-component nature of the gas in galaxies have been considered. The occurence of shocks in particle models simulating the large-scale behaviour of interstellar gas clouds has been investigated by Bash (33.151.032), Fukunaga (34.151.004), Kwan and Valdes (34.151.031), Leisawitz and Bash (32.155.002, 37.131.308), Roberts (33.131.128), Roberts and Hausman (34.151.095, 34.151.096, 34.151.098, 37.151.034), Roberts, Hausman and Levinson (33.151.031), and Schwarz (37.157.111). Feitzinger and Spicker (33.151.034), and Nelson, Matsuda and Johns (33.151.035) studied the vertical extension of gaseous spiral arms and spiral shocks.

Van Albada and Roberts (29.151.086) performed a high-resolution study of the gas flow in barred spirals. Continuum models for gas in disturbed galaxies have been developed by Scalo and Struck-Marcell (33.151.112, 37.151.011, 37.151.032).

4. Observational Aspects

Bash (30.155.049) reconsidered the question whether the Galaxy has two or four spiral arms. Hilton and Bash (31.151.022) investigated the vertex deviation of young stars near the sun in the framework of their ballistic particle model for molecular clouds. Haass, Bertin and Lin (32.151.026, 32.151.055) presented a dynamical interpretation for the classification of spiral galaxies. Various measured spiral arm properties have been compared by Kennicutt and Hodge (31.158.026) and by Louise (31.151.030) with model predictions.

5. References

Athanassoula, E.: 1984, Physics Reports (in press).
Dzigvashvili, R.M., Malasidze, I.A.: 1984, Abastumanskaya Astrofiz. Obs. Byull. (in press).
Elmegreen, B.G., Elmegreen, D.M.: 1984, Astrophys. J. (in press).
Grivnev, E.M.: 1984, Astron. Zh. (in press).
Lin, C.C., Bertin, G.: 1985, IAU Symposium No. 106.
Litvintzev, S.I.: 1984, Byull. Inst. Astrofiz. 76 (in press).
Maksumov, M.N.: 1982, Dokl. Akad. Nauk Tadzh. SSR 25, 720.
Nelson, A.H., Matsuda, T., Johns, T.: 1984, Mon. Not. R. Astron. Soc. (in press).

D. STABILITY AND EVOLUTION

1. Stability of Galactic Disks

The global stability of galactic disks against various kinds of instabilities and oscillations have been analyzed by Abramyan (32.151.085), Aoki (37.151.053), Caimmi and Dallaporta (32.151.012), Chalov (32.151.083), Durisen and Bacon (29.151.059), Hachisu (32.151.047), Ishibashi and Ando (37.151.055), Iye (37.151.028), Iye, Ueda, Noguchi and Aoki (33.151.028, 1984), Morozov (29.151.047), Nishida, Yoshizawa, Watanabe and Inagaki (30.151.084), Nishimoto (33.151.095), Nuritdinov (29.151.083), Tajima (29.151.095), Vandervoort and Welty (29.151.077), Vandervoort (31.151.044, 32.151.022, 34.151.055), Watanabe, Inagaki, Nishida and Tanaka (30.151.083), Wiegandt (31.151.023, 31.151.024), and de Zeeuw, Franx, Meys, Brink and Habing (33.151.053). Local stability criteria which take into account the multi-component nature of galactic disks have been developed by Abramyan (33.151.076), Balbus (33.151.111), Churilov and Shukhman (29.151.048), Grishchuck and Zeldovich (29.151.082), Grivnev, Ivannikova and Maksumov (1984), Jog and Solomon (37.151.013, 37.151.014), Morozov (29.151.009), Ogorodnikov and Osipkov (1980), and Polyachenko and Fridman (29.151.011).

Bar and spiral instabilities of galactic disks under the stabilyzing influence of a nuclear bulge or halo have been investigated by Athanassoula (33.151.051), Athanassoula and Sellwood (33.151.040), Berman and Mark (32.151.023), Combes and Sanders (29.151.040), Efstathiou, Lake and Negroponte (31.151.063, 31.151.081), Nishida (37.151.056), Robe and Leruth (37.151.043), Sellwood (29.151.094, 33.151.039, 33.151.080), Sellwood and Carlberg (1984), Terzides and Michalodimitrakis (33.151.122), and Tohline, Durisen and McCollough (37.151.026).

2. Warps of Galactic Disks

Recent developments of the theory of warps of galactic disks have been reviewed by Toomre (33.151.036). Detailed studies on the warps of galaxies, tilting of galactic disks and vertical disk oscillations have been presented by Blitz, Mark and Sinha (29.155.005), Dekel and Shlosman (33.151.037), Fleck (34.155.015), Johns and Nelson (1984), Nelson (30.151.003), Mark (33.151.073), May and James (37.151.010), Papp and Innanen (32.151.079), Simonson and Tohline (33.151.127), Sparke (37.151.084, 1984), and Yoshii and Fujimoto (30.151.059).

3. Secular Evolution of Galaxies

Reviews on recent progress in understanding the evolution of galaxies have been given by Martinet (30.151.027), and Strom and Strom (31.151.059). The secular evolution of galactic disks due to angular momentum transport and matter accretion has been investigated by Bertin (34.151.038), Gorbatskij and Serbin (34.151.045), Mayor and Vigroux (29.151.065), Norman (37.151.005), and Simonson (37.151.027). The