

59. THE THEORY OF SPIRAL STRUCTURE OF GALAXIES

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Abstract. A Landau-type instability mechanism for generating spiral waves is suggested.

Two populations of stars, Populations I and II, are considered, the second one with mean rotational velocity zero. Then a dispersion relation is derived which is reduced to the Lin-Shu dispersion relation in the case of vanishing Population II. The amplification of the wave is of the same type as the two-stream instability. It occurs if the angular velocity of the spiral pattern Ω_s is smaller than the angular velocity of the Population I stars. A value of $\Omega_s = 22\text{--}25 \text{ km s}^{-1} \text{ kpc}^{-1}$ was found, as well as the growth parameter. Spiral arms are formed in $10^8\text{--}10^9 \text{ yr}$, while trailing and leading waves grow at the same rate.

A quasi-linear theory is developed to account for the limited growth of the spiral waves.

Detailed accounts of the theory and of its implications are contained in recent publications (Marochnik, 1969; Marochnik and Suchkov, 1969a; 1969b; Marochnik and Ptitzina, 1969; Marochnik *et al.*, 1969).

References

- Marochnik, L. S.: 1969, *Astrofiz.* **15**, 487.
Marochnik, L. S. and Suchkov, A. A.: 1969a, *Astron. Zh.* **46**, 319, 524.
Marochnik, L. S. and Suchkov, A. A.: 1969b, *Astrophys. Space Sci.* **4**, 317.
Marochnik, L. S. and Ptitzina, N. G.: 1969, *Astron. Zh.* **46**, 762.
Marochnik, L. S., Pomagaev, S. G., Sagdeev, R. Z., and Suchkov, A. A.: 1969, *Dokl. Akad. Nauk S.S.S.R.*, in press.