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11. Galactic Dynamics : Stellar Orbits

11.1 General Problems

The interest in stellar orbits focussed on two areas: Firstly, on the existence of non-classical integrals of motion ("third integral") and on the occurence of stochastic or chaotic motions in systems with two or three degrees of freedom. While the case of three degrees of freedom is the more realistic one, results on systems with only two degrees of freedom can be applied to situations such as the motions of stars in the co-moving meridional plane of axisymmetric galaxies or in the equatorial plane of spiral or barred galaxies. Secondly, there is continuing interest in the orbital motions of stars in triaxial systems, which may represent either triaxial elliptical galaxies or galactic bars. The ultimate aim of many of the studies on stellar orbits is to build self-consistent models of stellar systems on the basis of the individual orbits of the stars.

A review of stellar dynamics has been given by Dejonghe (41.151.112). Orbital theory and the existence of non-classical integrals of motion have been reviewed or generally discussed by Antonov (40.042.118), Binney (38.151.018), Cleary (43.151.068), and Contopoulos (38.151.075).

Best approximations for quadratic integrals have been discussed by de Zeeuw and Lynden-Bell (40.151.158). The number of effective integrals in galactic models was studied by Magnenat (39.151.158). Models of stellar systems with third integrals have been constructed by Petrou (40.151.061), Vandervoort (38.151.106), and Villumsen and Binney (40.151.033). Non-isolating integrals were studied by Genkin and Genkina (43.151.048).

Periodic orbits in systems with two or three degrees of freedom have been investigated by Barbanis (40.151.063), Caranicolas, Diplas and Varvoglis (38.151.064, 41.151.105, 42.151.104), Cartigny, Desolneux and Hayli (38.042.028), and Hadjidemetriou (39.042.028). Resonant orbits were studied especially by Andrle (39.151.046), Caranicolas (38.151.042, 39.151.099, 40.151.050), and Contopoulos and Barbanis (40.151.078).

The consequences of bifurcations of families of periodic orbits, the collisions of bifurcations and complex instability in systems with three degrees of freedom have been studied by Contopoulos (39.151,073, 40.151.098, 41.151.087, 41.151.104), Contopoulos and Magnenat (41.151.086), Martinet and Pfenniger (43.151.034, 43.151.100), and Pfenniger (40.151.025, 43.151.092).

The transition from integrable orbits to chaotic motions was studied by Contopoulos (40.151.053, 1987a), Contopoulos and Polymilis (1987), Contopoulos, Varvoglis and Barbanis (43.151.027), Evangelidis and Neethling (38.042.007) and Innanen (39.151.156). Stochastic orbits in galaxies have been discussed by Barbanis (38.151.071, 43.151.073) and Gerhard (39.151.179, 40.151.065, 42.151.037).

The effect of dynamical friction on stellar orbits was investigated by Casertano, Phinney and Villumsen (41.151.-060), Hoffer (39.151.045), and Pfenniger (42.151.031). A general definition of orbital excentricity was given by Ninkovich (41.151.048.)

11.2 Spiral and Barred Galaxies

The orbits of stars in spiral or barred galaxies were investigated under various aspects. The occurence of Lindblad resonances in general were discussed by Dzigvashvili and Malsidze (43.151.091). Contopoulos (42.151.053) and Contopoulos and Grosbol (41.151.048, 41.151.019) investigated the orbits near the 4/1 resonance in spiral galaxies. Contopoulos (1987b) reviewed non-linear phenomena in spiral galaxies.

Periodic orbits in barred galaxies have been studied by Michalodimitrakis and Terzides (40.151.023, 40.151.052, 42.151.007), especially for explaining inner rings in barred galaxies (39.151.026, 40.151.003). The implications of the 1/1 resonance for barred galaxies were investigated by Petrou and Papayannopoulos (41.151.018), and the response density of irregular orbits by Petrou (38.151.039). Pfenniger (38.151.063) derived the velocity field in barred galaxies on the basis of orbit calculations.

11.3 Oblate Elliptical Galaxies

Orbits in classical oblate models of elliptical galaxies have been investigated by Andrie (42.151.076), Caranicolas (39.151.076), Caranicolas (39.151.009), and Caranicolas and Vozikis (42.151.054).

11.4 Triaxial Systems

De Zeeuw (40.151.014, 40.151.035) and de Zeeuw, Peletier and Franx (42.151.036) studied mass models of elliptical galaxies with separable potentials, especially of Stäckel form in ellipsoidal coordinates. The effect of a nucleus at the center of a triaxial galaxy on the stellar orbits has been investigated by Gerhard and Binney (40.151.036) and by Spyrou and Varvoglis (43.151.119). Periodic orbits in triaxial ellipticals have been calculated by Davoust (41.151.020) and Robe (39.151.006, 42.151.001). Preferred orbital planes in triaxial systems have been studied by David, Steiman-Cameron and Durisen (38.151.081, 40.151.017). Habe and Ikeuchi (39.151.047) investigated gas orbits in prolate triaxial galaxies. Schwarzschild (42.151.120) discussed the perfect ellipsoid and derived a truncated perfect elliptic disk as a model for galactic bars.

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12. Galactic Dynamics : Computer Simulations

Computer simulations have become a standard tool for investigating the structure and evolution of gravitating systems.

12.1 General Problems of Stellar Dynamics and New Methods

Reviews on numerical methodes for simulating gravitating have been given by Aarseth (42.151.078), Saslaw (40.003.011), Anosova (40.042.119), Tajima, Clark, Craddock, Gilden, Leung, Li, Robertson, and Saltzman

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