Horedt

Polytropes

Applications in Astrophysics and Related Fields

While it seems possible to present a fairly complete uni?ed theory of undistorted polytropes, as attempted in the previous chapter, the theory of distorted polytropes is much more extended and - phisticated, so that I present merely a brief overview of the theories that seem to me most interesting and important. Basically, the methods proposed to study the hydrostatic equilibrium of a distorted self-gravitating mass can be divided into two major groups (Blinnikov 1975): (i) Analytic or semia- lytic methods using a small parameter connected with the distortion of the polytrope. (ii) More or less accurate numerical methods. Lyapunov and later Carleman (see Jardetzky 1958, p. 13) have demonstrated that a sphere is a unique solution to the problem of hydrostatic equilibrium for a ?uid mass at rest in tridimensional space. The problem complicates enormously if the sphere is rotating rigidly or di?erentially in space round an axis, and/or if it is distorted magnetically or tidally. Even for the simplest case of a uniformly rotating ? uid body with constant density not all possible solutions have been found (Zharkov and Trubitsyn 1978, p. 222). The sphere becomes an oblate ?gure, and we have no a priori knowledge of its strati?cation, boundary shape, planes of symmetry, transfer of angular momentum in di?erentially rotating bodies, etc.

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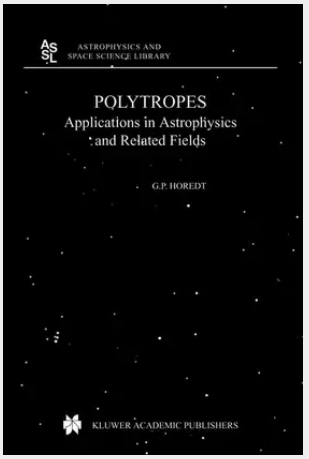

320,99 €
299,99 € (zzgl. MwSt.)

Lieferfrist: bis zu 10 Tage

Artikelnummer: 9789048166459
Medium: Buch
ISBN: 978-90-481-6645-9
Verlag: Springer
Erscheinungstermin: 05.12.2010
Sprache(n): Englisch
Auflage: 1. Auflage. Softcover version of original hardcover Auflage 2004
Serie: Astrophysics and Space Science Library
Produktform: Kartoniert
Gewicht: 1095 g
Seiten: 724
Format (B x H): 155 x 235 mm

Kundenservice Verlag Dr. Otto Schmidt KG
Neumannstraße 10, 40235 Düsseldorf | kundenservice@otto-schmidt.de | 0221-93738-997 (Inland)