core and the envelope. In absence of a poloidal field, one must distinguish two cases depending on whether the centrifugal force is larger or smaller than the magnetic force and the corresponding solutions are presented in different papers (**16**).

The effects of a magnetic field in a contracting star have been considered by Chvojková and Kohoutek (**17**) who find that a thick equatorial shell could be detached from the star. Schatzman (**18**) has persued his studies of the consequences of conservation of angular momentum and mass loss in presence of strong magnetic activity during star formation. In his lectures in Varenna (**19**), he has also discussed the effects of mass loss from the equator of a fast rotating star and made a first attempt to find the resulting meridan circulation.

A short review of the rotational, magnetic and tidal effects on the shape of a star and of the influence of the resulting circulations on the mixing between different parts of the star as their chemical composition varies in the course of evolution was presented by Kippenhahn (**20**) during the same course in Varenna.

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VII. GRAVITATIONAL INSTABILITY — ORIGIN OF STARS

A short but very pertinent review of the classical problem of gravitational instability as introduced by Jeans has been presented by S. Chandrasekhar (**1**) including the effects of a uniform rotation and a uniform magnetic field alone or in combination. Quite a number of papers have been devoted to generalizations of this problem to somewhat more complex situations. For

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instance, Kossacki (2) has considered the gravitational instability of a homogeneous, infinite viscous rotating medium with finite electrical conductivity and many aspects of this generalized problem have been reviewed by Pacholczyk (3).

Other discussions especially directed at the stability of spiral arms are due to Stodolkiewicz (4). R. K. Jaggi (5) has also rediscussed the stabilizing effect of a magnetic field on the perturbations of a cylindrical plasma and J. L. Tassoul (6) has extended the discussion to include the effect of rotation as well. The problem has also been the object of a critical analysis by R. Simon (7) emphasizing the importance of correct boundary conditions. If compressibility is taken into account, Simon (8) finds that the notion of critical wavelength and marginal mode vanishes. He has also reconsidered quite generally the influence of a non-uniform rotation (9) on the usual Jeans's problem and has brought some precisions on the circumstances in which Bell and Schatzman's result applies. The effects of non-uniformity either in rotation or magnetic fields or of finite conductivity have also been the object of other papers (10) some of which have been rather uncritical in their use of 'local analysis' (cf. 11).

Hruska (12) has considered the problem of the stability of a cylindrically symmetrical gas undergoing a radial stationary expansion from the axis where mass is supplied. Under certain assumptions, he finds that strong instabilities should occur at a critical distance which recalls some characteristics of the central region of the galaxy.

But even the classical Jeans's problem is not without ambiguities and its application to actual astrophysical conditions raises some difficult points. Simon has devoted a series of papers (13) to a critical discussion of the formal problem considering in particular the instability associated with the growth of a single local perturbation. Attempts on more realistic problems, concerning the fragmentation of gas clouds already in contraction or expansion are due to Hunter (14) and Savedoff and Villa (15), the latter concluding that the instabilities encountered in this case do not seem to have much to do with Jeans's criterion (except in an isolated critical case without probably much physical significance); it is not obvious either that they will really lead to the wanted fragmentation.

On the other hand, Hatanaka, Unno and Takebe (16) trying to introduce the actual physics of interstellar matter in the relation between the perturbation of density and pressure, have obtained a correcting factor to Jeans's criterion which may reduce the critical mass appreciably.

A penetrating analysis of the difficulties presented by the problem of the fragmentation of a more or less homogeneous cloud can be found in a paper by D. Layzer (17) and he has begun to develop his own ideas on the formation of self-gravitating systems through gravitational clustering in an expanding cosmic distribution in another paper (18). Clustering but of small 'flocules' plays also a major role in McCrea's suggestion (19) aimed especially at getting rid of the angular momentum difficulties. Cameron (20) and Cameron and Ezer (21) have emphasized the importance of the phases of dynamical instability and dynamical collapse which must arise in a contracting cloud when its internal temperature is able to bring about dissociation of molecular hydrogen and ionization of hydrogen and helium.

Mestel (22) has discussed in detail the evolution of the magnetic field of a gravitationally-bound isothermal magnetic cloud formed by the non-homologous compression of an external uniform medium permeated by a uniform magnetic field and shown that it is able to relax to a dipole-type structure with most of the cloud field-lines detached from the background galactic field.

Papers (23) attempting to account for the observed mass function in stellar system on the basis of gravitational instability may be of some help in confirming or otherwise the real significance of the corresponding criteria.

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