density under conditions of axisymmetry. The equilibria depend on an infinite set of integrals of motion, and some of the simpler cases have been investigated in detail.

A magnetic field which lies completely in meridional planes deforms the star into a doughnut-like object, but when the fluid is in self-gravitational equilibrium, the boundary surface is always an ellipsoid of revolution. The eccentricity and the form of the magnetic fields may be evaluated. A special case is that of the force-free fields. The effect of surface forces may be included explicitly.

If the fluid rotates as a solid body without magnetic fields, the well known results on MacLaurin ellipsoids follow from the variational method. In the presence of magnetic fields the treatment may be generalized to include different modes of isorotation.

If a certain relation between the integrals of motion is satisfied, there is equipartition between magnetic and kinetic energy everywhere in the fluid at equilibrium.

When the virial theorem is not satisfied, instability appears to manifest itself primarily in a decrease in density rather than large changes in boundary shape.

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Wilson, Raymond H., Jr. *Geomagnetic rotational retardation of satellite 1959 α 1 (Vanguard II).*

Observations on satellite 1959 α 1 (Vanguard II) of the frequency of radio signal maxima show, over the three weeks of battery life, an exponential decay in spin-rate with a relaxation time of 72 days. Its rotational damping is thus three times more rapid than that observed on 1958 β 2 (Vanguard I) (Wilson 1959). This ratio is to be expected if the effects on both satellites are due to energy dissipation by geomagnetic induction of eddy currents in the satellite, since, for the rough approximation of similar solid spheres, the damping rate would be inversely proportional to density (Wilson 1956), and the mean density of Vanguard II is less than one-third that of Vanguard I.

A precise analysis of electromagnetic couples, taking into account the various shapes and materials of conducting parts of Vanguard II, seems to show quantitative confirmation of the

terrestrial dipole field found by a similar analysis (Wilson 1959) of Vanguard I.

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Wright, F. W., Jacchia, L. G. and Boehm, B. W. *Photographic Lyrid meteors.*

The present analysis gives the mean radiant path of the photographic Lyrids. The mean radiant of the stream has a daily motion of 16' eastward and 10' northward with respect to the equator in the interval from April 7 through April 23 U.T. The mean deviation of an extended meteor trail from the mean moving radiant is $\pm 23'$. This is in general agreement with the relation between meteor stream-widths and radiant deviations which was derived for eleven other photographic streams.

At the time of maximum activity of the Lyrids, on April 21 and 22, U.T., the sun is only six degrees from the extended mean radiant path. This is in good agreement with a recent observation by one of us that the sun is never more than a few degrees from the extended mean radiant path of a meteor shower near the time of maximum activity for the shower.

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Wright, K. O. *Line intensities in the spectrum of Arcturus.*

In continuation of a study of line intensities in the spectra of K-type stars (Wright 1950) additional high-dispersion ($3.2\text{\AA}/\text{mm}$) spectra of α Bootis, K2 IIIp, have been obtained in the region $\lambda\lambda$ 4000–4900. Regions of little or no absorption, adopted as the continuum, usually agree with those shown by Hiltner and Williams (1946). Line identifications, though not their intensities, usually follow those given by Miss Davis (1947) for β Pegasi; molecular absorption, though present, is small and can be neglected in many regions of the spectrum. Even with a narrow slit, the profiles of most lines are defined by the instrument; this is also shown by comparison with Mount Wilson coude spectra ($2.9\text{\AA}/\text{mm}$) which show greater resolution and where the lines are sharper. Strong FeI lines show

well-developed wings, but lines of moderate intensity also seem to show traces of wings.

Curves of growth have been constructed for several elements; for high-excitation *FeI* lines, *f*-values recently measured in emission by Crosswhite (1958) have been used. The curves of growth tend to confirm the adopted level of the continuum since lines in the λ 4000 region fit the same curves as those of longer wave length. Most lines of *FeI*, *VI* and *TiII* fit a single curve of growth which corresponds to a velocity of 2.7 km/sec and a damping factor, $\log 2\alpha = -2.3$ for Hunger's (1956) Milne-Eddington model for pure absorption.

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Zirin, H. and Tandberg-Hanssen, E. *Spectroscopic classification of prominences.*

Spectra obtained at Climax of an active limb region, March 23, 1958, show clearly the spectroscopic difference between active and quiescent prominences, as a large nearby filament also appears on the spectra. The following differences appear: the ionized metallic lines, which appear strongly in the quiescent, disappear or are greatly weakened in the active. The line *HeI* 4713 is about 8 times as intense as *HeII* 4686 in the

quiescent, but is only one-half as intense as 4686 in the active prominence. The spectrum of the quiescent is essentially that of the chromosphere at 1500 km. The lines in the active prominence (which was a loop type) are much broader than those in the quiescent and the width at half-intensity of λ 4686 is considerably greater than that of 4713, as already found by us in other cases.

On the basis of these and other spectra, the gas in the solar atmosphere exhibits physical properties which fall into four well-defined classes. These, with criteria, are:

- I. Low chromosphere (*HeI* 4713 < *TiII* 4572).
- II. Chromosphere above 1500 km; Quiescent prominences (filaments); Ascending prominences (disparitions brusques): *HeI* 4713 > *TiII* 4572 4713 $\gg$ *HeII* 4686; *HeI* 4026 $\sim$ *SrII* 4077.
- III. Loop prominences; Coronal rain; Flares; Flare sprays; Surges: 4713 $\lesssim$ 4686; 4026 > 4077.
- IV. Corona.

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