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II. OPACITY, EQUATION OF STATE, IONIZATION, CONDUCTIVITY, ETC.

The lack of reliable opacity tables which has been a stumbling block for a long time seems to be on the point of being alleviated. Some of the results of Arking and Herring (**1**) on the relative contribution of absorption lines to the opacity of stellar matter have been published and A. N. Cox has prepared a very complete and up-to-date account of the whole problem including ions line absorption and at least partially molecular absorption to be published soon (**2**). Apart from tables and graphs of opacities for the mixture ($X = 0{\cdot}596$, $Y = 0{\cdot}384$, $Z = 0{\cdot}02$) this paper contains also a great deal of information on ionization equilibrium, conductivity, etc. for a large range of conditions. Cox reports that work is continuing on

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computation of opacities for twenty mixtures (X varying from 0·9996 to 0·30) in the ranges ($3000 \leqslant T \leqslant 10^9$°K; $10^{-12} \leqslant \rho \leqslant 10^{10}$ gm/cm^3) as well as on monochromatic absorption and scattering coefficients at and below 10^5°K, the results to be published in *Los Alamos Reports* and in the *Astrophysical Journal Supplements*.

T. D. Kusnetsova and D. A. Frank-Kamenetski (**3**) have evaluated the opacity for completely ionized hydrogen according to the exact formulae of the 'Bremsstrahlung' theory and have given a convenient interpolation formula, while Hayashi, Hôshi and Sugimoto have discussed the corrections to the opacity due to free-free transitions in degenerate matter (**4**).

One may also mention here the work of D. H. Samson (**5**) on the effects of the equilibrium concentration of electron-positron pairs on the properties of stars at very high temperatures and the series of papers by C. A. Rouse (**6**) on ionization equilibrium and equation of state for a large range of stellar conditions.

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III. CONVECTION, EXTERNAL CONVECTION ZONES, SURFACE BOUNDARY CONDITIONS.

Thermal convection either laminar or turbulent is of interest for many fields (hydrodynamics, meteorology, oceanography, geophysics) beside our own. Unfortunately, it is impossible to present here a complete survey of all the work accomplished in these different disciplines although much of it may be of interest for our particular problem.

As far as laminar convection is concerned, Chandrasekhar's book (Chap. II-VI) (**1**) provides an exhaustive and synthetic survey of the associated linear problem including the effects of rotation and magnetic fields when compressibility is negligible. A very short summary of significant results in the same general field together with some remarks on non-linear effects is presented in a paper by Y. Nakagawa (**2**).

Applications to stellar conditions [cf. general accounts by M. Schwarzschild (**3**) and E. Böhm-Vitense (**4**)] requires extensions to take into account:

1. compressibility both in the structure of the layer as well as during the motion of its elements,
2. more realistic boundary conditions,
3. the effects of non-linear terms.

The discussion of the first two points has mainly been approached by the study of convection (usually laminar modes) in superposed polytropic layers (one thermally stable, the other unstable—or of different degrees of instability). In this line, one may report a paper by S. Kato and W. Unno (**5**) discussing especially the effect of compressibility on the scale of motion at marginal stability, one by S. Kato (**6**) concerning the influence of the variation of the superadiabatic temperature gradient on the critical Rayleigh number and the flow pattern, one by P. Souffrin (**7**) (an unstable polytropic layer bounded on both sides by stable isothermal layers) attention being paid essentially to the penetration of the currents in the stable zone, and one by E. Spiegel and W. Unno (**8**) on the same general type of questions. One may perhaps consider that this type of approach culminates in a paper by K. H. Böhm (**9**) in which the same kind of

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