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TABLES OF MODEL STELLAR ATMOSPHERES

(MODEL STELLAR ATMOSPHERES. I)

BY

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1. The theoretical analysis of the observations of stellar spectra is carried out with the aid of both inductive and deductive methods. The pioneer work in this field of astrophysics has been done mainly by the former methods, and very important results have been reached by these. During recent years it has become possible, however, to apply deductive methods to an increasing number of problems within the field in question.

Deductive theoretical analysis of stellar spectra is carried out by investigations of so called *model stellar atmospheres*, cf. (1).

A stellar atmosphere is, by definition, that part of a star which is accessible to observations from the outside. The physical structure of the atmosphere thus determines the spectrum emitted by the star. The structure of the atmosphere is, in its turn, given by 1. its chemical composition, and 2. the influence of the interior star, as described by a number of factors specifying the physical conditions at the lower boundary of the atmosphere.

A model stellar atmosphere is specified by a number of *parameters*, describing its chemical composition and the physical conditions at its lower boundary. In principle, the structure of such an atmosphere, and the spectrum emitted by it, can be calculated by physical theory. A priori, the parameters of a model stellar atmosphere can be chosen *arbitrarily*. The ultimate aim of the theoretical study of model stellar atmospheres is, of course, to determine the parameters in such a way that complete agreement is obtained between the various *observed* stellar spectra and the corresponding theoretically *calculated* spectra. To achieve this purpose it is necessary to investigate a great number of model stellar atmospheres, varying the parameters systematically. Complete agreement between theoretical and observed spectrum can be assumed to mean identity in structure of the real stellar atmosphere and the considered model stellar atmosphere.

In specifying model stellar atmospheres it is generally necessary to make certain simplifying assumptions. Thus, as a rule, and in particular also in the present investigation, the analysis is restricted by the assumption that the atmosphere is symmetrical with respect to the centre of the star, so that the physical parameters vary with the depth in the atmosphere only. It is further assumed that the atmosphere is in mechanical equilibrium, and that the chemical composition is constant throughout the atmosphere. As far as is known at present these assumptions mean only small departures from the actual conditions of normal stars.

A model stellar atmosphere of the simplified type considered is completely specified by the effective temperature T_e (determined by the outward net-flux of energy per unit area), the gravity g, and the relative abundances of the elements. In practice it is only necessary to consider a rather limited number of the elements, since the structure of actual stellar atmospheres is practically uninfluenced by the great majority of the elements on account of their small abundance.

Given the effective temperature T_e, the gravity g, and the chemical composition of a model stellar atmosphere, the first step in the theoretical calculations leading up to the calculation of the emitted spectrum is the determination of temperature T, total pressure p, electron pressure p_e, and opacity $\bar{\varkappa}$ as a function of the geometrical depth, or the optical depth τ. The next step is the calculation of the coefficients of continuous absorption and emission, and the coefficients of line absorption and emission. These coefficients must be known, for all wave lengths, as functions of the depth. The final step consists in the evaluation of the radiation field, in particular the radiation field on the surface, which gives the emitted spectrum.

In the present investigation we shall consider only the first of the problems mentioned, namely, the calculation of temperature T, total pressure p, electron pressure p_e, and opacity $\bar{\varkappa}$ as functions of the optical depth τ. The final result of the investigations will consist of tables of these functions for a number of model stellar atmospheres. The results here obtained will be utilized in further calculations of the continuous spectrum, and of selected absorption lines, for the model stellar atmospheres considered.

In a previous paper (2) the author has considered the problem of model solar atmospheres, defined by values of T_e and g equal to those valid for the sun ($T_e = 5740°$, $\log g = 4.44$). It was shown that certain discrepancies between theory and observation previously encountered in the study of model solar atmospheres were entirely removed when the opacity of the atmospheric matter was calculated with due regard to the effect, discovered by WILDT (3), of the continuous absorption by the negative hydrogen ion. The comparison of observed and calculated solar spectra led to the determination of a number of the chemical parameters for the solar atmosphere, *viz.* the ratio A between the abundance of hydrogen and all the metals, and the relative abundances of hydrogen, sodium, potassium, calcium and magnesium.

In the present investigation the methods for calculating p, p_e and $\bar{\varkappa}$ as functions of τ developed in the author's paper mentioned above are applied to a number of model stellar atmospheres. The models studied cover the range of effective temperature T_e from that of $G\,0$ stars like the sun ($T_e = 5740°$) to that of $A\,5$ stars ($T_e = 8500°$). The range of effective gravity g covered corresponds to a region in the Hertzsprung-Russell-diagram, roughly between a line somewhat below the main series and a line around $M_{\mathrm{bol}} = 0^m$, i. e. slightly above the giant branch. The hydrogen-metal ratio A was varied within the limits $\log A = 3.4$ and $\log A = 4.2$.

The values of the parameters of the model atmospheres are shown in the table below. The value of θ_0, i. e. the value of the temperature function $\theta = \dfrac{5040°}{T}$ at the surface of the star ($T_0 = 0.84\,T_e$), is given instead of T_e. Approximate values of the spectral type and visual absolute magnitude are also inserted for convenience.

For $\theta_0 = 0.7$ a variation of $\log A$ within the range from 3.4 to 4.2 has practically no influence on the structure of the model atmosphere.

In addition to the model atmospheres listed on p. 6 a few special model atmospheres were also considered, namely $\theta_0 = 1.041$, $\log g = 4.44$ (the Sun) for $\log A = 3.0$, 3.4, 3.8, and 4.2, further $\theta_0 = 1.041$, $\log g = 3.0$ (Capella) for $\log A = 3.4$, 3.8, and 4.2, and

θ_0	$\log g = 3.0$		3.5		4.0		4.5	
1.0	$\log A =$	3.4	$\log A =$	3.4	$\log A =$	3.4	$\log A =$	3.4
	F 7	3.8	F 8	3.8	F 9	3.8	G 0	3.8
	0^m	4.2	$+2^m$	4.2	$+4^m$	4.2	$+5^m$	4.2
0.9			$\log A =$	3.4	$\log A =$	3.4	$\log A =$	3.4
			F 4	3.8	F 4	3.8	F 5	3.8
			$+1^m$	4.2	$+3^m$	4.2	$+5^m$	4.2
0.8			$\log A =$	3.4	$\log A =$	3.4	$\log A =$	3.4
			F 0	3.8	F 0	3.8	F 0	3.8
			0^m	4.2	$+2^m$	4.2	$+4^m$	4.2
0.7			$\log A =$	3.8	$\log A =$	3.8	$\log A =$	3.8
			A 5		A 5		A 5	
			0^m		$+2^m$		$+3^m$	

finally $\theta_0 = 0.7$, $\log g = 4.2$, and $\log g = 2.5$ ($cA\,5$ star) for $\log A = 3.8$. Altogether forty-five model stellar atmospheres have been investigated.

The limits of the range of effective temperatures $0.7 < \theta_0 < 1.04$, corresponding to the range of spectral types $A\,5$—$G\,0$, were fixed according to the following considerations. For stellar atmospheres with temperatures considerably lower than that of the sun it becomes difficult to distinguish between the continuous spectrum and the absorption line spectrum, both observationally and theoretically. Also the influence of molecular bands on the opacity probably becomes of importance. An accurate calculation of the structure of these atmospheres therefore presents additional difficulties, which have not yet been completely solved. On the other hand, for stars with higher temperatures than $A\,5$, electron scattering becomes of importance in the calculation of the opacity. Although it would not have presented very great difficulties to solve the problems arising in this connection, it was thought advisable to reserve the study of high temperature atmospheres for a following investigation.

It is well known that, while the upper layers of a stellar atmosphere are convectively stable, the deeper layers are characterized by convective instability, cf. (4). It has not yet been possible, however, to reach a final solution of the problems connected with the question of the influence of convective instability upon the structure of the unstable layers, cf. (5).

Unsöld and Siedentopf assumed that the structure of the unstable zone is governed by the equations valid in radiational equilibrium. BIERMANN, on the other hand, assumed that the temperature gradient in the unstable layers is everywhere equal to the adiabatic gradient. The two assumptions clearly represent ideal limiting cases, so that the true structure would be intermediate between the structures calculated according to them.

In the present investigation the structure of the convectively unstable layers is calculated separately according to both assumptions. The calculations have been made according to the methods developed by UNSÖLD, BIERMANN, and SIEDENTOPF (5). In a recent paper RUDKJØBING (6) has adapted these methods to the calculation of model stellar atmospheres of the type considered here. In particular the continuous absorption by the negative hydrogen ion was taken into account. RUDKJØBING's procedure has been employed in calculating the structure of the convectively unstable layer for all the stellar models considered here.

In the following sections 2—4, the procedure of calculation of the opacity and pressure tables is described in somewhat greater detail than in the paper by the author quoted above (2). These, brief summaries of which have been previously given (2), are collected in an appendix. The methods of calculation of the model stellar atmospheres are discussed in sections 5—7. The tables giving the structure of the model stellar atmospheres considered are given in the appendix. The results obtained are discussed in sections 8 and 9.

The calculation of the opacity tables and pressure tables required for the determination of the structure of the model atmospheres considered was made by M. RUDKJØBING, K. A. THERNÖE, and the author. The calculations of the model atmospheres were made by K. GYLDENKÆRNE, M. RUDKJØBING, and the author.

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2. When the chemical composition of a model stellar atmosphere is specified, it is possible to construct tables giving the electron pressure p_e and the opacity $\bar{\varkappa}$ of the stellar atmospheric gas as a function of temperature T and total pressure p.

The chemical composition of the model atmospheres investigated was chosen according to the following considerations. The analysis of the solar spectrum has shown (cf. RUSSELL (7), WILDT (3), MENZEL (8), B. STRÖMGREN (2), and TEN BRUGGENCATE (9)) that hydrogen is by far the most abundant element in the solar atmosphere. Next follow helium, oxygen, carbon, nitrogen, and perhaps neon. Then follow magnesium, silicon, iron, calcium, aluminum, and sodium. For the rest of the elements the abundance is so small that they need not be considered in this connection.

The analysis of the spectrum of τ Scorpii by UNSÖLD (10) has yielded a similar result.

We now have to consider the contribution of the various elements to the electron pressure and to the opacity. The ionization potential of hydrogen is 13.53 volts. For helium, oxygen, nitrogen and neon the ionization potential is higher and the abundance compared with that of hydrogen so much lower that the contribution of these elements both to the electron pressure and to the opacity can be neglected.

The elements of the metal group have ionization potentials from 5 to 8 volts. In spite of their low abundance they contribute the major part of the electron pressure at low temperatures when the degree of ionization of hydrogen is very small. The contribution of the metal atoms and ions to the opacity may be neglected in comparison with that of the neutral hydrogen atoms and the negative hydrogen ion (cf. (2)).

The case of carbon requires special consideration. The ionization potential is 11.22 volts, or 2.31 volts lower than that of hydrogen. The abundances of hydrogen, carbon and all the metals put together are probably roughly in the ratios 10000 : 10 : 1. Assuming these ratios we find that at high and intermediate temperatures ($\theta < 0.6$) carbon contributes a few per cent. of the electron pressure. For lower temperatures, the contribution is higher, rising to about eighteen per cent. of that of hydrogen at $\theta = 0.9$, and about thirty per cent. at $\theta = 1.0$. At this temperature, however, the metals contribute more to the electron pressure than hydrogen, except for very low pressures ($p_e < 0.1$ bar, i. e. dyne per square centimeter). With the exception of a small part of the relevant pressure-temperature range the relative contribution of carbon to the electron pressure is, therefore, less than ten per cent., generally much less. The relative contribution of carbon to the opacity is easily seen to be smaller than that of the metals, and therefore negligible.

In the present investigation the influence of carbon upon electron pressure and opacity has been neglected.

The data given above of course depend upon the assumed relative abundance of carbon. Subsequent investigations might possibly lead to a higher value of the abundance, thus making it desirable to consider the influence of carbon. A corresponding revision of the present calculation would present no difficulties. It would, however, be possible to obtain approximate values of the corrections to the model atmosphere tables (for radiative equilibrium) given in the present investigation in the following way. The ratio of the number of free electrons contributed by carbon and by hydrogen on account of the relatively small difference in ionization potential varies relatively little in the relevant part of the atmosphere. It is, therefore, a reasonably good approximation to put the ratio in question equal to a suitably chosen constant, k. Then it can be shown (cf. p. 35) that the corrected values of p, p_e and T as functions of τ are obtained from the tables when these are entered with arguments $(1+k)\,g$ and $(1+k)\,A$ instead of g and A, and the pressure thus obtained is divided by $(1+k)$.

In our investigation we have assumed that practically the whole weight of the atmospheric matter is contributed by hydrogen. This is in agreement with the results obtained so far from the quantitative analysis of stellar atmospheres. It may become desirable, however, to consider model atmospheres with an increased content of helium and oxygen (cf. Biermann (5)), in which these two elements contribute appreciably to the weight (without contributing materially to the electron pressure or the opacity). Tables giving the structure of such atmospheres can easily be obtained by a simple transformation of the tables of our investigation. It is in fact easy to prove (cf. p. 34) that correct values of p, p_e and T are obtained when the tables are entered with the argument $\frac{g}{X}$ instead of g, where X is the hydrogen content (relative weight) of the atmospheric matter.

Summarizing, we see that the model atmospheres considered in the present investigation are characterized by a chemical composition consisting of a mixture of hydrogen and metals (magnesium, silicon, iron, calcium, aluminum, and sodium). The number of hydrogen atoms and ions per unit volume is equal to A times the total number of metal atoms and ions. The value of the constant A is so large that only hydrogen contributes to the opacity. Both hydrogen and the metals contribute to the electron pressure.

In the relevant range of pressure and temperature the metals are strongly ionized. In calculating the contribution of the metals to the electron pressure it is only necessary to consider singly ionized ions, because the contribution due to higher stages of ionization are always very small as compared with that of hydrogen, since the ionization potentials of the metal ions never are much smaller than that of hydrogen, while the abundances are very much smaller.

In the major part of the range of pressure and temperature it is in fact a very good approximation to put the number of electrons contributed per metal atomic particle equal to 1. In the whole of the relevant range this number is higher than 0.5. From this fact and the fact that the differences between the ionization potentials of the various metals are comparatively small it follows that the contribution of the metals to the electron pressure is not sensitive to changes in the relative abundances of the metals *inter se*. The actual calculations were made with a composition equal to that found by Goldschmidt (11) for the meteorites. This agrees remarkably well with the result of the quantitative analysis of the solar atmosphere (cf. (2)). The relative abundances assumed are shown in the following table.

Element	Adopted relative number of atoms
Mg	0.30
Si	0.33
Fe	0.30
Ca	0.02
Al	0.03
Na	0.02
	1.00

Thus we see that the only parameter of chemical constitution which it is necessary to vary in the calculation of the basic tables of electron pressure and opacity, is the ratio A between the number of hydrogen atoms and ions per unit volume and the number of metal atoms and ions per unit volume. The analysis of the solar spectrum leads to a value of A equal to 8000 (cf. (2)). In the present investigation a range of A from 2500 (for some of the tables from 1000) to 16000 is covered.

3. The opacity of the atmospheric gas is calculated as the ROSSELAND mean $\bar{\varkappa}$ of the continuous absorption coefficient $\varkappa_\nu$ (cf. f. inst. (4)). As mentioned above only hydrogen contributes to the latter.

The coefficient $\varkappa_\nu$ of continuous absorption due to hydrogen can be calculated for all frequencies in the required range of frequency ν, when the temperature T and the electron pressure p_e are known. The continuous absorption coefficient for a given frequency is the sum of contributions from the various stationary states of the neutral hydrogen atom and the one existing state of the negative hydrogen ion.

The continuous absorption coefficient per atom or ion in the stationary states mentioned is known from quantum-mechanical calculations. For neutral hydrogen we have (cf. UNSÖLD (4) and the literature quoted there):

$$a_\nu(n) = \frac{64\,\pi^4}{3\sqrt{3}} \frac{m_e\, e^{10}}{c\, h^6}\, g_\nu(n) \frac{1}{n^5\, \nu^3} \quad (\text{for } \nu > \nu(n)). \qquad (1)$$

Here $a_\nu(n)$ is the continuous absorption coefficient per hydrogen atom in the stationary state with principal quantum number n, while $g_\nu(n)$ is a correcting factor depending upon ν and n, which is always very nearly equal to 1. In the present investigation we have, following UNSÖLD, put all $g_\nu(n)$ equal to 1. The quantity $\nu(n)$ is the frequency of the series limit for the stationary state n.

Introducing numerical values of the natural constants m_e, e, c, and h in (1) we get:

$$a_\nu(n) = 1.04 \cdot 10^{-17} \cdot \frac{1}{n^5} \left(\frac{\lambda}{1000\ \text{Å}}\right)^3. \qquad (2)$$

The continuous absorption coefficient of the negative hydrogen ion has been calculated by MASSEY and BATES (12). The resulting value of the continuous absorption coefficient per negative hydrogen ion is shown for the frequency range corresponding to wave lengths between 3000 Å and 18000 Å in the following table.

λ	a_λ
3000 Å	$23 \cdot 10^{-18}$
4000	26
5000	25
6000	22
7000	18
8000	14
10000	9
18000	0

In the range between 3000 Å and 7000 Å the variations of a_λ are less than ± 20 per cent. Outside this range the value of the continuous absorption coefficient of the negative hydrogen ion has very little influence upon the opacity. This is so because even at the lowest temperatures in question the infra-red part of the spectrum has very little weight when forming the ROSSELAND mean. For the part of the spectrum in the far ultra-violet beyond 3000 Å the same is true for the lower temperatures. For the higher temperatures, on the other hand, the contribution from neutral hydrogen atoms is much greater than that from negative hydrogen ions.

For the range between 3000 Å and 7000 Å observations of the intensity distribution of the continuous spectrum of the sun indicate small variations of the absorption coefficient with wave length (cf. RAUDENBUSCH (13)) which are in the opposite direction of the variation shown by the theoretically calculated values.

In view of these facts it was considered appropriate and sufficiently accurate to adopt an absorption coefficient of the negative hydrogen ion independent of frequency and equal to the maximum value calculated for λ about 4400 Å.

RUDKJØBING (6) has calculated the opacity according to a different assumption, namely, that the absorption coefficient is constant for all wave lengths greater than that of maximum absorption according to MASSEY and BATES, while it follows MASSEY and BATES's curve for the shorter wave lengths. The resulting opacities, as was to be expected, differed only slightly from those calculated in the present investigation. In a recent investigation RUDKJØBING (14) has revised the quantum-mechanical calculation of the continuous absorption coefficient in the far ultra-violet and thereby obtained values not much below the maximum value in the region 500—1000 Å. In view of this result we have preferred the opacity tables calculated on the assumption of constant absorption coefficient also in the ultra-violet.

The continuous absorption coefficient for any given frequency can now be evaluated if the distribution over the three stages of ionization and over the various stationary states of neutral hydrogen are known. This distribution is governed by the following equations:

$$\frac{N_H}{N_{H^-}} p_e = \frac{(2\pi m_e)^{\frac{3}{2}}}{h^3} \frac{2 g_H}{g_{H^-}} (kT)^{\frac{5}{2}} e^{-\frac{I_{H^-}}{kT}} \tag{3}$$

$$\frac{N_{H^+}}{N_H} p_e = \frac{(2\pi m_e)^{\frac{3}{2}}}{h^3} \frac{2 g_{H^+}}{g_H} (kT)^{\frac{5}{2}} e^{-\frac{I_H}{kT}} \tag{4}$$

$$\frac{N_H(n)}{N_H} = n^2 e^{-\frac{I_H - I(n)}{kT}} \tag{5}$$

Here N_H, N_{H^-}, and N_{H^+} denote the number of neutral hydrogen atoms in the ground state, negative hydrogen ions, and positive hydrogen ions per unit volume, while g_H, g_{H^-}, and g_{H^+} are the corresponding statistical weights, and I_{H^-}, I_H, $I(n)$ the ionization potentials of the negative hydrogen ion, the neutral hydrogen atom in the ground state, and in the stationary state n.

The statistical weights are $g_H = 2$, $g_{H^-} = 1$, $g_{H^+} = 1$, while $I_H = 13.53$ volts and $I(n) = \frac{13.53}{n^2}$ volts. The ionization potential I_{H^-} of the negative hydrogen ion has been evaluated by HYLLERAAS (15) by means of quantum-mechanical calculations. We have adopted the value $I_{H^-} = 0.70$ volts.

Introducing these values, and further the temperature function

$$\theta = \frac{5040°}{T} \tag{6}$$

we can write the ionization equations and equation (5) as follows:

$$\log \frac{N_{H^-}}{N_H} = -0.12 + 0.70\,\theta - \frac{5}{2}\log T + \log p_e \tag{7}$$

$$\log \frac{N_{H^+}}{N_H} = -0.48 - 13.53\,\theta + \frac{5}{2}\log T - \log p_e \tag{8}$$

$$\log \frac{N_H(n)}{N_H} = 2\log n - 13.53\left(1 - \frac{1}{n^2}\right)\theta. \tag{9}$$

Here the electron pressure must be measured in bars (i. e. dynes per square centimeter). We shall use this unit throughout (1 atm $= 1.01 \cdot 10^6$ bar).

With the aid of equations (7), (8), and (9) the distribution over the stationary states in question can be found as a function of the electron pressure p_e and the temperature function θ. The atomic continuous absorption coefficient of the various stationary states being also known, the resulting continuous absorption coefficient $\varkappa_\nu$ per gram hydrogen can be evaluated. The final step is the calculation of the Rosseland mean $\bar{\varkappa}$:

$$\frac{1}{\bar{\varkappa}} = \frac{15}{4\pi^4}\int_0^\infty \frac{1}{\varkappa_\nu}\frac{u^4 e^{-u}\,du}{(1-e^{-u})^3}, \tag{10}$$

where

$$u = \frac{h\nu}{kT} \tag{11}$$

or

$$u = \frac{28400\,\text{Å}}{\lambda}\,\theta. \tag{12}$$

The actual calculations of the tables giving the opacity $\bar{\varkappa}$ as a function of θ and p_e were carried out as follows. For a given value of the temperature function θ the frequency dependence of the continuous absorption coefficient due to neutral hydrogen is fixed, independently of the electron pressure. The frequency dependence of the continuous absorption coefficient due to the negative hydrogen ion is independent of both θ and p_e. The resulting absorption coefficient $\varkappa_\nu$, however, shows a run with the frequency which, for given θ, depends upon p_e. Instead of considering immediately the change of the frequency dependence of $\varkappa_\nu$ with p_e, we shall investigate, first, the change of frequency dependence of $\varkappa_\nu$ with the ratio of the absorption by the negative hydrogen ion and that of neutral hydrogen.

In the limiting case of negligible absorption by the negative hydrogen ion (sufficiently small p_e) the frequency dependence of $\varkappa_\nu$ is that of neutral hydrogen for the value of θ considered, and the opacity is equal to $\bar{\varkappa}_H$, the ROSSELAND mean of the neutral hydrogen absorption coefficient:

$$\frac{1}{\bar{\varkappa}_H} = \frac{15}{4\pi^4}\int_0^\infty \frac{1}{\varkappa_\nu(H)} \frac{u^4 e^{-u} du}{(1-e^{-u})^3}. \tag{13}$$

This has been calculated by UNSÖLD (cf. (4)) as a function of θ. The values given by UNSÖLD were used in our calculations (after corrections of an error for $\theta = 0.5$, *viz.* $\log \varkappa_H$ 1.69 instead of 1.59).

The absorption coefficient of the negative hydrogen ion is assumed to be independent of the frequency, equal to $\varkappa_{H^-}$. As a measure of the ratio of the absorption of the negative hydrogen ion and that of neutral hydrogen we use $\frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$. We thus calculate, first, a table giving the ratio $\frac{\bar{\varkappa}}{\bar{\varkappa}_H}$ as a function of θ and $\frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$.

From equations (1) and (5) we obtain the following expression for the absorption coefficient $\varkappa_\nu(H)$ of neutral hydrogen, per gram neutral hydrogen in the ground state:

$$\varkappa_\nu(H) = \frac{1}{m_H}\frac{64\pi^4}{3\sqrt{3}}\frac{m_e e^{10}}{ch^3}\frac{1}{(kT)^3}\frac{e^{-u_H}}{u^3}\sum_{u_n<u}\frac{1}{n^3}e^{u_n}, \tag{14}$$

where

$$u = \frac{h\nu}{kT} \tag{15}$$

$$u_H = \frac{I_H}{kT} \tag{16}$$

and

$$u_n = \frac{1}{n^2} u_H, \tag{17}$$

while m_H is the mass of the hydrogen atom. For a given ν the sum has to be extended over all n, for which the corresponding absorption edge has a smaller frequency than ν, i. e. $u_n < u$.

Following UNSÖLD (4) we approximate the sum of the terms with $n \geqq 5$ in (14) by the corresponding integral. Introducing

$$F = \frac{1}{m_H} \frac{64\,\pi^4}{3\sqrt{3}} \frac{m_e e^{10}}{ch^3} \frac{1}{(kT)^3} e^{-u_H} \tag{18}$$

and

$$D = \frac{1}{2\,u_H} e^{u_5} + \sum_{u_n < u}^{4} \frac{1}{n^3} e^{u_n} \tag{19}$$

we then have

$$\varkappa_\nu (H) = F \frac{D}{u^3} \tag{20}$$

and consequently according to (10)

$$\frac{1}{\bar{\varkappa}_H} = \frac{15}{4\,\pi^4} \frac{1}{F} \int_0^\infty \frac{1}{D} \frac{u^7 e^{-u} du}{(1-e^{-u})^3}. \tag{21}$$

The following table gives F and D for the required values of the temperature function θ. The table also gives u_n for the absorption edges $n = 1, 2, 3$ and 4. Between successive absorption edges D is constant according to equation (19). The values of D for the frequency region of the LYMAN continuum ($\lambda < 912$ Å) are not given, since for all the temperatures considered the absorption coefficient is here so high that the contribution to the opacity integral in equation (21) is negligible.

The table further contains the contributions of the various frequency regions to the opacity integral (with omission of the factor F), the sum Σ of these contributions, and finally the resulting neutral hydrogen opacity

$$\frac{1}{\bar{\varkappa}_H} = \frac{\Sigma}{F} \tag{22}$$

or

$$\bar{\varkappa}_H = \frac{F}{\Sigma}. \tag{23}$$

$\theta = 0.3$ $\log F = 5.53$

n	u_n	D	Contr. to Σ
1	9.34		
		1.503	93.3
2	2.34		
		0.210	4.2
3	1.04		
		0.106	0.1
4	0.58		
		0.078	0.0
		$\Sigma =$	97.6

$\log \bar{z}_H = 3.54$

$\theta = 0.4$ $\log F = 4.55$

n	u_n	D	Contr. to Σ
1	12.46		
		3.066	58.4
2	3.12		
		0.248	14.5
3	1.38		
		0.100	0.6
4	0.78		
		0.066	0.0
		$\Sigma =$	73.5

$\log \bar{z}_H = 2.68$

$\theta = 0.5$ $\log F = 3.49$

n	u_n	D	Contr. to Σ
1	15.58		
		6.448	28.5
2	3.90		
		0.310	32.0
3	1.73		
		0.101	1.8
4	0.97		
		0.060	0.1
		$\Sigma =$	62.4

$\log \bar{z}_H = 1.69$

$\theta = 0.6$ $\log F = 2.37$

n	u_n	D	Contr. to Σ
1	18.69		
		13.77	12.7
2	4.67		
		0.402	52.3
3	2.08		
		0.107	4.4
4	1.17		
		0.056	0.4
		$\Sigma =$	69.8

$\log \bar{z}_H = 0.53$

$\theta = 0.7$ $\log F = 1.22$

n	u_n	D	Contr. to Σ
1	21.80		
		29.66	5.4
2	5.45		
		0.534	69.1
3	2.42		
		0.116	8.7
4	1.36		
		0.055	1.0
		$\Sigma =$	84.2

$\log \bar{z}_H = 9.29 - 10$

$\theta = 0.8$ $\log F = 0.04$

n	u_n	D	Contr. to Σ
1	24.92		
		64.19	2.2
2	6.23		
		0.719	78.2
3	2.77		
		0.129	15.2
4	1.56		
		0.054	2.0
		$\Sigma =$	97.6

$\log \bar{z}_H = 8.05 - 10$

$\theta = 0.9$ $\log F = 8.84$

n	u_n	D	Contr. to Σ
1	28.04		
		139.3	0.8
2	7.01		
		0.979	78.5
3	3.12		
		0.145	23.8
4	1.75		
		0.055	3.7
		$\Sigma =$	106.8

$\log \bar{z}_H = 6.81 - 10$

$\theta = 1.0$ $\log F = 7.62$

n	u_n	D	Contr. to Σ
1	31.15		
		302.6	0.3
2	7.79		
		1.345	72.0
3	3.46		
		0.165	34.0
4	1.95		
		0.056	6.2
		$\Sigma =$	112.5

$\log \bar{z}_H = 5.57 - 10$

Except for $\theta = 0.9$ and $\theta = 1.0$ corresponding values have been given by UNSÖLD (cf. (4), p. 121). Our values agree with UNSÖLD's within a few units of the last decimal.

Considering again the case of both neutral hydrogen and the negative hydrogen ion contributing to the opacity, we now introduce, for each separate temperature, $\bar{\varkappa}_H$ (reckoned per gram neutral hydrogen in the ground state) as the unit of absorption coefficient. From equations (20) and (23) we get

$$\frac{\varkappa_\nu(H)}{\bar{\varkappa}_H} = \frac{D\,\Sigma}{u^3}. \tag{24}$$

The ratio between the resulting continuous absorption coefficients $\varkappa_\nu$ and $\bar{\varkappa}_H$ is

$$\frac{\varkappa_\nu}{\bar{\varkappa}_H} = \frac{\varkappa_\nu(H) + \varkappa_{H^-}}{\bar{\varkappa}_H} = \frac{D\,\Sigma}{u^3} + \frac{\varkappa_{H^-}}{\bar{\varkappa}_H}. \tag{25}$$

Introducing this in the opacity integral we find

$$\frac{\bar{\varkappa}_H}{\bar{\varkappa}} = \frac{15}{4\,\pi^4}\int_0^\infty \frac{1}{\dfrac{D\,\Sigma}{u^3} + \dfrac{\varkappa_{H^-}}{\bar{\varkappa}_H}} \frac{u^4 e^{-u}}{(1-e^{-u})^3}\,du. \tag{26}$$

By means of equation (26) the required quantity $\dfrac{\bar{\varkappa}}{\bar{\varkappa}_H}$ can be found when $\dfrac{\varkappa_{H^-}}{\bar{\varkappa}_H}$ and θ are known. The calculations were carried out for $\theta = 0.3$, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9, 1.0 and $\log \dfrac{\varkappa_{H^-}}{\bar{\varkappa}_H}$ equal to 8.0, 8.4, 8.8, 9.2, 9.6, 0.0, 0.4, 0.8, 1.2, 1.6, 2.0. In each case the integral was calculated numerically. The integrand was evaluated for the values of u corresponding to the absorption edges (u_1, u_2, u_3, and u_4) and at three additional equidistant points between successive absorption edges, so that the contribution of each interval with constant D to the integral could be found with the aid of Cotes' five-term formula for equidistant abscissae, *viz.*

$$\int_a^b f(x)\,dx = \frac{1}{90}(b-a)\left[7\,f(a) + 32\,f\left(a + \frac{b-a}{4}\right) + \right.$$

$$\left. + 12\,f\left(a + \frac{b-a}{2}\right) + 32\,f\left(a + \frac{3\,(b-a)}{4}\right) + 7\,f(b)\right].$$

The final table (Table 2, p. 39) was calculated by interpolation to the interval 0.1 instead of 0.4 for the argument $\log \frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$. A glance at the table shows that the variation of the tabulated quantity $\log \frac{\bar{\varkappa}}{\bar{\varkappa}_H}$ with θ is quite small. This is the principal advantage of the chosen procedure.

With the aid of Table 2 a table of $\log \bar{\varkappa}$ with arguments θ and $\log p_e$ could easily be constructed. First, $\log \bar{\varkappa}_H$ is computed. The number of neutral hydrogen atoms in the ground state per gram is practically equal to

$$\frac{1}{m_H}(1 - x_H), \tag{27}$$

where x_H is the degree of ionization of hydrogen. The latter is calculated according to equation (4). In Table 3, p. 40, $-\log(1 - x_H)$ is given as a function of θ and $\log p_e$. The opacity per neutral hydrogen atom in the ground state being known as a function of θ, $\log \bar{\varkappa}_H$ follows (cf. Table 1, p. 38).

The number N_{H^-} of negative hydrogen ions per gram follows from equations (7) and (27):

$$\log N_{H^-} = \log \frac{1}{m_H} - 0.12 + 0.70\,\theta - \frac{5}{2}\log T + \log p_e + \log(1 - x_H). \tag{28}$$

The continuous absorption coefficient per negative hydrogen ion has been assumed to be equal to $26 \cdot 10^{-18}$ (cf. p. 12). For $\varkappa_{H^-}$ we therefore get

$$\log \varkappa_{H^-} = 7.21 - 0.12 + 0.70\,\theta - \frac{5}{2}\log T + \log p_e + \log(1 - x_H). \tag{29}$$

Table 1, p. 38, together with Table 3, p. 40, mentioned above, facilitates the calculation of $\log \bar{\varkappa}_H$, $\log \varkappa_{H^-}$, and $\log \frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$.

With arguments θ and $\log \frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$ we find $\log \frac{\bar{\varkappa}}{\bar{\varkappa}_H}$ from Table 2. Since $\log \bar{\varkappa}_H$ is known, the required value of $\log \bar{\varkappa}$ follows immediately.

Table 4 contains the calculated values of $\log \bar{\varkappa}$ with arguments θ and $\log p_e$. Except for very small p_e ($p_e < 1$ bar) it was not necessary to extend the table beyond $\theta = 0.9$, since absorption by neutral hydrogen is negligible for $\theta > 0.9$, so that $\log \bar{\varkappa}$ is here practically equal to $\log \varkappa_{H^-}$ [corrected for the averaged effect of induced emission by subtracting 0.02 from the logarithm, cf. equation (10)], which is calculated with the aid of Table 1.

It should be emphasized that the table giving the logarithm of the opacity $\log \bar{\varkappa}$ with arguments θ and $\log p_e$, is valid for all values of the hydrogen-metal ratio A.

4. For the calculation of the structure of a model stellar atmosphere the opacity $\bar{\varkappa}$ must be known as a function of θ and the total pressure p. Since $\bar{\varkappa}$ has been calculated as a function of θ and the electron pressure p_e, the next step will be the construction of tables giving the relation between p_e and p, and thus characterizing the degree of ionization of the particular element mixture of the model atmosphere considered.

The following element mixture is adopted in the present investigation (cf. p. 10)

Element	Relative number of atoms
H	A
Mg	0.30
Si	0.33
Fe	0.30
Ca	0.02
Al	0.03
Na	0.02
	1

The mixture is thus characterized by one variable parameter, namely, the ratio A ($A \gg 1$) between the number of atomic particles (atoms and ions) of hydrogen and the corresponding number for all metals together.

Denoting the degree of ionization of hydrogen by x_H, and that of a metal by $x_i (i = 1, 2, \ldots 6)$, and denoting further the relative metal abundances by $\alpha_i \left(\sum_{i=1}^{6} \alpha_i = 1\right)$, we get the following expression for the number of free electrons N_e per unit volume:

$$N_e = N_H x_H + \frac{N_H}{A} \sum_{i=1}^{6} \alpha_i x_i. \tag{30}$$

Here N_H is the number of hydrogen atoms and ions per unit volume, so that the number of neutral atoms is $N_H(1 - x_H)$, the number of ions $N_H x_H$, and the number of free electrons contributed by hydrogen $N_H x_H$. The number of atoms and singly ionized ions of any metal (the doubly and multiply ionized metal ions can be neglected, cf. p. 8) is $\frac{N_H}{A} \alpha_i$. Hence the corresponding contribution to the number of free electrons is $\frac{N_H}{A} \alpha_i x_i$.

Introducing the average degree of ionization x_M of the metals defined by

$$x_M = \sum_{i=1}^{6} \alpha_i x_i \tag{31}$$

equation (30) becomes

$$N_e = N_H x_H + \frac{N_H}{A} x_M. \tag{32}$$

Now, since A is here always assumed to be greater than 1000, the total number N of particles per unit volume is practically equal to the number N_H of hydrogen atoms and ions plus the number of free electrons contributed by hydrogen

$$N = N_H (1 + x_H). \tag{33}$$

The ratio of electron pressure p_e to total pressure p is equal to the ratio of N_e to N. We thus have

$$\frac{p_e}{p} = \frac{x_H}{1 + x_H} + \frac{1}{A} \frac{x_M}{1 + x_H}. \tag{34}$$

The second term on the right-hand side of (34) is negligible as compared with the first, except when x_H is very small. Hence, it is permissible to substitute 1 for $1+x_H$ in the term in question,

$$\frac{p_e}{p} = \frac{x_H}{1+x_H} + \frac{1}{A} x_M. \tag{35}$$

The degree of ionization x_H of hydrogen is given by equation (8). Table 5 gives $\log \frac{1+x_H}{x_H}$ with arguments θ and $\log p_e$ computed according to this equation.

The degree of ionization of each metal in the assumed metal mixture was computed according to the standard methods (cf. Unsöld (4)). The average degree of ionization x_M of the metals then was found according to equation (31). In Table 6 the quantity x_M is given as a function of θ and $\log p_e$.

By means of Table 5 giving x_H and Table 6 giving x_M the ratio $\frac{p_e}{p}$ can be calculated according to equation (35). This means that p can be found corresponding to given values of θ and p_e. The calculation of p, however, has to be made for each separate value of A, since A enters into equation (35).

Table 7 gives $\log p$ with arguments θ and $\log p_e$. It consists of four separate tables valid for $\log A = 3.0, 3.4, 3.8,$ and 4.2. The range of θ covered by the table is $0.60 \leqq \theta \leqq 1.04$. For $\theta < 0.6$ the contribution of the metals to the electron pressure is negligible as compared with that of hydrogen, so that $\log p$ has practically the same value for all four values of A and for pure hydrogen $x_H (A = \infty)$. The range of θ from 0.30 to 0.60 is therefore covered by a single table.

It is sometimes necessary to find $\log p_e$ when $\log p$ and θ are given. This is possible with the aid of Table 7 by backward interpolation. For the sake of convenience, however, a set of tables—Table 8—has been computed giving $\log p_e$ with arguments θ and $\log p$ for $\log A = 3.0, 3.4, 3.8,$ and 4.2. The range of θ from 0.30 to 0.60 is covered by a table valid for all four values of A as well as for pure hydrogen.

Table 4 (cf. p. 42) gives the opacity $\bar{\varkappa}$ with arguments θ and $\log p_e$, while Table 7, or Table 8, gives the relation between $\log p$

and log p_e for each θ and A. By combining these tables it is therefore possible to construct tables—Table 9—giving log $\bar{z}$ with arguments θ and log p_e. For $0.60 \leq \theta \leq 1.04$ there are four separate tables for log $A = 3.0, 3.4, 3.8,$ and 4.2. For $0.30 \leq \theta \leq 0.60$ there is again only one table, valid also for pure hydrogen.

Table 9 completes the series of auxiliary tables.

We have previously considered the case of carbon contributing appreciably to the electron pressure (cf. p. 8). In this case we have instead of equation (32)

$$N_e = N_H x_H + N_C x_C + \frac{N_H}{A} x_M. \tag{36}$$

Putting

$$\frac{N_H}{N_C} = B,$$

we get from equations (33) and (36), neglecting again x_H in comparison with 1 in the last term,

$$\frac{p_e}{p} = \frac{x_H}{1+x_H} + \frac{1}{B}\frac{x_C}{1+x_H} + \frac{1}{A} x_M, \tag{37}$$

or

$$\frac{p_e}{p} = \frac{x_H}{1+x_H}\left(1 + \frac{1}{B}\frac{x_C}{x_H}\right) + \frac{1}{A} x_M. \tag{38}$$

Now $\frac{1}{B}\frac{x_C}{x_H}$ can be put equal to a constant $k = \frac{1}{B}\frac{\overline{x_C}}{x_H}$ equal to the average value of $\frac{1}{B}\frac{x_C}{x_H}$ in the relevant layers of the atmosphere (cf. p. 9). With

$$K = 1 + \frac{1}{B}\frac{\overline{x_C}}{x_H} = 1 + k \tag{39}$$

equation (38) then becomes

$$\frac{p_e}{p} = \frac{x_H}{1+x_H} K + \frac{1}{A} x_M, \tag{40}$$

or

$$\frac{p_e}{Kp} = \frac{x_H}{1+x_H} + \frac{1}{KA} x_M. \tag{41}$$

We shall make use of this equation later on (cf. p. 35) in a discussion of the influence of an appreciable carbon admixture upon the structure of model stellar atmospheres.

5. The model stellar atmospheres here considered are assumed to be in mechanical equilibrium. The gravity g is set constant throughout the atmosphere. Radiation pressure can be neglected. For the atmospheres considered its gradient is generally quite small as compared with that of gas pressure. The corresponding reduction of gravity (cf. UNSÖLD (4)) is less than five per cent. except for the $cA\,5$ atmosphere tabulated on p. 85.

Under these circumstances the equation expressing mechanical equilibrium is

$$\frac{dp}{dh} = -g\varrho, \tag{42}$$

where p, as before, is the total gas pressure, ϱ is the density of the atmospheric gas, while h is the height of the point considered over some arbitrarily chosen fixed level.

In this section we shall consider only the case of the temperature gradient being everywhere given by the equations valid in radiational equilibrium (cf. p. 6). We then define the optical depth τ through

$$d\tau = -\bar{\varkappa}\varrho\, dh \tag{43}$$

and the additional condition that τ is zero at the top of the atmosphere. Here $\bar{\varkappa}$ is the opacity defined by equation (10) as the ROSSELAND mean of the continuous absorption coefficient.

From equations (42) and (43) one obtains

$$\frac{dp}{d\tau} = \frac{g}{\bar{\varkappa}}. \tag{44}$$

This means that by introducing the optical depth instead of the geometrical depth it is possible to eliminate the density from the problem.

In radiational equilibrium the standard equation connecting optical depth and temperature is valid,

$$T^4 = T_e^4\left(\frac{1}{2} + \frac{3}{4}\tau\right), \tag{45}$$

or

$$T^4 = T_0^4\left(1+\frac{3}{2}\tau\right), \tag{46}$$

where

$$T_0 = \sqrt[4]{\frac{1}{2}}\,T_e$$

is the surface temperature, while T_e is the effective temperature.

Equation (45) is only approximately correct, but the approximation was considered sufficient for our purposes.

Introducing again the temperature function

$$\theta = \frac{5040^\circ}{T}, \tag{47}$$

equation (46) becomes

$$\theta = \theta_0\left(1+\frac{3}{2}\tau\right)^{-\frac{1}{4}}, \tag{48}$$

where θ_0 is the value of the temperature function θ on the surface of the atmosphere.

In the previous section we have considered the problem of calculating the opacity $\bar{\varkappa}$ as a function of θ and p. Tables of $\log \bar{\varkappa}$ with arguments θ and $\log p$ are given in the appendix (Table 9). We can, therefore, consider $\bar{\varkappa}$ as a known function of θ and p,

$$\bar{\varkappa} = \bar{\varkappa}(\theta, p). \tag{49}$$

Comparing now equations (44), (48), and (49), we see that for a given model atmosphere—for which θ_0, g and A are specified—p can be found as a function of τ by integrating the differential equation (44). The solution is fixed by the boundary condition that $p = 0$ for $\tau = 0$. In general the solution has to be calculated by means of numerical integration.

In carrying out the numerical integration it is convenient to introduce $\log p$ as the independent variable. From (44) we get

$$\frac{d\tau}{d\log p} = \frac{1}{g\log e}\,\bar{\varkappa}\,p, \tag{50}$$

where e is the base of the natural logarithms, while log means the logarithm with base 10, or, with regard to the boundary condition,

$$\tau\,(\log p) = \frac{1}{g \log e}\int_{-\infty}^{\log p} \bar{\varkappa}\,(\theta, p)\, p\, d \log p\,. \tag{51}$$

The numerical integration for a model stellar atmosphere with given values of θ_0, g, and A, is now carried out as follows. It is started at a point, where the optical depth is so small that θ according to equation (48) is practically equal to θ_0. Then

$$\tau\,(\log p) = \frac{1}{g \log e}\int_{-\infty}^{\log p} \bar{\varkappa}\,(\theta_0, p)\, p\, d \log p \quad (\tau << 1), \tag{52}$$

which means that τ can be found as a function of $\log p$ by a quadrature, use being made of the $\bar{\varkappa}$-table, with $\theta = \theta_0$. The quadrature starts at a suitably chosen value of $\log p$, for which the integrand is practically zero. It is carried further up to a point, where τ is so large that θ begins to deviate from θ_0.

The numerical integration is now continued step by step in the usual way. With an extrapolated value of θ one finds $\bar{\varkappa}$ from the $\bar{\varkappa}$-table and the corresponding value of the integrand in (52) is calculated. From this the integral, and thus τ, is found. Finally θ follows by the insertion of τ in (48). Should this value of θ deviate appreciably from the extrapolated value, the whole process is repeated. The interval of integration was chosen so small, however, that repetition was usually unnecessary.

The integral was determined with the aid of the standard formula

$$\frac{1}{w}\int_a^{a+nw} f(x)\, dx = \frac{1}{2} f(a) + f(a+w) + \cdots + f(a+(n-1)\,w) +$$
$$+ \frac{1}{2} f(a+nw) + \frac{1}{12} f^I(a) - \frac{1}{12} f^I(a+nw) + \cdots \tag{53}$$

Here $f^I(a)$ denotes the first difference at a, i. e. the average of the first differences $f(a) - f(a-w)$ and $f(a+w) - f(a)$, and $f^I(a+nw)$ the same quantity at $a+nw$. The interval w was chosen so small that the terms involving differences of the third and higher orders were negligible.

For small and moderate values of τ the integration interval of $\log p$ could be taken equal to 0.1. With increasing τ the interval was gradually decreased to 0.002. A glance at the resulting tables given in the appendix shows that this was necessary, because the increase of p with τ gradually becomes very small. The difficulty could also have been overcome by introducing, from a suitably chosen point, τ as the independent variable instead of $\log p$, i. e. calculating

$$\log p(\tau) = \log p(\tau_0) + g \log e \int_{\tau_0}^{\tau} \frac{1}{\bar{\varkappa} p} d\tau. \tag{54}$$

The frequent changes of intervals required in the adopted method, however, are not very inconvenient.

After the completion of the integration the required values of $\log p$ as a function of τ were found by interpolation. Finally the corresponding values of $\log \bar{\varkappa}$ and $\log p_e$ were found with the aid of the auxiliary tables, Table 8 and Table 9.

The results of the integrations are collected in Tables 10, 11, 12, and 13 of the appendix. The integrations were made with one more figure than given in the tables. The computational errors of the tabular values should not exceed one or two units of the last decimal given.

6. A glance at the tables of model stellar atmospheres given in the appendix suffices to show that in the deeper atmospheric layers the relative increase of temperature is more rapid than that of total pressure. This means that in the layers in question the density decreases with depth in the atmosphere.

Already before the density gradient becomes negative, however, convectional instability sets in. The criterion for convectional instability, due to K. Schwarzschild, is

$$\left|\frac{dT}{dh}\right|_{\text{adiab.}} < \left|\frac{dT}{dh}\right|_{\text{rad.}} \tag{55}$$

Here $\left|\frac{dT}{dh}\right|_{\text{adiab.}}$ means the numerical value of the adiabatic temperature gradient and $\left|\frac{dT}{dh}\right|_{\text{rad.}}$ the numerical value of the actual temperature gradient in radiational equilibrium. With regard to equation (42) expressing the condition of mechanical equilibrium this can be written in the form

$$\left(\frac{d \log T}{d \log p}\right)_{\text{adiab.}} < \left(\frac{d \log T}{d \log p}\right)_{\text{rad.}} \tag{56}$$

With the aid of equations (44) and (46) one finds the following expression for $\left(\frac{d\log T}{d\log p}\right)_{\text{rad.}}$,

$$\left(\frac{d\log T}{d\log p}\right)_{\text{rad.}} = \frac{3}{8}\frac{1}{g}\frac{p\bar{\varkappa}}{1+\frac{3}{2}\tau}. \tag{57}$$

For the model stellar atmospheres tabulated in the appendix this expression can easily be found as a function of τ.

The adiabatic gradient has been determined by Unsöld (4) for a two-component gas. Identifying the two components with hydrogen and an average metal we get an expression sufficiently accurate for our purposes. With our notation the expression is (cf. Rudkjøbing (6))

$$\left(\frac{d\log T}{d\log p}\right)_{\text{adiab.}} = \frac{\left(1+x_H+\frac{1}{A}x_M+\frac{x_H(1-x_H)}{x_H+\frac{1}{A}x_M}\right)+x_H(1-x_H)\left(\frac{5}{2}+\frac{I_H}{kT}\right)}{\frac{5}{2}\left(1+x_H+\frac{1}{A}x_M+\frac{x_H(1-x_H)}{x_H+\frac{1}{A}x_M}\right)+x_H(1-x_H)\left(\frac{5}{2}+\frac{I_H}{kT}\right)^2}. \tag{58}$$

Both for x_H nearly equal to 0 and for x_H nearly equal to 1 this expression tends toward 0.4. For intermediate values of x_H, it is, however, considerably smaller. This, in connection with an increase of the radiative gradient, leads to convective instability in the layers where hydrogen becomes appreciably ionized, as was first shown by Unsöld.

For a given value of A expression (58) for $\left(\frac{d\log T}{d\log p}\right)_{\text{adiab.}}$ can be calculated as a function of θ and $\log p$ by using the auxiliary tables of the appendix.

For any model stellar atmosphere that has been calculated on the assumption of radiational equilibrium it is thus possible to compute $\left(\frac{d\log T}{d\log p}\right)_{\text{adiab.}}$ and $\left(\frac{d\log T}{d\log p}\right)_{\text{rad.}}$ and apply the criterion (56). In this way the upper boundary of the zone of convectional instability is determined. If it is assumed that the temperature gradient in the unstable zone is equal to the value given by the equations of radiative equilibrium (cf. p. 6), then the lower boundary of the zone is determined in the same way.

As an example we consider the model atmosphere for $\theta_0 = 0.7$, $\log g = 4.0$, $\log A = 3.8$ in radiational equilibrium (cf. p. 78). The numerical values of the radiative and adiabatic gradients are given below as a function of τ.

τ	$\left(\frac{d \log T}{d \log p}\right)_{\text{rad.}}$	$\left(\frac{d \log T}{d \log p}\right)_{\text{adiab.}}$
0.01	0.006	0.11
0.10	0.05	0.14
0.15	0.09	0.14
0.2	0.11	0.13
0.4	0.28	0.11
0.6	0.46	0.10
0.8	0.68	0.09
1.0	0.93	0.09
2	1.95	0.08
3	2.24	0.08
4	1.91	0.09
5	1.51	0.11
6	1.12	0.14
7	0.89	0.17
8	0.71	0.20
9	0.59	0.23
10	0.49	0.26

The convectively unstable zone is seen to extend from about $\tau = 0.2$ to somewhat below $\tau = 10$. It should be noted that for lower effective temperatures, such as e. g. that of the sun, the unstable zone extends to much greater optical depths (cf. RUDKJØBING (6)).

In the tables of the appendix the upper boundaries of the convectively unstable regions are marked with horizontal lines. With increasing effective temperature T_e and decreasing surface gravity g the upper boundary moves towards higher atmospheric levels. An increase of the hydrogen-metal ratio A has the same effect.

The structure of the convectively unstable zones has also been determined according to the assumption that the temperature gradient is equal to the adiabatic value (cf. p. 6). Since for a given model stellar atmosphere $\left(\frac{d \log T}{d \log p}\right)_{\text{adiab.}}$ can be calculated according to (58) as a function of T and p, it is comparatively simple to find $\log T$ as a function of $\log p$ by numerical integration (cf. RUDKJØBING (6)). The results of these calculations are given at the foot of each model atmosphere table of the appendix. The much slower increase of T with p, compared with that characterizing the atmospheres in radiational equilibrium, is obvious. As a consequence of this the zone of convectional instability extends to very great depths in this case (cf. BIERMANN (5) and RUDKJØBING (6)).

7. The density ϱ and the height h over a suitably chosen level are not given in the model atmosphere tables in the appendix. If required they can be found from the tabulated data as follows.

The equation of state of the atmospheric gas is

$$p = NkT, \tag{59}$$

where k is the Boltzmann constant. Since practically the whole total pressure is contributed by hydrogen, this becomes

$$p = \frac{k}{m_H}(1 + x_H)\,\varrho\, T, \tag{60}$$

if the degree of ionization of hydrogen is x_H. The logarithm of the gas constant $\frac{k}{m_H}$ is 7.916.

The values of θ, p and p_e are given in the model atmosphere tables of the appendix. The degree of ionization x_H of hydrogen can be found from Table 3 with arguments θ and $\log p_e$. The density ϱ can thus be determined. The following table may facilitate the calculations.

θ	$\log p = 0.0$	1.0	2.0	3.0	4.0	5.0	6.0
0.3	12.14	11.14	10.14	9.14	8.14	7.14	6.14
0.4	12.02	11.02	10.02	9.02	8.02	7.02	6.02
0.5	11.92	10.92	9.92	8.92	7.92	6.92	5.92
0.6	11.84	10.84	9.84	8.84	7.84	6.84	5.84
0.7	11.77	10.77	9.77	8.77	7.77	6.77	5.77
0.8	11.72	10.72	9.72	8.72	7.72	6.72	5.72
0.9	11.66	10.66	9.66	8.66	7.66	6.66	5.66
1.0	11.62	10.62	9.62	8.62	7.62	6.62	5.62

The table gives $-\log \varrho (1 + x_H)$

The geometrical height h can be found as a function of the optical depth τ by means of the tabulated data. From equation (42) we get

$$-\frac{dh}{d\log p} = \frac{1}{g\log e}\frac{p}{\varrho}. \tag{61}$$

Making use of the equation of state (60) we get

$$-\frac{dh}{d\log p} = \frac{k\cdot 5040°}{m_H \log e}\frac{1}{g}\frac{1+x_H}{\theta}, \tag{62}$$

or

$$h_0 - h = \frac{9.57\cdot 10^{11}}{g}\int_{p_0}^{p}\frac{1+x_H}{\theta}\,d\log p \tag{63}$$

Use being made of the tabulated data and Table 3 the integral can easily be evaluated by numerical quadrature.

The following table is given as an example. It is valid for the solar atmosphere ($\theta_0 = 1.041$, $\log g = 4.44$, $\log A = 3.8$) assumed to be in radiational equilibrium.

τ	θ	T	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	$1-x_H$	$\log \varrho$	h
0.01	1.037	4860	4.02	0.15	8.74	1.00	2.42 − 10	427 km
0.1	1.005	5010	4.54	0.64	9.17	1.00	2.92	251
0.3	0.949	5310	4.80	0.95	9.38	1.00	3.16	159
0.5	0.905	5570	4.92	1.15	9.50	1.00	3.26	114
1.0	0.828	6090	5.06	1.56	9.77	1.00	3.36	59
2.0	0.736	6850	5.16	2.19	0.23	1.00	3.41	15
3.0	0.681	7400	5.19	2.60	0.56	1.00	3.40	0

It follows from equation (62) that the geometrical height of a stellar atmosphere is roughly proportional to the effective temperature T_e, and roughly inversely proportional to the gravity g.

8. We shall now discuss some of the features shown by the data tabulated in the model atmosphere tables of the appendix.

Since the tables have four arguments, *viz.* θ_0, $\log g$, $\log A$, and τ, an intercomparison cannot be conveniently made. We have therefore made extracts from the tables for two values of τ, namely, for $\tau = 0.3$ as a point representative of conditions influencing absorption lines (cf. (2)), and $\tau = 0.7$ similarly as a representative point with regard to the continuous spectrum. Separate tables are given below for $\log p$, $\log p_e$, and $\log \bar{\varkappa}$.

		$\tau = 0.3$, $\log A = 3.4$				$\tau = 0.3$, $\log A = 3.8$				$\tau = 0.3$, $\log A = 4.2$			
θ_0	θ	$\log g = 3.0$	3.5	4.0	4.5	3.0	3.5	4.0	4.5	3.0	3.5	4.0	4.5
1.0	0.911	3.86	4.13	4.39	4.66	4.00	4.27	4.56	4.83	4.10	4.40	4.69	4.98
0.9	0.820		4.05	4.35	4.64		4.11	4.42	4.73		4.13	4.46	4.79
0.8	0.729						3.71	4.07	4.42				
0.7	0.638						3.13	3.54	3.93				

		$\tau = 0.7$, $\log A = 3.4$				$\tau = 0.7$, $\log A = 3.8$				$\tau = 0.7$, $\log A = 4.2$			
θ_0	θ	$\log g = 3.0$	3.5	4.0	4.5	3.0	3.5	4.0	4.5	3.0	3.5	4.0	4.5
1.0	0.836	4.03	4.31	4.59	4.86	4.15	4.44	4.73	5.01	4.22	4.53	4.83	5.13
0.9	0.752		4.18	4.50	4.80		4.23	4.55	4.87		4.25	4.59	4.92
0.8	0.669						3.83	4.19	4.55				
0.7	0.585						3.25	3.66	4.06				

The tables above give $\log p$

		$\tau = 0.3$, $\log A = 3.4$				$\tau = 0.3$. $\log A = 3.8$				$\tau = 0.3$, $\log A = 4.2$			
θ_0	θ	$\log g = 3.0$	3.5	4.0	4.5	3.0	3.5	4.0	4.5	3.0	3.5	4.0	4.5
1.0	0.911	0.55	0.76	0.99	1.22	0.45	0.64	0.86	1.06	0.40	0.59	0.77	0.97
0.9	0.820		1.07	1.26	1.46		1.05	1.22	1.40		1.03	1.20	1.38
0.8	0.729						1.49	1.67	1.85				
0.7	0.638						1.86	2.07	2.27				

		$\tau = 0.7$, $\log A = 3.4$				$\tau = 0.7$, $\log A = 3{,}8$				$\tau = 0.7$, $\log A = 4.2$			
θ_0	θ	$\log g = 3.0$	3.5	4.0	4.5	3.0	3.5	4.0	4.5	3.0	3.5	4.0	4.5
1.0	0.836	0.97	1.16	1.36	1.55	0.97	1.13	1.30	1.48	0.97	1.13	1.30	1.47
0.9	0.752		1.58	1.76	1.93		1.59	1.75	1.93		1.59	1.76	1.93
0.8	0.669						1.99	2.18	2.37				
0.7	0.585						2.29	2.52	2.73				

The tables above give $\log p_e$.

		$\tau = 0.3$, $\log A = 3.4$				$\tau = 0.3$, $\log A = 3.8$				$\tau = 0.3$, $\log A = 4.2$			
θ_0	θ	$\log g = 3.0$	3.5	4.0	4.5	3.0	3.5	4.0	4.5	3.0	3.5	4.0	4.5
1.0	0.911	8.91	9.13	9.35	9.58	8.82	9.00	9.22	9.42	8.77	8.95	9.14	9.33
0.9	0.820		9.29	9.47	9.66		9.26	9.43	9.60		9.24	9.40	9.58
0.8	0.729						9.65	9.78	9.93				
0.7	0.638						0.23	0.32	0.42				

		$\tau = 0.7$, $\log A = 3.4$				$\tau = 0.7$, $\log A = 3.8$				$\tau = 0.7$, $\log A = 4.2$			
θ_0	θ	$\log g = 3.0$	3.5	4.0	4.5	3.0	3.5	4.0	4.5	3.0	3.5	4.0	4.5
1.0	0.836	9.21	9.38	9.57	9.77	9.19	9.36	9.53	9.71	9.20	9.35	9.52	9.68
0.9	0.752		9.70	9.85	0.01		9.71	9.85	0.00		9.71	9.86	0.00
0.8	0.669						0.14	0.26	0.39				
0.7	0.585						0.76	0.84	0.91				

The tables above give $\log \bar{\varkappa}$.

A glance at these tables shows that the variation of the tabulated quantities with the arguments is quite regular. In fact, linear interpolation will everywhere give sufficient accuracy.

The variation of p, p_e, and $\bar{\varkappa}$ with θ, g, and A is seen to be quite similar for the two optical depths.

With increasing effective temperature, i. e. decreasing θ_0, p decreases, while p_e and $\bar{\varkappa}$ increase. From $\theta_0 = 1.0$ to $\theta_0 = 0.7$ these quantities change by factors between 10 and 30.

A qualitative interpretation of the variation of p, p_e, and $\bar{\varkappa}$ with g and A can be derived as follows. At low temperatures the free electrons are contributed mainly by the metals. As the temperature rises, they are contributed mainly by hydrogen, which to begin with is little ionized, and finally strongly ionized. Further, the opacity is at low temperatures mainly due to H^-, and at high temperatures mainly to H. We consider, therefore, the simplified cases specified in the following table.

Electron pressure	Opacity	$\bar{\varkappa}$	p_e	p	p_e	$\bar{\varkappa}$
Metals ($x_M \backsimeq 1$) ..	H^-	$A^{-1}p$	$A^{-1}p$	$A^{\frac{1}{2}}g^{\frac{1}{2}}$	$A^{-\frac{1}{2}}g^{\frac{1}{2}}$	$A^{-\frac{1}{2}}g^{\frac{1}{2}}$
$H(x_H << 1)$	H^-	$p^{\frac{1}{2}}$	$p^{\frac{1}{2}}$	$g^{\frac{2}{3}}$	$g^{\frac{1}{3}}$	$g^{\frac{1}{3}}$
$H(x_H << 1)$	H	p^0	$p^{\frac{1}{2}}$	g	$g^{\frac{1}{2}}$	g^0
$H(1-x_H << 1)$ ...	H	p	p	$g^{\frac{1}{2}}$	$g^{\frac{1}{2}}$	$g^{\frac{1}{2}}$

In the four cases considered the dependence of $\bar{\varkappa}$ and p_e upon A and p is easily seen to be as stated in the third and fourth column.

Assuming now

$$\bar{\varkappa} = C f(\tau)\, p^n, \tag{64}$$

where $f(\tau)$ is some function of τ (and therefore of T), and n a positive constant, we get from the equation (44) expressing mechanical equilibrium,

$$\frac{dp}{d\tau} = \frac{g}{C}\frac{1}{f(\tau)}p^{-n}, \tag{65}$$

or

$$\frac{p^{1+n}}{1+n} = \frac{g}{C}\int_0^\tau \frac{d\tau}{f(\tau)}. \tag{66}$$

This shows that

$$p \propto \left(\frac{g}{C}\right)^{\frac{1}{1+n}}. \tag{67}$$

From this the dependences of p, p_e, and $\bar{\varkappa}$ upon A and g given in the three last columns of the schedule are easily derived.

As an example we shall consider the dependence of p_e upon g. This is seen to lie always between $g^{\frac{1}{3}}$ and $g^{\frac{1}{2}}$. In fact the tables on p. 32 show that this is the case, and that the dependence is never far from $g^{0.4}$.

The first of the four simplified cases has been considered in greater detail in the author's previous paper (2). The equations resulting from the discussion of this case are good approximations in the case of the solar atmosphere.

9. We have seen (cf. p. 9) that it might become desirable to calculate the effect of a higher content of helium, oxygen, and nitrogen than that assumed in the model stellar atmospheres considered in the present investigation.

We consider the case that these elements contribute to the weight, but not appreciably to the opacity or the electron pressure. We denote the relative weight of hydrogen by X, so that 1 gram of matter contains very nearly $(1-X)$ gram helium, oxygen, and nitrogen, X gram hydrogen, and a negligible weight of the rest of the elements. This means that the opacity $\bar{\varkappa}$, which is due to hydrogen (neutral hydrogen atoms and negative hydrogen ions) alone, is reduced in the ratio $X:1$ as compared with the case of the model stellar atmospheres previously considered.

Now in the calculation of the atmospheric structure (p, p_e, and $\bar{\varkappa}$ as functions of τ), $\bar{\varkappa}$ enters only in the differential equation expressing mechanical equilibrium,

$$\frac{d\tau}{dp} = \frac{\bar{\varkappa}}{g}. \qquad (68)$$

It is therefore immediately seen that a reduction of $\bar{\varkappa}$ by the factor X is equivalent to a multiplication of the gravity g by the factor $\frac{1}{X}$. We thus derive the rule stated on p. 9 that a hydrogen content $X\,(X<1)$ is allowed for by entering the tables given in the appendix with argument $\frac{g}{X}$ instead of g. Correct values of $\log p$, and $\log p_e$ are thus obtained. The value of $\bar{\varkappa}$ obtained from the tables must, of course, be multiplied by X.

It might also become desirable (cf. p. 9) to correct approximately for the influence of an appreciable admixture of carbon. We assume that the contributions of carbon to the weight and to the opacity are negligible, while the contribution to the electron pressure is appreciable. This means (cf. p. 23) that instead of the equation

$$\frac{p_e}{p} = \frac{x_H}{1+x_H} + \frac{x_M}{A} \tag{69}$$

assumed in the calculation of the model stellar atmospheres, we now have [cf. equation (41)]

$$\frac{p_e}{Kp} = \frac{x_H}{1+x_H} + \frac{x_M}{KA} \quad (K = 1+k). \tag{70}$$

Consequently, if the ionization tables (Table 7) used in the calculation of the model stellar atmospheres are entered with argument KA instead of A, a quantity p' is obtained, which is equal to the true corrected pressure multiplied by K, i. e.

$$p' = p'(\theta, p_e; KA) \quad \text{(Table 7)} \tag{71}$$

with

$$p' = Kp. \tag{72}$$

Now equation (44) expressing mechanical equilibrium can be written

$$d\tau = \bar{\varkappa}\frac{1}{Kg}\,dp'. \tag{73}$$

If therefore the structure of a model stellar atmosphere be calculated with the use of the standard Table 7 and with Kg instead of g, this will give the true values of τ for a model stellar atmosphere with a carbon admixture characterized by K, and gravity g.

We thus derive the rule stated on p. 9 that the influence of the carbon admixture is allowed for by entering the model atmosphere tables of the appendix with arguments KA and Kg instead of A and g, and finally dividing the values in the p-column by K.

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APPENDIX

Table 1.

θ	$\log \bar{\varkappa}_H$	$\log \varkappa_{H^-}$	$\log \frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$
0.30....	$3.52 + \log(1-x)$	$6.74-10 + \log p_e + \log(1-x)$	$3.22-10 + \log p_e$
32....	3.36	6.82	3.46
34....	3.20	6.90	3.70
36....	3.04	6.98	3.94
38....	2.86	7.05	4.19
0.40....	2.68	7.12	4.44
42....	2.49	7.18	4.69
44....	2.30	7.25	4.95
46....	2.11	7.31	5.20
48....	1.90	7.37	5.47
0.50....	1.69	7.43	5.74
52....	1.46	7.49	6.03
54....	1.23	7.54	6.31
56....	1.00	7.60	6.60
58....	0.76	7.65	6.89
0.60....	0.52	7.70	7.18
62....	0.27	7.75	7.48
64....	0.03	7.80	7.77
66....	9.78—10	7.85	8.07
68....	9.54	7.89	8.35
0.70....	9.29	7.94	8.65
72....	9.04	7.98	8.94
74....	8.79	8.03	9.24
76....	8.55	8.07	9.52
78....	8.30	8.11	9.81 — 10
0.80....	8.05	8.15	0.10
82....	7.80	8.19	0.39
84....	7.55	8.23	0.68
86....	7.30	8.27	0.97
88....	7.05	8.31	1.26
0.90....	6.81 — 10	8.35 — 10	1.54

θ	$\log \varkappa_{H^-}$
0.90....	$8.35-10 + \log p_e + \log(1-x)$
92....	8.39
94....	8.42
96....	8.46
98....	8.49
1.00....	8.53
02....	8.57
04....	8.60
06....	8.64
08....	8.67
1.10....	8.71

Table 2.

$\log \frac{\varkappa_{H^-}}{\bar{\varkappa}_H}$	θ = 0.3	0.4	0.5	0.6	0.7	0.8	0.9
8.0—10	0.01	0.01	0.01	0.01	0.01	0.01	0.01
8.1...........	0.01	0.01	0.01	0.01	0.01	0.01	0.01
8.2...........	0.01	0.01	0.01	0.01	0.01	0.01	0.01
8.3...........	0.02	0.02	0.02	0.02	0.02	0.02	0.02
8.4...........	0.02	0.02	0.02	0.02	0.02	0.02	0.02
8.5...........	0.02	0.02	0.02	0.02	0.02	0.02	0.02
8.6...........	0.03	0.03	0.03	0.03	0.03	0.03	0.03
8.7...........	0.04	0.03	0.03	0.03	0.03	0.03	0.03
8.8...........	0.05	0.04	0.04	0.04	0.04	0.04	0.04
8.9...........	0.06	0.05	0.05	0.05	0.05	0.05	0.05
9.0...........	0.08	0.07	0.07	0.07	0.07	0.07	0.07
9.1...........	0.10	0.09	0.08	0.08	0.08	0.08	0.08
9.2...........	0.12	0.11	0.10	0.10	0.10	0.10	0.10
9.3...........	0.14	0.13	0.12	0.12	0.12	0.12	0.12
9.4...........	0.17	0.15	0.15	0.15	0.15	0.15	0.15
9.5...........	0.20	0.18	0.17	0.17	0.17	0.17	0.17
9.6...........	0.23	0.21	0.20	0.20	0.20	0.20	0.20
9.7...........	0.27	0.24	0.24	0.24	0.24	0.24	0.24
9.8...........	0.31	0.28	0.28	0.28	0.28	0.28	0.28
9.9—10	0.35	0.32	0.32	0.32	0.33	0.33	0.32
0.0...........	0.40	0.37	0.37	0.37	0.38	0.38	0.37
0.1...........	0.45	0.42	0.42	0.42	0.43	0.43	0.43
0.2...........	0.51	0.48	0.48	0.48	0.49	0.49	0.49
0.3...........	0.57	0.54	0.54	0.54	0.55	0.56	0.55
0.4...........	0.63	0.60	0.60	0.60	0.61	0.62	0.61
0.5...........	0.70	0.67	0.67	0.67	0.68	0.69	0.68
0.6...........	0.78	0.75	0.75	0.75	0.76	0.77	0.76
0.7...........	0.85	0.82	0.82	0.82	0.83	0.84	0.83
0.8...........	0.93	0.90	0.90	0.90	0.91	0.92	0.91
0.9...........	1.00	0.98	0.98	0.98	0.99	1.00	0.99
1.0...........	1.09	1.07	1.07	1.07	1.07	1.08	1.07
1.1...........	1.17	1.15	1.15	1.15	1.15	1.16	1.15
1.2...........	1.26	1.24	1.24	1.24	1.24	1.25	1.24
1.3...........	1.34	1.33	1.33	1.33	1.33	1.34	1.33
1.4...........	1.43	1.43	1.43	1.43	1.43	1.43	1.43
1.5...........	1.52	1.52	1.52	1.52	1.52	1.52	1.52
1.6...........	1.62	1.62	1.62	1.62	1.62	1.62	1.62
1.7...........	1.71	1.71	1.71	1.71	1.71	1.71	1.71
1.8...........	1.81	1.81	1.81	1.81	1.81	1.81	1.81
1.9...........	1.90	1.90	1.90	1.90	1.90	1.90	1.90
2.0...........	1.99	1.99	1.99	1.99	1.99	1.99	1.99

The table gives $\log \frac{\bar{\varkappa}}{\bar{\varkappa}_H}$

Table 3. Ionization

θ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
0.30......	6.02	5.82	5.62	5.42	5.22	5.02	4.82	4.62	4.42	4.22	4.02	3.82	3.62
32......	5.68	5.48	5.28	5.08	4.88	4.68	4.48	4.28	4.08	3.88	3.68	3.48	3.28
34......	5.35	5.15	4.95	4.75	4.55	4.35	4.15	3.95	3.75	3.55	3.35	3.15	2.95
36......	5.01	4.81	4.61	4.41	4.21	4.01	3.81	3.61	3.41	3.21	3.01	2.81	2.61
38......	4.68	4.48	4.28	4.08	3.88	3.68	3.48	3.28	3.08	2.88	2.68	2.48	2.28
0.40......	4.35	4.15	3.95	3.75	3.55	3.35	3.15	2.95	2.75	2.55	2.35	2.15	1.95
42......	4.03	3.83	3.63	3.43	3.23	3.03	2.83	2.63	2.43	2.23	2.03	1.84	1.64
44......	3.71	3.51	3.31	3.11	2.91	2.71	2.51	2.31	2.11	1.92	1.72	1.52	1.33
46......	3.39	3.19	2.99	2.79	2.59	2.39	2.19	1.99	1.80	1.60	1.41	1.22	1.03
48......	3.07	2.87	2.67	2.47	2.27	2.07	1.88	1.68	1.48	1.29	1.11	0.92	0.75
0.50......	2.76	2.56	2.36	2.16	1.96	1.77	1.57	1.38	1.19	1.01	0.83	0.67	0.52
52......	2.45	2.25	2.05	1.86	1.66	1.47	1.27	1.09	0.91	0.74	0.58	0.44	0.33
54......	2.14	1.94	1.75	1.55	1.36	1.17	0.99	0.81	0.65	0.50	0.38	0.27	0.19
56......	1.84	1.64	1.45	1.25	1.07	0.89	0.72	0.57	0.43	0.32	0.22	0.15	0.10
58......	1.53	1.34	1.15	0.97	0.80	0.63	0.49	0.37	0.26	0.18	0.12	0.08	0.05
0.60......	1.24	1.05	0.87	0.71	0.55	0.42	0.31	0.22	0.15	0.10	0.07	0.04	0.03
62......	0.96	0.79	0.63	0.48	0.36	0.26	0.18	0.12	0.08	0.05	0.03	0.02	0.01
64......	0.70	0.55	0.41	0.30	0.21	0.15	0.10	0.06	0.04	0.03	0.02	0.01	0.01
66......	0.48	0.35	0.25	0.18	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00
68......	0.30	0.21	0.15	0.10	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00
0.70......	0.17	0.12	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00
72......	0.10	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
74......	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76......	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
78......	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.80......	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The table gives

of *H.* I.

2.6	2.8	3.0	θ $\log p_e$	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
3.42	3.22	3.02	0.30......	3.02	2.82	2.62	2.42	2.22	2.02	1.83	1.63	1.44	1.25	1.06
3.08	2.88	2.68	32......	2.68	2.48	2.28	2.08	1.89	1.69	1.49	1.30	1.11	0.93	0.76
2.75	2.55	2.35	34......	2.35	2.15	1.95	1.76	1.56	1.37	1.18	1.00	0.82	0.66	0.51
2.41	2.21	2.01	36......	2.01	1.82	1.62	1.43	1.24	1.06	0.87	0.70	0.55	0.42	0.31
2.08	1.89	1.69	38......	1.69	1.49	1.30	1.11	0.93	0.76	0.60	0.46	0.34	0.25	0.17
1.76	1.56	1.37	0.40......	1.37	1.18	1.00	0.82	0.66	0.51	0.38	0.28	0.19	0.13	0.09
1.45	1.25	1.07	42......	1.07	0.89	0.72	0.57	0.43	0.32	0.23	0.16	0.10	0.07	0.04
1.14	0.96	0.79	44......	0.79	0.63	0.48	0.36	0.26	0.18	0.12	0.08			
0.86	0.69	0.54	46......	0.54	0.41	0.30	0.21	0.14	0.10	0.06				
0.60	0.46	0.34	48......	0.34	0.24	0.17	0.11	0.07	0.05	0.03				
0.39	0.28	0.20	0.50......	0.20	0.13	0.09	0.06	0.04	0.02					
0.23	0.16	0.11	52......	0.11	0.07	0.05	0.03	0.02	0.01					
0.13	0.09	0.06	54......	0.06	0.04	0.02	0.01	0.01	0.01					
0.07	0.04	0.03	56......	0.03	0.02	0.01	0.01	0.00	0.00					
0.03	0.02	0.01	58......	0.01	0.01	0.01	0.00	0.00	0.00					
0.02	0.01	0.01	0.60......	0.01	0.00	0.00	0.00	0.00	0.00					
0.01	0.01	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												
0.00	0.00	0.00												

$-\log(1-x_H)$

Table 4. Opacity $\bar{\varkappa}$. I.

θ \ $\log p_e$	9.0—10	9.2	9.4	9.6	9.8	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
0.30...						7.50	7.70	7.90	8.10	8.30	8.50	8.70	8.90	9.10	9.30	9.50
32...						7.68	7.88	8.08	8.28	8.48	8.68	8.88	9.08	9.28	9.48	9.68
34...						7.85	8.05	8.25	8.45	8.65	8.85	9.05	9.25	9.45	9.65	9.85
36...						8.03	8.23	8.43	8.63	8.83	9.03	9.23	9.43	9.63	9.83	0.03
38...						8.18	8.38	8.58	8.78	8.98	9.18	9.38	9.58	9.78	9.98	0.18
0.40...						8.33	8.53	8.73	8.93	9.13	9.33	9.53	9.73	9.93	0.13	0.33
42...						8.46	8.66	8.86	9.06	9.26	9.46	9.66	9.86	0.06	0.26	0.46
44...						8.59	8.79	8.99	9.19	9.39	9.59	9.79	9.99	0.19	0.38	0.58
46...						8.72	8.92	9.12	9.32	9.52	9.72	9.92	0.12	0.31	0.51	0.70
48...						8.83	9.03	9.23	9.43	9.63	9.83	0.02	0.22	0.42	0.61	0.79
0.50...						8.93	9.13	9.33	9.53	9.73	9.92	0.12	0.31	0.50	0.68	0.86
52...						9.01	9.21	9.41	9.60	9.80	9.99	0.19	0.37	0.55	0.72	0.89
54...						9.09	9.29	9.48	9.68	9.87	0.06	0.24	0.42	0.58	0.74	0.87
56...						9.16	9.36	9.55	9.75	9.93	0.11	0.28	0.43	0.58	0.70	0.81
58...						9.22	9.41	9.60	9.78	9.95	0.12	0.27	0.40	0.51	0.60	0.68
0.60...						9.28	9.47	9.65	9.81	9.97	0.11	0.23	0.33	0.41	0.48	0.55
62...						9.31	9.48	9.64	9.80	9.93	0.03	0.12	0.20	0.27	0.33	0.40
64...						9.33	9.48	9.63	9.75	9.85	9.92	9.99	0.06	0.13	0.19	0.27
66...						9.31	9.45	9.55	9.63	9.71	9.78	9.84	9.91	9.98	0.08	0.18
68...						9.26	9.35	9.42	9.50	9.57	9.63	9.69	9.78	9.88	9.98	0.11
0.70...						9.15	9.21	9.28	9.35	9.42	9.49	9.58	9.68	9.79	9.93	0.08
72...						9.00	9.07	9.13	9.19	9.27	9.37	9.48	9.61	9.74	9.89	0.05
74...						8.85	8.92	8.98	9.08	9.18	9.29	9.42	9.57	9.72	9.88	0.06
76...						8.69	8.77	8.88	8.98	9.12	9.25	9.40	9.56	9.72	9.90	0.08
78...						8.57	8.67	8.78	8.92	9.07	9.22	9.38	9.55	9.73	9.92	0.12
0.80...						8.46	8.60	8.73	8.88	9.04	9.20	9.38	9.56	9.76	9.95	0.14
82...						8.41	8.55	8.70	8.86	9.03	9.21	9.40	9.60	9.79	9.98	0.18
84...						8.37	8.53	8.69	8.86	9.04	9.24	9.43	9.62	9.82	0.02	0.22
86...						8.34	8.50	8.69	8.88	9.08	9.27	9.46	9.66	9.86	0.06	0.26
88...						8.33	8.53	8.72	8.91	9.10	9.30	9.50	9.70	9.90	0.10	0.30
90...	7.51	7.66	7.82	7.99	8.17	8.36	8.56	8.75	8.94	9.14	9.34	9.54	9.74	9.94	0.14	0.34

The table gives $\log \bar{\varkappa}$

Table 4 (continued). Opacity $\bar{\varkappa}$. I.

θ \ $\log p_e$	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
0.30...	9.50	9.70	9.90	0.10	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.69	1.89	2.08	2.28	2.47
32...	9.68	9.88	0.08	0.28	0.48	0.68	0.88	1.08	1.28	1.47	1.67	1.87	2.06	2.26	2.44	2.62
34...	9.85	0.05	0.25	0.45	0.65	0.85	1.05	1.25	1.44	1.64	1.83	2.02	2.21	2.40	2.56	2.72
36...	0.03	0.23	0.43	0.63	0.83	1.03	1.22	1.42	1.61	1.80	1.98	2.18	2.36	2.51	2.66	2.79
38...	0.18	0.38	0.58	0.78	0.97	1.17	1.37	1.56	1.75	1.93	2.11	2.28	2.43	2.56	2.68	2.79
0.40...	0.33	0.53	0.73	0.92	1.12	1.31	1.50	1.68	1.87	2.03	2.19	2.33	2.44	2.57	2.67	2.75
42...	0.46	0.65	0.85	1.04	1.24	1.42	1.60	1.78	1.94	2.08	2.20	2.31	2.42	2.52	2.59	2.68
44...	0.58	0.78	0.97	1.16	1.34	1.51	1.68	1.84	1.96	2.07	2.18	2.26	2.36			
46...	0.70	0.89	1.08	1.25	1.42	1.58	1.72	1.84	1.94	2.04	2.11	2.20				
48...	0.79	0.97	1.15	1.31	1.46	1.58	1.69	1.78	1.87	1.94	2.01	2.09				
0.50...	0.86	1.02	1.18	1.32	1.43	1.52	1.61	1.69	1.76	1.83	1.92					
52...	0.89	1.03	1.15	1.26	1.34	1.42	1.49	1.56	1.64	1.73	1.83					
54...	0.87	0.98	1.07	1.15	1.22	1.29	1.36	1.45	1.54	1.64	1.76					
56...	0.81	0.89	0.97	1.03	1.11	1.17	1.26	1.36	1.46	1.59	1.74					
58...	0.68	0.75	0.82	0.89	0.97	1.06	1.16	1.27	1.41	1.56	1.72					
0.60...	0.55	0.62	0.68	0.77	0.87	0.97	1.10	1.25	1.40	1.56	1.73					
62...	0.40	0.48	0.57	0.66	0.78	0.92	1.07	1.23	1.40	1.57	1.76					
64...	0.27	0.37	0.48	0.61	0.75	0.90	1.06	1.23	1.42	1.61	1.81					
66...	0.18	0.30	0.43	0.58	0.74	0.90	1.07	1.26	1.46	1.65	1.84					
68...	0.11	0.25	0.40	0.56	0.73	0.91	1.10	1.30	1.49	1.68	1.88					
0.70...	0.08	0.23	0.39	0.57	0.76	0.95	1.15	1.33	1.53	1.73	1.93					
72...	0.05	0.22	0.40	0.59	0.79	0.98	1.17	1.37	1.57	1.77	1.97					
74...	0.06	0.25	0.44	0.63	0.82	1.02	1.22	1.42	1.62	1.82	2.02					
76...	0.08	0.28	0.47	0.66	0.86	1.06	1.26	1.46	1.66	1.86	2.06					
78...	0.12	0.31	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10					
0.80...	0.14	0.34	0.54	0.74	0.94	1.14	1.34	1.54	1.74	1.94	2.14					
82...	0.18	0.38	0.58	0.78	0.98	1.18	1.38	1.58	1.78	1.98	2.18					
84...	0.22	0.42	0.62	0.82	1.02	1.22	1.42	1.62	1.82	2.02	2.22					
86...	0.26	0.46	0.66	0.86	1.06	1.26	1.46	1.66	1.86	2.06	2.26					
88...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30					
0.90...	0.34	0.54	0.74	0.94	1.14	1.34	1.54	1.74	1.94	2.14	2.34					

The table gives $\log \bar{\varkappa}$

Table 5. Ionization

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
0.30......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
32......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
34......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
36......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
38......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
0.40......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
42......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31
44......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31
46......	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.32	0.32
48......	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.32	0.33	0.35
0.50......	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.32	0.33	0.34	0.36	0.39
52......	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.32	0.33	0.35	0.37	0.41	0.46
54......	0.30	0.30	0.31	0.31	0.31	0.32	0.33	0.34	0.36	0.39	0.44	0.50	0.58
56......	0.31	0.31	0.31	0.31	0.32	0.33	0.35	0.38	0.41	0.47	0.54	0.63	0.75
58......	0.31	0.31	0.32	0.33	0.34	0.36	0.39	0.44	0.50	0.59	0.70	0.83	0.98
0.60......	0.32	0.32	0.33	0.35	0.38	0.42	0.48	0.55	0.65	0.77	0.92	1.07	1.25
62......	0.33	0.34	0.37	0.39	0.44	0.51	0.60	0.71	0.84	0.99	1.15	1.33	1.51
64......	0.35	0.38	0.42	0.48	0.55	0.66	0.78	0.92	1.08	1.25	1.44	1.62	1.82
66......	0.40	0.44	0.51	0.60	0.71	0.85	1.00	1.16	1.34	1.52	1.72	1.92	2.10
68......	0.48	0.55	0.66	0.78	0.92	1.08	1.25	1.44	1.62	1.82	2.00	2.20	2.40
0.70......	0.60	0.72	0.86	1.01	1.17	1.35	1.53	1.73	1.93	2.11	2.31	2.51	2.71
72......	0.79	0.92	1.09	1.26	1.45	1.63	1.83	2.01	2.21	2.41	2.61	2.81	3.01
74......	1.01	1.17	1.35	1.53	1.73	1.93	2.11	2.31	2.51	2.71	2.91	3.11	3.31
76......	1.26	1.45	1.63	1.83	2.01	2.21	2.41	2.61	2.81	3.01	3.21	3.41	3.61
78......	1.52	1.72	1.92	2.11	2.31	2.51	2.71	2.91	3.11	3.31	3.51	3.71	3.91
0.80......	1.82	2.00	2.20	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20
82......	2.10	2.30	2.50	2.70	2.90	3.10	3.30	3.50	3.70	3.90	4.10	4.30	4.50
84......	2.40	2.60	2.80	3.00	3.20	3.40	3.60	3.80	4.00	4.20	4.40	4.60	4.80
86......	2.70	2.90	3.10	3.30	3.50	3.70	3.90	4.10	4.30	4.50	4.70	4.90	5.10
88......	2.99	3.19	3.39	3.59	3.79	3.99	4.19	4.39	4.59	4.79	4.99	5.19	5.39
0.90......	3.29	3.49	3.69	3.89	4.09	4.29	4.49	4.69	4.89	5.09	5.29	5.49	5.69
92......	3.58	3.78	3.98	4.18	4.38	4.58	4.78	4.98	5.18	5.38	5.58	5.78	5.98
94......	3.88	4.08	4.28	4.48	4.68	4.88	5.08	5.28	5.48	5.68	5.88	6.08	6.28
96......	4.17	4.37	4.57	4.77	4.97	5.17	5.37	5.57	5.77	5.97	6.17	6.37	6.57
98......	4.46	4.66	4.86	5.06	5.26	5.46	5.66	5.86	6.06	6.26	6.46	6.66	6.86
1.00......	4.75	4.95	5.15	5.35	5.55	5.75	5.95	6.15	6.35	6.55	6.75	6.95	7.15
02......	5.04	5.24	5.44	5.64	5.84	6.04	6.24	6.44	6.64	6.84	7.04	7.24	7.44
04......	5.33	5.53	5.73	5.93	6.13	6.33	6.53	6.73	6.93	7.13	7.33	7.53	7.73

The table gives

of *H.* II.

2.6	2.8	3.0	θ \ $\log p_e$	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
0.30	0.30	0.30	0.30......	0.30	0.30	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.32	0.32
0.30	0.30	0.30	32......	0.30	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.32	0.33	0.34
0.30	0.30	0.30	34......	0.30	0.30	0.30	0.31	0.31	0.31	0.32	0.33	0.34	0.36	0.39
0.30	0.30	0.30	36......	0.30	0.31	0.31	0.31	0.32	0.33	0.33	0.35	0.38	0.42	0.48
0.30	0.31	0.31	38......	0.31	0.31	0.31	0.32	0.33	0.35	0.37	0.40	0.45	0.52	0.61
0.31	0.31	0.31	0.40......	0.31	0.32	0.33	0.34	0.36	0.39	0.43	0.50	0.57	0.68	0.81
0.32	0.32	0.32	42......	0.32	0.33	0.35	0.38	0.41	0.47	0.55	0.65	0.75	0.90	1.05
0.32	0.33	0.34	44......	0.34	0.37	0.40	0.44	0.51	0.60	0.71	0.84			
0.33	0.35	0.38	46......	0.38	0.42	0.48	0.56	0.66	0.79	0.93				
0.37	0.41	0.46	48......	0.46	0.52	0.62	0.73	0.87	1.02	1.19				
0.43	0.49	0.57	0.50......	0.57	0.67	0.80	0.95	1.11	1.28					
0.53	0.63	0.75	52......	0.75	0.88	1.04	1.21	1.39	1.57					
0.69	0.82	0.97	54......	0.97	1.13	1.30	1.48	1.68	1.88					
0.90	1.05	1.23	56......	1.23	1.41	1.59	1.79	1.98	2.17					
1.14	1.32	1.50	58......	1.50	1.70	1.90	2.08	2.28	2.48					
1.43	1.61	1.81	0.60......	1.81	1.99	2.19	2.39	2.59	2.79					
1.71	1.91	2.10	62......	2.10	2.29	2.49	2.69	2.89	3.09					
2.00	2.20	2.40	64......	2.40	2.60	2.80	3.00	3.20	3.40					
2.30	2.50	2.70	66......	2.70	2.90	3.10	3.30	3.50	3.70					
2.60	2.80	3.00	68......	3.00	3.20	3.40	3.60	3.80	4.00					
2.91	3.11	3.31	0.70......	3.31	3.51	3.71	3.91	4.11	4.31					
3.21	3.41	3.61	72......	3.61	3.81	4.01	4.21	4.41	4.61					
3.51	3.71	3.91	74......	3.91	4.11	4.31	4.51	4.71	4.91					
3.81	4.01	4.21	76......	4.21	4.41	4.61	4.81	5.01	5.21					
4.11	4.31	4.51	78......	4.51	4.71	4.91	5.11	5.31	5.51					
4.40	4.60	4.80	0.80......	4.80	5.00	5.20	5.40	5.60	5.80					
4.70	4.90	5.10	82......	5.10	5.30	5.50	5.70	5.90	6.10					
5.00	5.20	5.40	84......	5.40	5.60	5.80	6.00	6.20	6.40					
5.30	5.50	5.70	86......	5.70	5.90	6.10	6.30	6.50	6.70					
5.59	5.79	5.99	88......	5.99	6.19	6.39	6.59	6.79	6.99					
5.89	6.09	6.29	0.90......	6.29	6.49	6.69	6.89	7.09	7.29					
6.18	6.38	6.58												
6.48	6.68	6.88												
6.77	6.97	7.17												
7.06	7.26	7.46												
7.35	7.55	7.75												
7.64	7.84	8.04												
7.93	8.13	8.33												

$$\log \frac{1+x_H}{x_H} = \log \frac{p}{p_e} \text{ for pure hydrogen}$$

Table 6. Ionization of metal mixture.

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4
0.70...	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.98
72...	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.98	0.97
74...	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.98	0.98	0.96	0.94
76...	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.99	0.97	0.96	0.93	0.90
78...	1.00	1.00	1.00	1.00	1.00	0.99	0.99	0.98	0.98	0.96	0.93	0.89	0.86
0.80...	1.00	1.00	1.00	1.00	0.99	0.98	0.98	0.97	0.96	0.93	0.89	0.85	0.81
82...	1.00	1.00	1.00	1.00	0.98	0.98	0.97	0.96	0.93	0.89	0.85	0.80	0.75
84...	1.00	1.00	0.99	0.99	0.98	0.97	0.96	0.94	0.90	0.85	0.80	0.74	0.68
86...	1.00	0.99	0.99	0.99	0.97	0.96	0.94	0.91	0.86	0.81	0.74	0.67	0.60
88...	0.99	0.99	0.98	0.98	0.96	0.94	0.91	0.87	0.81	0.75	0.67	0.60	0.52
0.90...	0.99	0.98	0.98	0.96	0.95	0.92	0.88	0.83	0.75	0.68	0.60	0.52	0.44
92...	0.98	0.98	0.97	0.94	0.93	0.89	0.84	0.77	0.69	0.60	0.52	0.44	0.37
94...	0.98	0.97	0.95	0.92	0.89	0.84	0.78	0.70	0.62	0.53	0.44	0.37	0.30
96...	0.96	0.95	0.93	0.89	0.85	0.79	0.73	0.63	0.54	0.45	0.37	0.30	0.24
98...	0.95	0.93	0.90	0.85	0.80	0.73	0.65	0.57	0.48	0.38	0.30	0.24	0.19
1.00...	0.93	0.90	0.86	0.80	0.74	0.67	0.58	0.50	0.41	0.32	0.25	0.19	0.15
02...	0.90	0.86	0.81	0.74	0.67	0.60	0.51	0.43	0.35	0.27	0.20	0.14	0.11
04...	0.86	0.81	0.75	0.68	0.60	0.52	0.44	0.37	0.29	0.22	0.16	0.11	0.08
06...	0.82	0.75	0.69	0.61	0.53	0.45	0.37	0.30	0.24	0.18	0.12	0.09	0.06
08...	0.78	0.69	0.62	0.53	0.45	0.38	0.30	0.24	0.19	0.14	0.10	0.07	0.05
1.10...	0.73	0.63	0.54	0.46	0.38	0.31	0.24	0.19	0.14	0.11	0.08	0.06	0.04

θ \ $\log p_e$	9.0—10	9.2	9.4	9.6	9.8	0.0
0.90...	1.00	1.00	1.00	1.00	0.99	0.99
92...	1.00	1.00	1.00	1.00	0.99	0.98
94...	1.00	1.00	1.00	0.99	0.98	0.98
96...	1.00	1.00	0.99	0.99	0.97	0.96
98...	1.00	0.99	0.99	0.97	0.96	0.95
1.00...	0.99	0.99	0.99	0.97	0.95	0.93
02...	0.99	0.99	0.98	0.95	0.92	0.90
04...	0.99	0.97	0.96	0.93	0.90	0.86
06...	0.98	0.96	0.94	0.90	0.86	0.82
08...	0.96	0.95	0.91	0.87	0.82	0.78
1.10...	0.95	0.92	0.88	0.83	0.78	0.73

The table gives x_M

Table 7. Ionization of matter in stellar atmospheres.
$\log A = 3.0, 3.4, 3.8, 4.2$ and pure H.

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
0.30...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	3.30
32...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	3.30
34...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	3.30
36...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.10	3.30
38...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.90	3.11	3.31
0.40...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	2.91	3.11	3.31
42...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.10	2.30	2.51	2.71	2.92	3.12	3.32
44...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.90	2.11	2.31	2.51	2.71	2.92	3.13	3.34
46...	0.30	0.50	0.70	0.90	1.10	1.30	1.50	1.70	1.91	2.11	2.31	2.52	2.72	2.93	3.15	3.38
48...	0.30	0.50	0.70	0.90	1.10	1.30	1.51	1.71	1.91	2.11	2.32	2.53	2.75	2.97	3.21	3.46
0.50...	0.30	0.50	0.70	0.90	1.10	1.31	1.51	1.71	1.92	2.13	2.34	2.56	2.79	3.03	3.29	3.57
52...	0.30	0.50	0.70	0.91	1.11	1.31	1.51	1.72	1.93	2.15	2.37	2.61	2.86	3.13	3.43	3.75
54...	0.30	0.50	0.71	0.91	1.11	1.32	1.53	1.74	1.96	2.19	2.44	2.70	2.98	3.29	3.62	3.97
56...	0.31	0.51	0.71	0.91	1.12	1.33	1.55	1.78	2.01	2.27	2.54	2.83	3.15	3.50	3.85	4.23
58...	0.31	0.51	0.72	0.93	1.14	1.36	1.59	1.84	2.10	2.39	2.70	3.03	3.38	3.74	4.12	4.50
0.60...	0.32	0.52	0.73	0.95	1.18	1.42	1.68	1.95	2.25	2.57	2.92	3.27	3.65	4.03	4.41	4.81

The table gives $\log p$

θ \ $\log p_e$	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
0.30...	3.30	3.50	3.70	3.90	4.10	4.30	4.51	4.71	4.91	5.12	5.32
32...	3.30	3.50	3.70	3.90	4.11	4.31	4.51	4.71	4.92	5.13	5.34
34...	3.30	3.50	3.70	3.91	4.11	4.31	4.52	4.73	4.94	5.16	5.39
36...	3.30	3.51	3.71	3.91	4.12	4.33	4.53	4.75	4.98	5.22	5.48
38...	3.31	3.51	3.71	3.92	4.13	4.35	4.57	4.80	5.05	5.32	5.61
0.40...	3.31	3.52	3.73	3.94	4.16	4.39	4.63	4.90	5.17	5.48	5.81
42...	3.32	3.53	3.75	3.98	4.21	4.47	4.75	5.06	5.35	5.70	6.05
44...	3.34	3.57	3.80	4.04	4.31	4.60	4.91	5.24			
46...	3.38	3.62	3.88	4.16	4.46	4.79	5.13				
48...	3.46	3.72	4.02	4.33	4.67	5.02	5.39				
0.50...	3.57	3.87	4.20	4.55	4.91	5.28					
52...	3.75	4.08	4.44	4.81	5.19	5.57					
54...	3.97	4.33	4.70	5.08	5.48	5.88					
56...	4.23	4.61	4.99	5.39	5.78	6.17					
58...	4.50	4.90	5.30	5.68	6.08	6.48					
0.60...	4.81	5.19	5.59	5.99	6.39	6.79					

The table gives $\log p$

Table 7 (continued).

Ionization of matter in stellar atmospheres. $\log A = 3.0$.

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
0.60...	0.32	0.52	0.73	0.95	1.18	1.42	1.68	1.95	2.25	2.57	2.92	3.26	3.64	4.02	4.39	4.78
62...	0.33	0.54	0.77	0.99	1.24	1.51	1.80	2.11	2.44	2.79	3.14	3.52	3.90	4.29	4.68	5.05
64...	0.35	0.58	0.82	1.08	1.35	1.66	1.98	2.32	2.67	3.04	3.43	3.80	4.19	4.56	4.94	5.30
66...	0.40	0.64	0.91	1.20	1.51	1.85	2.20	2.55	2.93	3.31	3.70	4.09	4.45	4.82	5.18	5.52
68...	0.48	0.75	1.06	1.38	1.72	2.08	2.44	2.83	3.20	3.59	3.96	4.34	4.70	5.06	5.39	5.70
0.70...	0.60	0.92	1.26	1.61	1.96	2.34	2.72	3.11	3.50	3.86	4.23	4.59	4.92	5.26	5.55	5.83
72...	0.79	1.12	1.49	1.86	2.24	2.61	3.00	3.37	3.74	4.11	4.46	4.80	5.11			
74...	1.01	1.37	1.75	2.13	2.51	2.90	3.26	3.63	3.99	4.33	4.66	4.96	5.28			
76...	1.25	1.64	2.01	2.40	2.77	3.14	3.51	3.86	4.20	4.51	4.80	5.08				
78...	1.51	1.90	2.29	2.66	3.03	3.39	3.73	4.06	4.35	4.64	4.91	5.17				
0.80...	1.79	2.16	2.54	2.90	3.26	3.59	3.90	4.20	4.47	4.73	4.98	5.22				
82...	2.05	2.42	2.78	3.12	3.45	3.75	4.03	4.29	4.55	4.79	5.03	5.27				
84...	2.30	2.65	2.99	3.30	3.59	3.86	4.12	4.36	4.60	4.84	5.08	5.32				
86...	2.52	2.85	3.15	3.43	3.69	3.94	4.17	4.40	4.64	4.87	5.12	5.37				
88...	2.67	2.99	3.26	3.51	3.76	3.98	4.21	4.44	4.68	4.92	5.17	5.42				
0.90...	2.82	3.09	3.33	3.56	3.79	4.01	4.24	4.47	4.72	4.96	5.22	5.48				
92...	2.91	3.14	3.37	3.60	3.81	4.04	4.27	4.51	4.76	5.02	5.28					
94...	2.95	3.18	3.40	3.62	3.84	4.07	4.30	4.55	4.81	5.07	5.36					
96...	2.99	3.20	3.42	3.64	3.86	4.10	4.33	4.60	4.87	5.15	5.43					
98...	3.01	3.22	3.44	3.67	3.89	4.13	4.38	4.64	4.92	5.22	5.52					
1.00...	3.02	3.24	3.46	3.69	3.93	4.17	4.44	4.70	4.99	5.29	5.60					
02...	3.04	3.26	3.49	3.73	3.97	4.22	4.49	4.77	5.06	5.37	5.70					
04...	3.06	3.29	3.52	3.77	4.02	4.28	4.56	4.83	5.14	5.46	5.80					

The table gives $\log p$

Table 7 (continued).

Ionization of matter in stellar atmospheres. $\log A = 3.4$.

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
0.60...	0.32	0.52	0.73	0.95	1.18	1.42	1.68	1.95	2.25	2.57	2.92	3.27	3.65	4.02	4.40	4.80
62...	0.33	0.54	0.77	0.99	1.24	1.51	1.80	2.11	2.44	2.79	3.15	3.53	3.90	4.30	4.70	5.08
64...	0.35	0.58	0.82	1.08	1.35	1.66	1.98	2.32	2.68	3.05	3.44	3.81	4.20	4.58	4.97	5.36
66...	0.40	0.64	0.91	1.20	1.51	1.85	2.20	2.56	2.94	3.31	3.71	4.11	4.48	4.87	5.25	5.62
68...	0.48	0.75	1.06	1.38	1.72	2.08	2.45	2.84	3.21	3.61	3.98	4.37	4.76	5.14	5.50	5.85
0.70...	0.60	0.92	1.26	1.61	1.97	2.35	2.72	3.12	3.52	3.89	4.28	4.66	5.03	5.39	5.73	6.05
72...	0.79	1.12	1.49	1.86	2.24	2.62	3.02	3.39	3.78	4.17	4.55	4.91	5.27			
74...	1.01	1.37	1.75	2.13	2.52	2.92	3.29	3.68	4.06	4.43	4.79	5.14	5.47			
76...	1.26	1.64	2.02	2.42	2.79	3.18	3.57	3.95	4.31	4.67	5.00	5.32				
78...	1.51	1.91	2.31	2.69	3.08	3.46	3.83	4.19	4.53	4.86	5.17	5.46				
0.80...	1.81	2.18	2.57	2.96	3.34	3.71	4.06	4.39	4.71	5.01	5.29	5.56				
82...	2.08	2.47	2.85	3.22	3.58	3.93	4.25	4.56	4.84	5.12	5.38	5.63				
84...	2.36	2.74	3.10	3.45	3.78	4.11	4.40	4.67	4.94	5.20	5.45	5.69				
86...	2.62	2.98	3.32	3.65	3.95	4.24	4.50	4.76	5.01	5.25	5.50	5.75				
88...	2.85	3.18	3.50	3.79	4.06	4.32	4.57	4.81	5.06	5.30	5.56	5.81				
0.90...	3.04	3.35	3.63	3.89	4.14	4.38	4.62	4.86	5.11	5.35	5.61	5.88				
92...	3.19	3.45	3.71	3.96	4.19	4.42	4.65	4.90	5.15	5.41	5.68					
94...	3.28	3.53	3.77	4.00	4.23	4.46	4.70	4.95	5.20	5.47	5.75					
96...	3.35	3.58	3.80	4.03	4.26	4.49	4.73	5.00	5.26	5.54	5.83					
98...	3.38	3.61	3.83	4.06	4.29	4.53	4.78	5.04	5.32	5.62	5.92					
1.00...	3.41	3.63	3.86	4.09	4.33	4.57	4.83	5.10	5.39	5.70	6.00					
02...	3.44	3.66	3.89	4.13	4.37	4.62	4.89	5.17	5.46	5.77	6.10					
04...	3.46	3.69	3.92	4.17	4.42	4.68	4.96	5.23	5.54	5.86	6.19					

The table gives $\log p$

Table 7 (continued).

Ionization of matter in stellar atmospheres. $\log A = 3.8$.

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
0.60...	0.32	0.52	0.73	0.95	1.18	1.42	1.68	1.95	2.25	2.57	2.92	3.27	3.65	4.03	4.41	4.80
62...	0.33	0.54	0.77	0.99	1.24	1.51	1.80	2.11	2.44	2.79	3.15	3.53	3.91	4.31	4.70	5.09
64...	0.35	0.58	0.82	1.08	1.35	1.66	1.98	2.32	2.68	3.05	3.44	3.82	4.21	4.59	4.99	5.38
66...	0.40	0.64	0.91	1.20	1.51	1.85	2.20	2.56	2.94	3.32	3.71	4.11	4.49	4.89	5.28	5.67
68...	0.48	0.75	1.06	1.38	1.72	2.08	2.45	2.84	3.22	3.62	3.99	4.39	4.78	5.17	5.56	5.94
0.70...	0.60	0.92	1.26	1.61	1.97	2.35	2.73	3.13	3.52	3.90	4.30	4.69	5.08	5.46	5.83	6.19
72...	0.79	1.12	1.49	1.86	2.25	2.63	3.02	3.40	3.80	4.19	4.58	4.97	5.35			
74...	1.01	1.37	1.75	2.13	2.53	2.92	3.30	3.70	4.09	4.48	4.86	5.23	5.59			
76...	1.26	1.65	2.03	2.42	2.80	3.20	3.59	3.98	4.37	4.75	5.11	5.47				
78...	1.52	1.92	2.31	2.70	3.10	3.49	3.88	4.26	4.63	4.99	5.34	5.67				
0.80...	1.82	2.19	2.59	2.98	3.37	3.76	4.14	4.51	4.86	5.20	5.52	5.83				
82...	2.09	2.49	2.88	3.27	3.65	4.02	4.38	4.73	5.06	5.37	5.67	5.95				
84...	2.38	2.77	3.16	3.54	3.90	4.26	4.59	4.91	5.22	5.51	5.78	6.05				
86...	2.67	3.05	3.42	3.78	4.13	4.45	4.76	5.05	5.33	5.60	5.86	6.12				
88...	2.93	3.30	3.65	3.98	4.30	4.60	4.88	5.15	5.41	5.67	5.94	6.20				
0.90...	3.17	3.52	3.84	4.15	4.44	4.71	4.97	5.22	5.48	5.74	6.00	6.27				
92...	3.38	3.69	3.99	4.27	4.52	4.78	5.02	5.28	5.54	5.80	6.07					
94...	3.54	3.83	4.09	4.35	4.59	4.84	5.08	5.34	5.60	5.87	6.15					
96...	3.66	3.91	4.16	4.40	4.64	4.88	5.12	5.39	5.66	5.94	6.23					
98...	3.73	3.97	4.21	4.44	4.68	4.93	5.18	5.44	5.71	6.01	6.33					
1.00...	3.78	4.02	4.24	4.48	4.72	4.97	5.23	5.50	5.79	6.09	6.40					
02...	3.82	4.05	4.28	4.52	4.77	5.02	5.29	5.57	5.86	6.17	6.49					
04...	3.85	4.08	4.32	4.57	4.82	5.09	5.35	5.64	5.94	6.26	6.60					

The table gives $\log p$

Table 7 (continued).

Ionization of matter in stellar atmospheres. $\log A = 4.2$.

θ \ $\log p_e$	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2
0.60..	0.32	0.52	0.73	0.95	1.18	1.42	1.68	1.95	2.25	2.57	2.92	3.27	3.65	4.03	4.41	4.81	5.19
62..	0.33	0.54	0.77	0.99	1.24	1.51	1.80	2.11	2.44	2.79	3.15	3.53	3.91	4.31	4.71	5.10	5.49
64..	0.35	0.58	0.82	1.08	1.35	1.66	1.98	2.32	2.68	3.05	3.44	3.82	4.22	4.60	5.00	5.39	5.78
66..	0.40	0.64	0.91	1.20	1.51	1.85	2.20	2.56	2.94	3.32	3.71	4.12	4.50	4.90	5.29	5.69	6.08
68..	0.48	0.75	1.06	1.38	1.72	2.08	2.45	2.84	3.22	3.62	4.00	4.40	4.79	5.19			
0.70..	0.60	0.92	1.26	1.61	1.97	2.35	2.73	3.13	3.53	3.91	4.30	4.70	5.10	5.49			
72..	0.79	1.12	1.49	1.86	2.25	2.63	3.03	3.41	3.81	4.20	4.60	4.99	5.38				
74..	1.01	1.37	1.75	2.13	2.53	2.93	3.31	3.70	4.10	4.50	4.89	5.28	5.66				
76..	1.26	1.65	2.03	2.43	2.81	3.21	3.60	4.00	4.39	4.78	5.17	5.55					
78..	1.52	1.92	2.32	2.71	3.10	3.50	3.90	4.29	4.68	5.06	5.43	5.80					
0.80..	1.82	2.20	2.60	2.99	3.39	3.79	4.17	4.56	4.94	5.31	5.67	6.01					
82..	2.10	2.49	2.89	3.29	3.68	4.07	4.45	4.82	5.19	5.54	5.88	6.20					
84..	2.39	2.79	3.19	3.57	3.96	4.34	4.71	5.06	5.40	5.73	6.04	6.34					
86..	2.69	3.08	3.47	3.85	4.22	4.58	4.93	5.26	5.58	5.88	6.18	6.46					
88..	2.97	3.35	3.73	4.10	4.45	4.79	5.11	5.42	5.71	6.00	6.28	6.55					
0.90..	3.24	3.61	3.98	4.32	4.65	4.96	5.26	5.54	5.82	6.09	6.37	6.64					
92..	3.49	3.84	4.18	4.50	4.80	5.09	5.36	5.63	5.89	6.18	6.44						
94..	3.71	4.04	4.35	4.64	4.91	5.18	5.44	5.71	5.98	6.26	6.54						
96..	3.90	4.19	4.47	4.74	4.99	5.24	5.50	5.77	6.04	6.34	6.62						
98..	4.02	4.29	4.55	4.80	5.06	5.31	5.57	5.83	6.11	6.40	6.72						
1.00..	4.11	4.37	4.61	4.86	5.10	5.36	5.62	5.88	6.19	6.50	6.80						
02..	4.18	4.42	4.66	4.91	5.16	5.41	5.68	5.97	6.26	6.57	6.89						
04..	4.23	4.47	4.71	4.96	5.21	5.48	5.75	6.04	6.34	6.65	7.00						

The table gives $\log p$

Table 8. Ionization of matter in stellar atmospheres.

θ \ log p	0.0	0.2	0.4	0.6	0.8	1.0	1.2	1.4
0.30	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
32	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
34	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
36	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
38	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
0.40	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
42	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
44	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
46	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
48	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.10
0.50	—0.30	—0.10	0.10	0.30	0.50	0.70	0.90	1.09
52	—0.30	—0.10	0.10	0.30	0.50	0.69	0.89	1.09
54	—0.30	—0.10	0.10	0.30	0.49	0.69	0.89	1.08
56	—0.30	—0.11	0.09	0.29	0.49	0.69	0.88	1.06
58	—0.30	—0.11	0.09	0.29	0.48	0.67	0.85	1.03
0.60	—0.31	—0.11	0.08	0.28	0.46	0.64	0.82	0.98

The table gives

θ \ log p	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4
0.30	2.70	2.90	3.10	3.30	3.50	3.70	3.90	4.10
32	2.70	2.90	3.10	3.30	3.50	3.70	3.89	4.09
34	2.70	2.90	3.10	3.30	3.50	3.69	3.89	4.09
36	2.70	2.90	3.10	3.29	3.49	3.69	3.88	4.07
38	2.70	2.89	3.09	3.29	3.49	3.68	3.86	4.05
0.40	2.69	2.89	3.09	3.28	3.47	3.65	3.83	4.01
42	2.68	2.88	3.08	3.26	3.44	3.62	3.79	3.95
44	2.68	2.87	3.05	3.23	3.40	3.57	3.72	3.86
46	2.66	2.84	3.02	3.18	3.34	3.49	3.63	3.76
48	2.62	2.79	2.95	3.11	3.25	3.39	3.52	3.64
0.50	2.58	2.73	2.88	3.02	3.15	3.28	3.40	3.51
52	2.50	2.65	2.78	2.91	3.03	3.15	3.27	3.38
54	2.41	2.54	2.67	2.79	2.90	3.02	3.13	3.24
56	2.31	2.43	2.54	2.66	2.77	2.88	2.98	3.09
58	2.18	2.30	2.41	2.52	2.63	2.74	2.84	2.95
0.60	2.05	2.16	2.27	2.37	2.48	2.58	2.69	2.79

The table gives

log A = 3.0, 3.4, 3.8, 4.2 and pure H.

1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	θ
1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	............0.30
1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	 32
1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	 34
1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	 36
1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.70	 38
1.30	1.50	1.70	1.90	2.10	2.30	2.50	2.69	............0.40
1.30	1.50	1.70	1.90	2.10	2.29	2.49	2.68	 42
1.30	1.50	1.70	1.89	2.09	2.29	2.49	2.68	 44
1.30	1.50	1.69	1.89	2.09	2.28	2.48	2.66	 46
1.29	1.49	1.69	1.89	2.08	2.26	2.45	2.62	 48
1.29	1.49	1.68	1.87	2.05	2.23	2.41	2.58	............0.50
1.29	1.48	1.66	1.85	2.02	2.19	2.35	2.50	 52
1.27	1.45	1.63	1.81	1.97	2.12	2.27	2.41	 54
1.24	1.42	1.59	1.75	1.90	2.04	2.18	2.31	 56
1.21	1.37	1.52	1.67	1.81	1.94	2.06	2.18	 58
1.14	1.29	1.43	1.57	1.69	1.82	1.93	2.05	............0.60

log p_e

4.6	4.8	5.0	5.2	5.4	θ
4.29	4.49	4.69	4.88		............0.30
4.29	4.49	4.68	4.87		 32
4.28	4.47	4.65	4.83		 34
4.26	4.44	4.62	4.78	4.94	 36
4.23	4.40	4.56	4.71	4.86	 38
4.18	4.33	4.47	4.62	4.75	............0.40
4.09	4.23	4.36	4.50	4.63	 42
4.00	4.13	4.25	4.38	4.49	 44
3.88	4.01	4.12	4.24	4.35	 46
3.76	3.87	3.99	4.10	4.21	 48
3.63	3.74	3.85	3.96	4.06	............0.50
3.45	3.59	3.70	3.81	3.91	 52
3.39	3.45	3.56	3.66	3.76	 54
3.19	3.30	3.40	3.50	3.61	 56
3.05	3.15	3.25	3.35	3.45	 58
3.00	3.10	3.20	3.30	2.90	............0.60

log p_e

Table 8 (continued). Ionization of matter

θ \ log p	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
0.60	0.08	0.28	0.46	0.64	0.82	0.98	1.14	1.29	1.43
62	0.07	0.25	0.43	0.61	0.77	0.92	1.06	1.20	1.33
64	0.04	0.22	0.38	0.54	0.69	0.83	0.96	1.09	1.21
66	0.00	0.17	0.32	0.46	0.60	0.73	0.85	0.97	1.09
68		0.09	0.23	0.36	0.49	0.61	0.73	0.84	0.95
0.70		0.00	0.13	0.25	0.36	0.48	0.59	0.71	0.82
72			0.01	0.13	0.24	0.35	0.46	0.57	0.67
74				—0.01	0.11	0.22	0.32	0.43	0.53
76						0.08	0.18	0.29	0.39
78							0.05	0.15	0.25
0.80								0.01	0.11
82									
84									
86									
88									
0.90					—1.00	—0.89	—0.78	—0.67	—0.55
92						—1.02	—0.91	—0.79	—0.66
94								—0.89	—0.76
96									—0.84
98									—0.90
1.00									—0.94
02									—0.97
04									—0.98

The table gives

θ \ log p	4.0	4.2	4.4	4.6	4.8	5.0	5.2
0.60	2.59	2.70	2.81	2.91	3.01		
62	2.45	2.55	2.66	2.76	2.86	2.97	
64	2.30	2.41	2.51	2.62	2.73	2.83	2.94
66	2.15	2.26	2.37	2.48	2.59	2.70	2.81
68	2.02	2.13	2.23	2.34	2.46	2.57	2.68
0.70	1.88	1.98	2.09	2.21	2.33	2.45	2.56
72	1.74	1.85	1.97	2.08	2.20	2.33	2.45
74	1.61	1.72	1.84	1.96	2.09	2.22	2.35
76	1.48	1.60	1.73	1.86	2.00	2.14	2.28
78	1.36	1.50	1.63	1.78	1.92	2.07	2.22
0.80	1.27	1.40	1.55	1.70	1.86	2.02	2.18
82	1.18	1.33	1.48	1.64	1.81	1.98	2.14
84	1.11	1.27	1.43	1.60	1.77	1.93	2.10
86	1.05	1.23	1.40	1.57	1.74	1.90	2.06
88	1.02	1.19	1.37	1.53	1.70	1.86	2.02
0.90	0.99	1.17	1.34	1.50	1.67	1.83	1.98
92	0.97	1.14	1.31	1.47	1.63	1.78	1.94
94	0.94	1.11	1.28	1.44	1.59	1.75	1.89
96	0.92	1.09	1.25	1.40	1.55	1.69	1.84
98	0.89	1.06	1.22	1.37	1.51	1.65	1.79
1.00	0.86	1.02	1.17	1.32	1.47	1.61	1.74
02	0.82	0.98	1.13	1.28	1.43	1.56	1.69
04	0.78	0.94	1.09	1.23	1.38	1.51	1.64

The table gives

in stellar atmospheres. $\log A = 3.0$.

2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	θ
1.57	1.69	1.82	1.93	2.05	2.16	2.27	2.38	2.48	2.59	....0.60
1.46	1.58	1.69	1.81	1.92	2.03	2.14	2.24	2.35	2.45	 62
1.33	1.45	1.56	1.67	1.78	1.88	1.98	2.09	2.20	2.30	 64
1.20	1.31	1.43	1.53	1.64	1.74	1.85	1.95	2.05	2.15	 66
1.07	1.18	1.28	1.38	1.49	1.60	1.70	1.81	1.91	2.02	 68
0.93	1.03	1.14	1.24	1.34	1.45	1.55	1.66	1.77	1.88	....0.70
0.78	0.89	0.99	1.10	1.20	1.31	1.42	1.52	1.63	1.74	 72
0.64	0.74	0.85	0.95	1.06	1.17	1.28	1.38	1.49	1.61	 74
0.50	0.60	0.71	0.82	0.92	1.03	1.14	1.25	1.37	1.48	 76
0.35	0.46	0.57	0.68	0.78	0.89	1.01	1.12	1.24	1.36	 78
0.22	0.33	0.43	0.54	0.66	0.77	0.88	1.01	1.13	1.27	....0.80
0.08	0.19	0.30	0.41	0.53	0.65	0.77	0.90	1.04	1.18	 82
	0.06	0.17	0.29	0.41	0.53	0.67	0.81	0.96	1.11	 84
		0.05	0.17	0.30	0.44	0.58	0.73	0.89	1.05	 86
			0.08	0.21	0.36	0.51	0.67	0.84	1.02	 88
−0.42	−0.29	−0.15	−0.01	0.13	0.29	0.46	0.63	0.81	0.99	....0.90
−0.52	−0.38	−0.24	−0.08	0.08	0.25	0.43	0.60	0.79	0.97	 92
−0.61	−0.46	−0.30	−0.13	0.04	0.22	0.40	0.58	0.76	0.94	 94
−0.68	−0.52	−0.35	−0.17	0.01	0.20	0.38	0.56	0.75	0.92	 96
−0.73	−0.56	−0.38	−0.20	−0.01	0.18	0.36	0.54	0.72	0.89	 98
−0.76	−0.57	−0.39	−0.22	−0.02	0.16	0.35	0.52	0.69	0.86	....1.00
−0.78	−0.59	−0.41	−0.23	−0.04	0.15	0.32	0.49	0.66	0.82	 02
−0.80	−0.61	−0.43	−0.24	−0.06	0.12	0.30	0.46	0.62	0.78	 04

$\log p_e$

$\log p_e$

Table 8 (continued). Ionization of matter

θ \ log p	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
0.60	0.08	0.28	0.46	0.64	0.82	0.98	1.14	1.29	1.43
62	0.07	0.25	0.43	0.61	0.77	0.92	1.06	1.20	1.33
64	0.04	0.22	0.38	0.54	0.69	0.83	0.96	1.09	1.21
66	0.00	0.17	0.32	0.46	0.60	0.73	0.85	0.97	1.09
68		0.09	0.23	0.36	0.49	0.61	0.73	0.84	0.95
0.70		0.00	0.13	0.25	0.36	0.48	0.59	0.70	0.81
72			0.01	0.13	0.24	0.35	0.46	0.57	0.67
74				−0.01	0.11	0.22	0.32	0.43	0.53
76						0.07	0.18	0.28	0.39
78							0.04	0.14	0.25
0.80								−0.01	0.10
82									−0.04
84									
86									
88									
0.90						−0.93	−0.82	−0.71	−0.61
92							−0.96	−0.85	−0.74
94								−0.98	−0.86
96									−0.98
98									
1.00									
02									
04									

The table gives

θ \ log p	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4
0.60	2.59	2.70	2.80	2.90	3.00	3.11		
62	2.45	2.55	2.65	2.75	2.85	2.96		
64	2.30	2.40	2.51	2.61	2.71	2.81	2.92	
66	2.14	2.25	2.36	2.46	2.56	2.67	2.77	2.88
68	2.01	2.11	2.22	2.32	2.42	2.52	2.63	2.74
0.70	1.86	1.96	2.06	2.17	2.27	2.38	2.49	2.61
72	1.71	1.81	1.92	2.03	2.14	2.25	2.36	2.48
74	1.56	1.67	1.78	1.89	2.01	2.12	2.24	2.36
76	1.43	1.54	1.65	1.76	1.88	2.00	2.12	2.26
78	1.29	1.41	1.52	1.64	1.76	1.89	2.02	2.16
0.80	1.16	1.28	1.40	1.53	1.66	1.79	1.94	2.08
82	1.04	1.17	1.30	1.43	1.57	1.71	1.86	2.01
84	0.93	1.06	1.20	1.35	1.50	1.65	1.80	1.96
86	0.83	0.97	1.12	1.28	1.43	1.59	1.76	1.92
88	0.76	0.91	1.06	1.22	1.39	1.56	1.72	1.88
0.90	0.69	0.85	1.02	1.18	1.35	1.51	1.68	1.84
92	0.63	0.81	0.98	1.15	1.32	1.48	1.64	1.79
94	0.60	0.77	0.95	1.12	1.28	1.44	1.60	1.75
96	0.58	0.75	0.92	1.09	1.25	1.40	1.55	1.70
98	0.55	0.72	0.89	1.06	1.21	1.37	1.51	1.65
1.00	0.52	0.69	0.86	1.02	1.18	1.33	1.46	1.61
02	0.48	0.66	0.82	0.98	1.13	1.28	1.42	1.56
04	0.46	0.62	0.78	0.94	1.09	1.23	1.38	1.51

The table gives

in stellar atmospheres. $\log A = 3.4$.

2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	θ
1.57	1.69	1.82	1.93	2.05	2.16	2.27	2.37	2.48	2.59	....0.60
1.46	1.58	1.69	1.81	1.92	2.03	2.13	2.24	2.35	2.45	 62
1.33	1.44	1.56	1.66	1.77	1.88	1.98	2.09	2.20	2.30	 64
1.20	1.31	1.42	1.53	1.63	1.74	1.84	1.94	2.04	2.14	 66
1.06	1.17	1.28	1.38	1.49	1.59	1.70	1.80	1.90	2.01	 68
0.92	1.02	1.13	1.24	1.34	1.44	1.54	1.64	1.75	1.86	....0.70
0.78	0.88	0.99	1.09	1.19	1.29	1.40	1.50	1.61	1.71	 72
0.64	0.74	0.84	0.94	1.04	1.15	1.26	1.36	1.46	1.56	 74
0.49	0.59	0.70	0.81	0.91	1.01	1.11	1.22	1.32	1.43	 76
0.35	0.45	0.55	0.66	0.76	0.86	0.97	1.08	1.18	1.29	 78
0.21	0.31	0.42	0.52	0.62	0.73	0.83	0.94	1.05	1.16	....0.80
0.06	0.16	0.27	0.37	0.48	0.59	0.70	0.81	0.92	1.04	 82
	0.02	0.12	0.23	0.34	0.46	0.57	0.69	0.81	0.93	 84
		−0.01	0.10	0.21	0.33	0.45	0.57	0.70	0.83	 86
				0.09	0.21	0.33	0.47	0.61	0.76	 88
−0.49	−0.38	−0.27	−0.15	−0.02	0.10	0.23	0.38	0.53	0.69	....0.90
−0.62	−0.51	−0.39	−0.26	−0.13	0.01	0.16	0.31	0.47	0.63	 92
−0.74	−0.62	−0.49	−0.36	−0.21	−0.06	0.10	0.26	0.43	0.60	 94
−0.85	−0.72	−0.59	−0.44	−0.29	−0.13	0.04	0.21	0.40	0.58	 96
−0.95	−0.81	−0.65	−0.50	−0.34	−0.16	0.02	0.19	0.37	0.55	 98
	−0.88	−0.71	−0.54	−0.37	−0.19	−0.01	0.17	0.35	0.52	....1.00
	−0.92	−0.75	−0.57	−0.40	−0.22	−0.04	0.15	0.31	0.48	 02
	−0.96	−0.78	−0.60	−0.42	−0.24	−0.05	0.12	0.30	0.46	 04

$\log p_e$

$\log p_e$

Table 8 (continued). Ionization of matter

θ \ log p	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
0.60	0.08	0.28	0.46	0.64	0.82	0.98	1.14	1.29	1.43
62	0.07	0.25	0.43	0.61	0.77	0.92	1.06	1.20	1.33
64	0.04	0.22	0.38	0.54	0.69	0.83	0.96	1.09	1.21
66	0.00	0.17	0.32	0.46	0.60	0.73	0.85	0.97	1.09
68		0.09	0.23	0.36	0.49	0.61	0.73	0.84	0.95
0.70		0.00	0.13	0.25	0.36	0.48	0.59	0.70	0.81
72			0.01	0.13	0.24	0.35	0.46	0.56	0.67
74				−0.01	0.11	0.22	0.32	0.43	0.53
76						0.07	0.17	0.28	0.38
78							0.04	0.14	0.24
0.80								−0.01	0.10
82									
84									
86									
88									
0.90						−0.94	−0.84	−0.73	−0.63
92							−0.97	−0.87	−0.77
94								−1.02	−0.91
96									
98									
1.00									
02									
04									

The table gives

θ \ log p	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6
0.60	2.58	2.69	2.79	2.90	3.00	3.10	3.21	3.31	
62	2.45	2.55	2.65	2.75	2.85	2.95	3.06	3.16	
64	2.29	2.40	2.50	2.61	2.71	2.81	2.91	3.01	
66	2.14	2.25	2.35	2.45	2.55	2.65	2.76	2.86	2.96
68	2.00	2.11	2.21	2.31	2.41	2.51	2.61	2.72	2.82
0.70	1.85	1.95	2.05	2.15	2.25	2.36	2.46	2.57	2.68
72	1.71	1.81	1.91	2.01	2.11	2.22	2.32	2.43	2.54
74	1.55	1.66	1.76	1.86	1.97	2.08	2.18	2.29	2.40
76	1.41	1.51	1.62	1.72	1.83	1.94	2.05	2.16	2.28
78	1.26	1.37	1.47	1.58	1.70	1.81	1.92	2.04	2.16
0.80	1.13	1.23	1.34	1.45	1.57	1.68	1.80	1.92	2.05
82	0.99	1.10	1.21	1.33	1.44	1.56	1.69	1.82	1.95
84	0.85	0.97	1.08	1.20	1.33	1.46	1.59	1.72	1.87
86	0.73	0.84	0.97	1.09	1.23	1.36	1.50	1.65	1.80
88	0.61	0.74	0.87	1.00	1.14	1.29	1.44	1.59	1.75
0.90	0.50	0.64	0.78	0.92	1.07	1.22	1.38	1.54	1.69
92	0.41	0.55	0.70	0.86	1.02	1.18	1.34	1.49	1.65
94	0.33	0.49	0.64	0.81	0.97	1.13	1.29	1.45	1.60
96	0.27	0.44	0.60	0.77	0.93	1.10	1.26	1.41	1.56
98	0.22	0.39	0.57	0.73	0.90	1.06	1.22	1.37	1.52
1.00	0.18	0.36	0.53	0.70	0.87	1.02	1.18	1.33	1.47
02	0.16	0.33	0.50	0.66	0.82	0.98	1.13	1.28	1.42
04	0.13	0.30	0.46	0.62	0.78	0.93	1.08	1.23	1.37

The table gives

in stellar atmospheres. $\log A = 3.8$.

	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	θ
	1.57	1.69	1.82	1.93	2.05	2.16	2.27	2.37	2.48	2.58	....0.60
	1.46	1.58	1.69	1.81	1.92	2.03	2.13	2.24	2.34	2.45	 62
	1.33	1.44	1.56	1.67	1.78	1.88	1.98	2.08	2.19	2.29	 64
	1.20	1.31	1.42	1.53	1.63	1.74	1.84	1.94	2.04	2.14	 66
	1.06	1.17	1.28	1.38	1.48	1.59	1.69	1.79	1.89	2.00	 68
	0.92	1.03	1.13	1.23	1.33	1.44	1.54	1.64	1.74	1.85	....0.70
	0.77	0.88	0.98	1.08	1.19	1.29	1.40	1.50	1.60	1.71	 72
	0.63	0.73	0.84	0.94	1.04	1.15	1.25	1.35	1.45	1.55	 74
	0.49	0.59	0.69	0.80	0.90	1.00	1.10	1.21	1.31	1.41	 76
	0.34	0.45	0.55	0.65	0.75	0.85	0.95	1.06	1.16	1.26	 78
	0.20	0.30	0.40	0.51	0.61	0.71	0.81	0.92	1.02	1.13	....0.80
	0.06	0.16	0.26	0.36	0.46	0.56	0.67	0.77	0.88	0.99	 82
		0.01	0.11	0.21	0.32	0.42	0.53	0.63	0.74	0.85	 84
				0.07	0.17	0.28	0.39	0.50	0.61	0.73	 86
					0.04	0.15	0.26	0.37	0.49	0.61	 88
	−0.53	−0.42	−0.31	−0.21	−0.09	0.02	0.13	0.25	0.38	0.50	....0.90
	−0.66	−0.56	−0.45	−0.34	−0.22	−0.11	0.01	0.14	0.27	0.41	 92
	−0.80	−0.69	−0.58	−0.46	−0.35	−0.22	−0.08	0.04	0.18	0.33	 94
	−0.93	−0.82	−0.70	−0.58	−0.46	−0.32	−0.19	−0.04	0.11	0.27	 96
		−0.94	−0.81	−0.68	−0.55	−0.41	−0.26	−0.10	0.06	0.22	 98
			−0.91	−0.78	−0.63	−0.48	−0.32	−0.16	0.02	0.18	....1.00
			−1.01	−0.85	−0.70	−0.53	−0.37	−0.20	−0.02	0.16	 02
				−0.91	−0.75	−0.57	−0.40	−0.22	−0.04	0.13	 04

$\log p_e$

$\log p_e$

Table 8 (continued). Ionization of matter

θ \ log p	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0
0.60	0.08	0.28	0.46	0.64	0.82	0.98	1.14	1.29	1.43
62	0.07	0.25	0.43	0.61	0.77	0.92	1.06	1.20	1.33
64	0.04	0.22	0.38	0.54	0.69	0.83	0.96	1.09	1.21
66	0.00	0.17	0.32	0.46	0.60	0.73	0.85	0.97	1.09
68		0.09	0.23	0.36	0.49	0.61	0.73	0.84	0.95
0.70		0.00	0.13	0.25	0.36	0.48	0.59	0.70	0.81
72			0.01	0.13	0.24	0.35	0.46	0.56	0.67
74				—0.01	0.11	0.22	0.32	0.43	0.53
76						0.07	0.17	0.28	0.38
78							0.04	0.14	0.24
0.80								—0.01	0.10
82									
84									
86									
88									
0.90						—0.94	—0.84	—0.74	—0.64
92							—0.98	—0.88	—0.78
94									—0.93
96									
98									
1.00									
02									
04									

The table gives

θ \ log p	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	5.6
0.60	2.58	2.69	2.79	2.89	3.00	3.10	3.20	3.30	
62	2.45	2.55	2.65	2.75	2.85	2.95	3.05	3.15	
64	2.29	2.40	2.50	2.60	2.70	2.80	2.90	3.01	3.11
66	2.14	2.24	2.34	2.45	2.55	2.65	2.76	2.86	2.96
68	2.00	2.10	2.20	2.30	2.41	2.51	2.61	2.71	2.81
0.70	1.84	1.95	2.05	2.15	2.25	2.35	2.45	2.55	2.65
72	1.70	1.80	1.90	2.00	2.10	2.21	2.31	2.41	2.51
74	1.55	1.65	1.75	1.85	1.95	2.06	2.16	2.26	2.36
76	1.40	1.50	1.61	1.71	1.81	1.91	2.02	2.12	2.23
78	1.25	1.35	1.46	1.56	1.67	1.77	1.88	1.98	2.09
0.80	1.11	1.21	1.32	1.42	1.53	1.63	1.74	1.85	1.96
82	0.96	1.07	1.17	1.28	1.39	1.50	1.61	1.72	1.84
84	0.82	0.93	1.03	1.14	1.25	1.36	1.48	1.60	1.72
86	0.68	0.79	0.90	1.01	1.12	1.24	1.36	1.49	1.61
88	0.55	0.66	0.77	0.89	1.01	1.13	1.26	1.39	1.52
0.90	0.41	0.53	0.65	0.77	0.90	1.03	1.16	1.30	1.44
92	0.29	0.41	0.54	0.67	0.80	0.94	1.08	1.23	1.38
94	0.17	0.30	0.44	0.58	0.72	0.86	1.01	1.17	1.32
96	0.07	0.21	0.35	0.50	0.65	0.81	0.97	1.12	1.27
98	—0.01	0.14	0.29	0.44	0.60	0.75	0.91	1.07	1.22
1.00	—0.09	0.07	0.23	0.39	0.55	0.72	0.88	1.03	1.18
02	—0.15	0.02	0.18	0.35	0.51	0.67	0.83	0.99	1.14
04	—0.19	—0.02	0.14	0.31	0.47	0.63	0.79	0.94	1.09

The table gives

in stellar atmospheres. $\log A = 4.2$.

2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	θ
1.57	1.69	1.82	1.93	2.05	2.16	2.27	2.37	2.48	2.58	....0.60
1.46	1.58	1.69	1.81	1.92	2.03	2.13	2.24	2.34	2.45	 62
1.33	1.44	1.56	1.67	1.78	1.88	1.98	2.08	2.19	2.29	 64
1.20	1.31	1.42	1.53	1.63	1.74	1.84	1.94	2.04	2.14	 66
1.06	1.17	1.28	1.38	1.48	1.59	1.69	1.79	1.89	2.00	 68
0.92	1.03	1.13	1.23	1.33	1.43	1.54	1.64	1.74	1.84	....0.70
0.77	0.88	0.98	1.08	1.19	1.29	1.39	1.50	1.60	1.70	 72
0.63	0.73	0.84	0.94	1.04	1.14	1.25	1.35	1.45	1.55	 74
0.48	0.58	0.69	0.79	0.90	1.00	1.10	1.20	1.30	1.40	 76
0.34	0.44	0.54	0.65	0.75	0.85	0.95	1.05	1.15	1.25	 78
0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	1.01	1.11	....0.80
0.05	0.16	0.26	0.36	0.45	0.55	0.66	0.76	0.86	0.96	 82
	0.00	0.11	0.21	0.31	0.41	0.51	0.61	0.72	0.82	 84
			0.06	0.16	0.26	0.36	0.47	0.57	0.68	 86
				0.02	0.12	0.23	0.33	0.44	0.55	 88
—0.54	—0.44	—0.33	—0.23	—0.13	—0.02	0.09	0.19	0.30	0.41	....0.90
—0.68	—0.57	—0.47	—0.37	—0.26	—0.16	—0.05	0.06	0.18	0.29	 92
—0.83	—0.72	—0.62	—0.51	—0.41	—0.29	—0.18	—0.06	0.05	0.17	 94
—0.96	—0.86	—0.75	—0.64	—0.53	—0.42	—0.30	—0.18	—0.06	0.07	 96
	—0.99	—0.88	—0.77	—0.66	—0.54	—0.42	—0.29	—0.16	—0.01	 98
		—1.01	—0.89	—0.77	—0.65	—0.52	—0.39	—0.24	—0.09	....1.00
			—1.01	—0.88	—0.74	—0.61	—0.46	—0.31	—0.15	 02
				—0.97	—0.83	—0.68	—0.52	—0.36	—0.19	 04

$\log p_e$

$\log p_e$

Table 9. Opacity $\bar{\varkappa}$. II. $\log A = 3.0$, 3.4, 3.8 4.2 and pure H.

θ \ $\log p$	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4
0.30........	8.40	8.60	8.80	9.00	9.20	9.40	9.60	9.80	0.00	0.20	0.40	0.60
32........	8.58	8.78	8.98	9.18	9.38	9.58	9.78	9.98	0.18	0.38	0 58	0.78
34........	8.75	8.95	9.15	9.35	9.55	9.75	9.95	0.15	0.35	0.55	0.75	0.95
36........	8.93	9.13	9.33	9.53	9.73	9.93	0.13	0.33	0.53	0.73	0.93	1.12
38........	9.08	9.28	9.48	9.68	9.88	0.08	0.28	0.48	0.68	0.88	1.06	1.26
0.40........	9.23	9.43	9.63	9.83	0.03	0.23	0.43	0.63	0.82	1.01	1.20	1.39
42........	9.36	9.56	9.76	9.96	0.16	0.36	0.55	0.74	0.94	1.13	1.32	1.49
44........	9.49	9.69	9.89	0.09	0.28	0.47	0.67	0.87	1.05	1.23	1.40	1.55
46........	9.62	9.82	0.02	0.21	0.40	0.60	0.78	0.97	1.14	1.30	1.45	1.59
48........	9.73	9.92	0.11	0.31	0.50	0.69	0.86	1.03	1.19	1.33	1.45	1.55
0.50........	9.82	0.01	0.21	0.39	0.57	0.74	0.90	1.05	1.19	1.30	1.39	1.47
52........	9.89	0.08	0.27	0.44	0.60	0.76	0.91	1.02	1.12	1.21	1.28	1.33
54........	9.95	0.13	0.30	0.46	0.61	0.75	0.85	0.94	1.01	1.08	1.13	1.17
56........	0.00	0.16	0.31	0.44	0.57	0.67	0.75	0.83	0.88	0.93	0.98	1.01
58........	0.00	0.15	0.28	0.38	0.47	0.54	0.60	0.65	0.70	0.74	0.79	0.82
0.60........		0.10	0.19	0.27	0.34	0.40	0.44	0.49	0.53	0.57	0.61	0.64

The table gives $\log \bar{\varkappa}$

θ \ $\log p$	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0
0.30........	0.60	0.80	1.00	1.20	1.40	1.59	1.78	1.98	2.17
32........	0.78	0.98	1.18	1.37	1.56	1.76	1.96	2.15	2.34
34........	0.95	1.15	1.34	1.53	1.72	1.91	2.10	2.27	2.44
36........	1.12	1.31	1.51	1.69	1.87	2.05	2.24	2.39	2.52
38........	1.26	1.46	1.64	1.82	1.99	2.15	2.30	2.43	2.53
0.40........	1.39	1.57	1.74	1.91	2.06	2.20	2.31	2.40	2.49
42........	1.49	1.66	1.82	1.95	2.07	2.17	2.25	2.33	2.40
44........	1.55	1.70	1.84	1.94	2.03	2.11	2.18	2.23	2.29
46........	1.59	1.71	1.81	1.88	1.95	2.02	2.07	2.11	2.17
48........	1.55	1.64	1.71	1.77	1.83	1.88	1.93	1.97	2.01
0.50........	1.47	1.53	1.59	1.64	1.69	1.73	1.77	1.81	1.85
52........	1.33	1.38	1.43	1.47	1.51	1.55	1.59	1.64	1.68
54........	1.17	1.22	1.26	1.30	1.33	1.38	1.43	1.47	1.52
56........	1.01	1.05	1.10	1.13	1.17	1.21	1.26	1.31	1.36
58........	0.82	0.86	0.90	0.94	0.99	1.04	1.09	1.14	1.19
0.60........	0.64	0.67	0.71	0.76	0.81	0.87	0.92	0.97	1.03

The table gives $\log \bar{\varkappa}$

Table 9 (continued). Opacity $\bar{\varkappa}$. II. $\log A = 3.0$.

θ \ $\log p$	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2
0.60..	0.34	0.40	0.44	0.49	0.53	0.57	0.61	0.64	0.67	0.72	0.77	0.82	0.87	0.92	0.98	1.04	
62..	0.17	0.22	0.26	0.30	0.33	0.37	0.41	0.45	0.50	0.55	0.59	0.64	0.69	0.76	0.83	0.90	
64..	9.99	0.04	0.08	0.12	0.15	0.18	0.22	0.26	0.32	0.37	0.43	0.48	0.55	0.62	0.70	0.77	
66..	9.81	9.84	9.88	9.92	9.96	0.00	0.05	0.10	0.15	0.21	0.27	0.34	0.41	0.49	0.57	0.66	
68..	9.61	9.65	9.68	9.73	9.77	9.83	9.88	9.93	9.98	0.05	0.12	0.20	0.27	0.36	0.44	0.53	
0.70..						9.65	9.71	9.76	9.83	9.91	9.99	0.07	0.15	0.23	0.33	0.43	
72..						9.48	9.55	9.62	9.69	9.76	9.85	9.93	0.02	0.12	0.22	0.34	
74..						9.33	9.40	9.48	9.56	9.64	9.72	9.82	9.92	0.03	0.15	0.27	
76..						9.20	9.27	9.36	9.44	9.53	9.63	9.72	9.84	9.96	0.08	0.22	
78..						9.06	9.14	9.22	9.32	9.42	9.52	9.64	9.76	9.89	0.04	0.19	
0.80..						8.92	9.01	9.11	9.21	9.32	9.44	9.56	9.71	9.85	0.00	0.16	
82..						8.80	8.90	9.00	9.12	9.24	9.38	9.53	9.68	9.83	9.99	0.16	0.32
84..						8.70	8.81	8.92	9.05	9.20	9.34	9.50	9.65	9.82	9.99	0.15	0.32
86..						8.60	8.72	8.86	9.01	9.16	9.32	9.49	9.66	9.83	0.00	0.16	0.32
88..						8.54	8.68	8.83	8.98	9.14	9.32	9.49	9.67	9.83	0.00	0.16	0.32
0.90..	7.86	7.97	8.09	8.22	8.35	8.49	8.65	8.81	8.97	9.15	9.33	9.51	9.68	9.84	0.01	0.17	0.32
92..	7.77	7.89	8.02	8.16	8.30	8.46	8.63	8.81	8.98	9.17	9.35	9.52	9.69	9.85	0.01	0.16	0.32
94..	7.68	7.82	7.97	8.12	8.28	8.45	8.63	8.81	8.99	9.17	9.35	9.52	9.69	9.85	0.00	0.16	0.30
96..	7.63	7.79	7.95	8.11	8.28	8.46	8.65	8.83	9.01	9.20	9.37	9.54	9.70	9.85	0.00	0.14	0.29
98..	7.60	7.76	7.93	8.10	8.29	8.47	8.66	8.84	9.02	9.20	9.37	9.54	9.69	9.85	9.99	0.13	0.27
1.00..	7.58	7.76	7.95	8.13	8.31	8.49	8.68	8.87	9.04	9.21	9.38	9.54	9.69	9.84	9.99	0.13	0.26
02..	7.59	7.78	7.97	8.15	8.33	8.52	8.70	8.88	9,05	9.22	9.38	9.54	9.69	9.84	9.98	0.12	0.25
04..	7.61	7.79	7.98	8.16	8.35	8.54	8.71	8.89	9.05	9.21	9.37	9.53	9.68	9.82	9.97	0.10	0.23

The table gives $\log \bar{\varkappa}$

Table 9 (continued). Opacity $\bar{\varkappa}$. II. $\log A = 3.4$.

θ \ $\log p$	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2
0.60..	0.34	0.40	0.44	0.49	0.53	0.57	0.61	0.64	0.67	0.71	0.77	0.82	0.87	0.92	0.97	1.03	
62..	0.17	0.22	0.26	0.30	0.33	0.37	0.41	0.45	0.50	0.55	0.59	0.64	0.69	0.75	0.82	0.89	
64..	9.99	0.04	0.08	0.11	0.15	0.18	0.22	0.26	0.31	0.37	0.42	0.48	0.55	0.62	0.69	0.76	
66..	9.81	9.84	9.88	9.92	9.95	0.00	0.05	0.10	0.15	0.21	0.27	0.33	0.40	0.48	0.55	0.63	
68..	9.61	9.65	9.68	9.72	9.77	9.82	9.88	9.93	9.98	0.05	0.12	0.19	0.26	0.34	0.42	0.50	
0.70..	9.43	9.46	9.50	9.55	9.60	9.65	9.70	9.76	9.82	9.90	9.97	0.05	0.13	0.21	0.29	0.38	0.48
72..						9.47	9.54	9.61	9.68	9.75	9.82	9.90	9.99	0.08	0.17	0.26	0.36
74..						9.32	9.39	9.46	9.54	9.62	9.70	9.78	9.87	9.97	0.07	0.17	0.28
76..						9.19	9.26	9.34	9.42	9.50	9.58	9.67	9.76	9.86	9.97	0.08	0.20
78..						9.04	9.12	9.20	9.28	9.37	9.46	9.56	9.67	9.77	9.88	0.01	0.14
0.80..						8.90	8.98	9.07	9.15	9.25	9.35	9.46	9.57	9.69	9.82	9.94	0.08
82..						8.76	8.85	8.94	9.04	9.15	9.26	9.37	9.49	9.63	9.76	9.90	0.04
84..						8.64	8.74	8.84	8.94	9.05	9.17	9.30	9.43	9.57	9.72	9.87	0.02
86..						8.51	8.62	8.74	8.85	8.98	9.11	9.24	9.39	9.54	9.69	9.85	0.02
88..						8.42	8.54	8.66	8.79	8.92	9.06	9.21	9.37	9.53	9.69	9.85	0.02
0.90..	7.82	7.91	8.01	8.11	8.22	8.34	8.46	8.59	8.73	8.88	9.03	9.19	9.36	9.52	9.69	9.85	0.02
92..	7.70	7.80	7.91	8.02	8.14	8.26	8.39	8.54	8.70	8.85	9.01	9.19	9.36	9.53	9.70	9.86	0.02
94..	7.58	7.69	7.81	7.94	8.07	8.21	8.36	8.51	8.67	8.84	9.01	9.18	9.36	9.53	9.69	9.85	0.01
96..	7.50	7.62	7.75	7.88	8.02	8.17	8.33	8.49	8.67	8.85	9.02	9.20	9.37	9.54	9.70	9.85	0.00
98..		7.55	7.68	7.84	7.99	8.14	8.32	8.50	8.67	8.85	9.02	9.20	9.37	9.54	9.70	9.85	9.99
1.00..			7.64	7.81	7.98	8.15	8.33	8.51	8.69	8.87	9.04	9.21	9.38	9.54	9.70	9.85	9.99
02..			7.64	7.81	7.99	8.16	8.34	8.52	8.71	8.87	9.04	9.22	9.38	9.54	9.69	9.84	9.98
04..			7.63	7.81	7.99	8.17	8.35	8.53	8.71	8.88	9.05	9.21	9.37	9.53	9.68	9.82	9.97

The table gives $\log \bar{\varkappa}$

Table 9 (continued). Opacity $\bar{\varkappa}$. II. $\log A = 3.8$.

θ \ $\log p$	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2
0.60..	0.34	0.40	0.44	0.49	0.53	0.57	0.61	0.64	0.67	0.71	0.76	0.81	0.87	0.92	0.97	1.03	
62..	0.17	0.22	0.26	0.30	0.33	0.37	0.41	0.45	0.50	0.54	0.59	0.64	0.69	0.75	0.82	0.89	
64..	9.99	0.04	0.08	0.11	0.15	0.18	0.22	0.26	0.31	0.36	0.42	0.47	0.54	0.61	0.68	0.75	
66..	9.81	9.84	9.88	9.92	9.96	0.00	0.05	0.10	0.15	0.21	0.27	0.33	0.40	0.47	0.55	0.63	
68..	9.62	9.65	9.68	9.73	9.77	9.82	9.87	9.92	9.98	0.04	0.11	0.18	0.25	0.33	0.41	0.49	
0.70..	9.43	9.46	9.50	9.55	9.60	9.65	9.70	9.76	9.82	9.89	9.97	0.04	0.12	0.20	0.28	0.36	0.45
72..						9.47	9.54	9.61	9.67	9.74	9.82	9.89	9.98	0.06	0.15	0.23	0.33
74..						9.32	9.39	9.46	9.53	9.61	9.69	9.77	9.85	9.94	0.03	0.13	0.23
76..						9.18	9.25	9.33	9.40	9.49	9.57	9.65	9.73	9.83	9.92	0.02	0.13
78..						9.03	9.11	9.19	9.27	9.35	9.43	9.52	9.62	9.72	9.82	9.93	0.04
0.80..						8.89	8.97	9.05	9.13	9.22	9.31	9.41	9.51	9.61	9.73	9.84	9.95
82..						8.75	8.85	8.92	9.01	9.10	9.20	9.31	9.42	9.53	9.64	9.76	9.88
84..						8.62	8.71	8.80	8.89	8.99	9.10	9.21	9.32	9.44	9.55	9.68	9.81
86..						8.48	8.58	8.68	8.79	8.89	9.01	9.12	9.24	9.36	9.49	9.63	9.77
88..						8.37	8.48	8.58	8.69	8.81	8.92	9.04	9.17	9.30	9.44	9.59	9.74
0.90..	7.80	7.88	7.97	8.06	8.17	8.27	8.38	8.49	8.61	8.73	8.85	8.97	9.11	9.26	9.41	9.56	9.72
92..	7.67	7.76	7.86	7.96	8.07	8.17	8.28	8.39	8.52	8.65	8.79	8.93	9.08	9.24	9.40	9.56	9.72
94..	7.54	7.64	7.74	7.85	7.97	8.08	8.20	8.32	8.45	8.59	8.74	8.89	9.05	9.22	9.38	9.54	9.70
96..		7.55	7.65	7.77	7.89	8.01	8.13	8.26	8.41	8.56	8.72	8.88	9.05	9.22	9.38	9.55	9.71
98..			7.55	7.68	7.81	7.94	8.07	8.22	8.38	8.54	8.70	8.87	9.05	9.22	9.38	9.54	9.70
1.00..				7.61	7.74	7.89	8.04	8.20	8.37	8.54	8.70	8.88	9.05	9.22	9.38	9.54	9.70
02..				7.55	7.71	7.86	8.03	8.19	8.36	8.54	8.71	8.89	9.06	9.22	9.38	9.54	9.69
04..					7.68	7.84	8.02	8.19	8.37	8.55	8.72	8.89	9.05	9.21	9.37	9.52	9.67

The table gives $\log \bar{\varkappa}$

Table 9 (continued).

θ \ log p	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6
0.60........	0.34	0.40	0.44	0.49	0.53	0.57	0.61	0.64	0.67
62........	0.17	0.22	0.26	0.30	0.33	0.37	0.41	0.45	0.50
64........	9.99	0.04	0.08	0.11	0.15	0.18	0.22	0.26	0.31
66........	9.81	9.84	9.88	9.92	9.95	0.00	0.05	0.10	0.15
68........	9.62	9.65	9.68	9.73	9.77	9.82	9.87	9.92	9.98
0.70........	9.43	9.46	9.50	9.55	9.60	9.65	9.70	9.75	9.82
72........	9.22	9.26	9.31	9.36	9.42	9.47	9.54	9.61	9.67
74........	9.05	9.10	9.15	9.20	9.25	9.31	9.38	9.45	9.53
76........	8.87	8.92	8.97	9.04	9.11	9.18	9.25	9.32	9.40
78........	8.69	8.75	8.81	8.88	8.95	9.03	9.11	9.18	9.26
0.80........	8.53	8.60	8.66	8.73	8.81	8.88	8.96	9.04	9.12
82........		8.44	8.51	8.59	8.67	8.74	8.82	8.91	9.00
84........			8.37	8.45	8.53	8.61	8.69	8.78	8.87
86........						8.47	8.56	8.66	8.76
88........						8.35	8.45	8.56	8.66
0.90........	7.79	7.87	7.96	8.05	8.14	8.24	8.34	8.45	8.55
92........	7.66	7.75	7.84	7.94	8.04	8.14	8.24	8.34	8.44
94........	7.52	7.62	7.72	7.81	7.92	8.02	8.13	8.24	8.35
96........		7.52	7.62	7.72	7.83	7.94	8.05	8.16	8.27
98........			7.51	7.61	7.72	7.83	7.95	8.06	8.19
1.00........					7.63	7.74	7.87	8.00	8.13
02........					7.55	7.68	7.82	7.95	8.10
04........						7.62	7.76	7.91	8.07

The table gives

Opacity $\bar{\varkappa}$. II. $\log A = 4.2$.

3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.2	5.4	θ
0.71	0.76	0.81	0.87	0.92	0.97	1.03	1.10	1.18	........0.60
0.54	0.59	0.64	0.69	0.75	0.82	0.88	0.96	1.04	 62
0.36	0.42	0.47	0.54	0.61	0.68	0.75	0.83	0.90	 64
0.21	0.27	0.33	0.40	0.47	0.54	0.62	0.70	0.78	 66
0.04	0.11	0.18	0.25	0.33	0.40	0.48	0.56	0.65	 68
9.89	9.96	0.04	0.12	0.19	0.27	0.35	0.44	0.53	........0.70
9.74	9.81	9.89	9.97	0.05	0.14	0.22	0.32	0.42	 72
9.61	9.68	9.76	9.84	9.93	0.02	0.11	0.21	0.31	 74
9.48	9.56	9.64	9.72	9.82	9.91	0.00	0.10	0.20	 76
9.34	9.42	9.51	9.60	9.69	9.79	9.89	0.00	0.10	 78
9.20	9.30	9.39	9.49	9.58	9.69	9.79	9.89	0.00	........0.80
9.09	9.18	9.28	9.38	9.48	9.59	9.69	9.80	9.90	 82
8.97	9.06	9.17	9.27	9.37	9.48	9.59	9.70	9.82	 84
8.86	8.96	9.07	9.18	9.28	9.39	9.50	9.62	9.75	 86
8.76	8.86	8.96	9.07	9.19	9.31	9.43	9.56	9.69	 88
8.66	8.76	8.87	8.99	9.11	9.24	9.37	9.50	9.64	........0.90
8.56	8.67	8.79	8.92	9.05	9.18	9.32	9.46	9.62	 92
8.46	8.59	8.71	8.84	8.98	9.13	9.28	9.43	9.58	 94
8.39	8.52	8.66	8.80	8.95	9.10	9.26	9.42	9.57	 96
8.32	8.47	8.61	8.76	8.92	9.08	9.23	9.40	9.55	 98
8.28	8.43	8.59	8.74	8.91	9.07	9.23	9.40	9.55	........1.00
8.25	8.41	8.58	8.74	8.91	9.07	9.23	9.38	9.55	 02
8.23	8.40	8.57	8.73	8.90	9.06	9.22	9.38	9.53	 04

$\log \bar{\varkappa}$

Table 10. Model stellar

		$\log g = 3.0$				$\log g = 3.5$		
τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00	1.000				1.000			
0.01	0.996	3.08			0.996	3.34		
0.02	0.993	3.22			0.993	3.50	0.09	8.60
0.03	0.989	3.31			0.989	3.59	0.17	8.67
0.04	0.985	3.38	9.99		0.985	3.65	0.23	8.71
0.05	0.982	3.44	0.05	8.53	0.982	3.70	0.28	8.76
0.06	0.978	3.48	0.09	8.57	0.978	3.75	0.33	8.80
0.07	0.975	3.52	0.13	8.61	0.975	3.78	0.36	8.83
0.08	0.972	3.55	0.16	8.63	0.972	3.81	0.39	8.86
0.09	0.968	3.58	0.19	8.65	0.968	3.84	0.42	8.88
0.10	0.965	3.60	0.21	8.67	0.965	3.86	0.45	8.90
0.15	0.950	3.69	0.32	8.75	0.950	3.96	0.55	8.98
0.2	0.936	3.76	0.40	8.81	0.936	4.03	0.63	9.04
0.3	0.911	3.86	0.55	8.91	0.911	4.13	0.76	9.13
0.4	0.889	3.92	0.67	8.99	0.889	4.19	0.87	9.19
0.5	0.869	3.97	0.78	9.07	0.869	4.24	0.97	9.26
0.6	0.852	4.00	0.87	9.13	0.852	4.28	1.06	9.32
0.7	0.836	4.03	0.97	9.21	0.836	4.31	1.16	9.38
0.8	0.821	4.05	1.07	9.29	0.821	4.34	1.25	9.45
0.9	0.808	4.07	1.16	9.35	0.808	4.36	1.34	9.52
1.0	0.795	4.08	1.24	9.42	0.795	4.37	1.42	9.57
1.5	0.745	4.13	1.60	9.72	0.745	4.43	1.77	9.86
2	0.707	4.15	1.88	9.98	0.707	4.45	2.04	0.10
3	0.653	4.17	2.28	0.37	0.653	4.48	2.44	0.48
4	0.614	4.18	2.58	0.69	0.614	4.49	2.74	0.77
5	0.585	4.19	2.80	0.95	0.585	4.49	2.96	1.02
6	0.562	4.19	2.97	1.15	0.562	4.50	3.13	1.21
7	0.543	4.19	3.11	1.31	0.543	4.50	3.27	1.38
8	0.527	4.19	3.21	1.45	0.527	4.50	3.38	1.51
9	0.512	4.19	3.31	1.58	0.512	4.50	3.49	1.64
10	0.500	4.20	3.40	1.69	0.500	4.50	3.57	1.75

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.823	4.05	1.06	0.808	4.35	1.33
0.790	4.10	1.28	0.776	4.40	1.55
0.733	4.20	1.72	0.720	4.50	1.98
0.688	4.30	2.10	0.674	4.60	2.35
0.650	4.40	2.44	0.636	4.70	2.69
0.620	4.50	2.70	0.605	4.80	2.96
0.595	4.60	2.94	0.579	4.90	3.21
0.574	4.70	3.14	0.557	5.00	3.42

atmospheres. $\theta_0 = 1.0$. $\log A = 3.4$

	$\log g = 4.0$				$\log g = 4.5$			
θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	τ
1.000				1.000				.... 0.00
0.996	3.60	0.17	8.69	0.996	3.90	0.44	8.94	.... 0.01
0.993	3.76	0.32	8.82	0.993	4.05	0.56	9.07	.... 0.02
0.989	3.85	0.41	8.90	0.989	4.14	0.66	9.15	.... 0.03
0.985	3.92	0.47	8.95	0.985	4.21	0.72	9.21	.... 0.04
0.982	3.97	0.52	8.99	0.982	4.25	0.76	9.24	.... 0.05
0.978	4.01	0.56	9.03	0.978	4.29	0.80	9.27	.... 0.06
0.975	4.05	0.60	9.06	0.975	4.32	0.83	9.30	.... 0.07
0.972	4.08	0.63	9.09	0.972	4.35	0.86	9.33	.... 0.08
0.968	4.11	0.66	9.12	0.968	4.38	0.89	9.35	.... 0.09
0.965	4.13	0.68	9.14	0.965	4.40	0.91	9.37	.... 0.10
0.950	4.23	0.79	9.22	0.950	4.50	1.02	9.45	.... 0.15
0.936	4.29	0.86	9.26	0.936	4.57	1.10	9.50	.... 0.2
0.911	4.39	0.99	9.35	0.911	4.66	1.22	9.58	.... 0.3
0.889	4.46	1.10	9.42	0.889	4.73	1.32	9.63	.... 0.4
0.869	4.51	1.18	9.47	0.869	4.79	1.41	9.68	.... 0.5
0.852	4.55	1.27	9.51	0.852	4.83	1.48	9.72	.... 0.6
0.836	4.59	1.36	9.57	0.836	4.86	1.55	9.77	.... 0.7
0.821	4.62	1.44	9.64	0.821	4.89	1.63	9.82	.... 0.8
0.808	4.64	1.51	9.70	0.808	4.92	1.71	9.87	.... 0.9
0.795	4.65	1.59	9.74	0.795	4.94	1.78	9.92	.... 1.0
0.745	4.72	1.93	0.00	0.745	5.01	2.09	0.16	.... 1.5
0.707	4.75	2.20	0.23	0.707	5.04	2.36	0.36	 2
0.653	4.78	2.59	0.59	0.653	5.07	2.75	0.71	 3
0.614	4.79	2.89	0.86	0.614	5.09	3.04	0.96	 4
0.585	4.80	3.11	1.10	0.585	5.10	3.27	1.17	 5
0.562	4.80	3.28	1.29	0.562	5.11	3.45	1.37	 6
0.543	4.81	3.44	1.45	0.543	5.11	3.60	1.53	 7
0.527	4.81	3.55	1.58	0.527	5.12	3.71	1.65	 8
0.512	4.81	3.66	1.71	0.512	5.12	3.82	1.77	 9
0.500	4.81	3.74	1.81	0.500	5.12	3.92	1.87	10

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.795	4.65	1.59	0.786	4.96	1.83
0.763	4.70	1.80	0.759	5.00	2.01
0.707	4.80	2.22	0.701	5.10	2.42
0.660	4.90	2.62	0.650	5.20	2.84
0.621	5.00	2.95	0.610	5.30	
0.589	5.10	3.23	0.578	5.40	3.47
0.563	5.20	3.48	0.550	5.50	3.74
0.540	5.30	3.71	0.527	5.60	3.96

Table 10 (continued). Model stellar

τ	θ	$\log p$ (log g = 3.0)	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$ (log g = 3.5)	$\log p_e$	$\log \bar{\varkappa}$
0.00	1.000				1.000			
0.01	0.996	3.22	9.55	8.06	0.996	3.47	9.75	8.26
0.02	0.993	3.36	9.67	8.17	0.993	3.65	9.91	8.41
0.03	0.989	3.46	9.76	8.26	0.989	3.74	9.99	8.49
0.04	0.985	3.53	9.83	8.31	0.985	3.80	0.05	8.54
0.05	0.982	3.59	9.88	8.36	0.982	3.85	0.10	8.58
0.06	0.978	3.63	9.93	8.40	0.978	3.89	0.14	8.61
0.07	0.975	3.67	9.97	8.43	0.975	3.93	0.18	8.64
0.08	0.972	3.71	0.00	8.47	0.972	3.96	0.21	8.67
0.09	0.968	3.74	0.05	8.49	0.968	3.99	0.24	8.70
0.10	0.965	3.76	0.07	8.52	0.965	4.01	0.27	8.73
0.15	0.950	3.85	0.18	8.61	0.950	4.11	0.39	8.81
0.2	0.936	3.92	0.29	8.69	0.936	4.18	0.48	8.88
0.3	0.911	4.00	0.45	8.82	0.911	4.27	0.64	9.00
0.4	0.889	4.06	0.60	8.93	0.889	4.33	0.78	9.09
0.5	0.869	4.09	0.73	9.02	0.869	4.38	0.91	9.20
0.6	0.852	4.12	0.85	9.10	0.852	4.41	1.02	9.28
0.7	0.836	4.15	0.97	9.19	0.836	4.44	1.13	9.36
0.8	0.821	4.17	1.07	9.28	0.821	4.46	1.24	9.44
0.9	0.808	4.18	1.17	9.36	0.808	4.47	1.33	9.51
1.0	0.795	4.19	1.27	9.43	0.795	4.48	1.42	9.57
1.5	0.745	4.22	1.63	9.75	0.745	4.52	1.78	9.87
2	0.707	4.24	1.92	0.01	0.707	4.54	2.07	0.12
3	0.653	4.26	2.33	0.40	0.653	4.56	2.49	0.51
4	0.614	4.26	2.62	0.70	0.614	4.57	2.78	0.79
5	0.585	4.27	2.84	0.97	0.585	4.58	3.00	1.04
6	0.562	4.27	3.01	1.16	0.562	4.58	3.17	1.24
7	0.543	4.27	3.15	1.33	0.543	4.58	3.32	1.40
8	0.527	4.27	3.26	1.46	0.527	4.58	3.43	1.53
9	0.512	4.27	3.36	1.59	0.512	4.58	3.53	1.60
10	0.500	4.27	3.44	1.70	0.500	4.58	3.61	1.77

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.844	4.14	0.88	0.832	4.44	1.16
0.804	4.20	1.20	0.794	4.50	1.43
0.743	4.30	1.69	0.735	4.60	1.90
0.696	4.40	2.08	0.686	4.70	2.31
0.656	4.50	2.43	0.644	4.80	2.68
0.624	4.60	2.72	0.610	4.90	2.98
0.598	4.70	2.96	0.582	5.00	3.24
0.575	4.80	3.19	0.557	5.10	3.47

atmospheres. $\theta_0 = 1.0$. $\log A = 3.8$.

	$\log g = 4.0$				$\log g = 4.5$			
θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	τ
1.000				1.000				0.00
0.996	3.78	0.01	8.52	0.996	4.00	0.19	8.70	0.01
0.993	3.95	0.15	8.66	0.993	4.18	0.35	8.86	0.02
0.989	4.05	0.25	8.74	0.989	4.29	0.44	8.95	0.03
0.985	4.11	0.31	8.79	0.985	4.36	0.52	9.01	0.04
0.982	4.16	0.36	8.84	0.982	4.41	0.57	9.06	0.05
0.978	4.20	0.39	8.87	0.978	4.45	0.61	9.09	0.06
0.975	4.23	0.43	8.90	0.975	4.49	0.65	9.12	0.07
0.972	4.26	0.46	8.93	0.972	4.52	0.68	9.15	0.08
0.968	4.29	0.49	8.96	0.968	4.55	0.71	9.18	0.09
0.965	4.31	0.52	8.98	0.965	4.57	0.73	9.19	0.10
0.950	4.41	0.63	9.06	0.950	4.67	0.84	9.28	0.15
0.936	4.47	0.71	9.12	0.936	4.73	0.92	9.32	0.2
0.911	4.56	0.86	9.22	0.911	4.83	1.06	9.42	0.3
0.889	4.62	0.98	9.30	0.889	4.89	1.18	9.50	0.4
0.869	4.67	1.10	9.38	0.869	4.94	1.28	9.57	0.5
0.852	4.70	1.20	9.46	0.852	4.98	1.39	9.64	0.6
0.836	4.73	1.30	9.53	0.836	5.01	1.48	9.71	0.7
0.821	4.75	1.40	9.60	0.821	5.03	1.57	9.78	0.8
0.808	4.77	1.50	9.67	0.808	5.05	1.66	9.84	0.9
0.795	4.78	1.58	9.74	0.795	5.07	1.75	9.90	1.0
0.745	4.83	1.95	0.02	0.745	5.12	2.11	0.15	1.5
0.707	4.85	2.23	0.25	0.707	5.15	2.39	0.39	2
0.653	4.87	2.64	0.63	0.653	5.18	2.80	0.75	3
0.614	4.88	2.94	0.90	0.614	5.19	3.09	1.01	4
0.585	4.90	3.16	1.12	0.585	5.19	3.32	1.21	5
0.562	4.90	3.34	1.31	0.562	5.20	3.49	1.39	6
0.543	4.91	3.49	1.48	0.543	5.20	3.64	1.56	7
0.527	4.91	3.60	1.61	0.527	5.20	3.76	1.68	8
0.512	4.91	3.71	1.73	0.512	5.21	3.87	1.80	9
0.500	4.91	3.80	1.83	0.500	5.21	3.97	1.90	10

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.823	4.75	1.40	0.812	5.05	1.64
0.788	4.80	1.65	0.777	5.10	1.88
0.726	4.90	2.12	0.717	5.20	2.34
0.675	5.00	2.54	0.664	5.30	2.78
0.633	5.10	2.91	0.620	5.40	3.16
0.598	5.20	3.22	0.586	5.50	3.46
0.569	5.30	3.49	0.556	5.60	3.74
0.544	5.40	3.73	0.529	5.70	

Tabel 10 (continued). Model stellar

τ	θ (log g = 3.0)	log p	$\log p_e$	$\log \bar{\varkappa}$	θ (log g = 3.5)	log p	$\log p_e$	$\log \bar{\varkappa}$
0.00.........	1.000				1.000			
0.01.........	0.996	3.30	9.44	7.95	0.996	3.60	9.64	8.15
0.02.........	0.993	3.47	9.57	8.08	0.993	3.77	9.77	8.27
0.03.........	0.989	3.57	9.65	8.15	0.989	3.87	9.86	8.35
0.04.........	0.985	3.65	9.71	8.20	0.985	3.94	9.92	8.42
0.05.........	0.982	3.70	9.76	8.25	0.982	4.00	9.98	8.47
0.06.........	0.978	3.75	9.82	8.30	0.978	4.04	0.03	8.51
0.07.........	0.975	3.78	9.86	8.33	0.975	4.08	0.07	8.54
0.08.........	0.972	3.82	9.90	8.36	0.972	4.11	0.10	8.57
0.09.........	0.968	3.84	9.93	8.39	0.968	4.14	0.13	8.60
0.10.........	0.965	3.87	9.96	8.42	0.965	4.16	0.16	8.62
0.15.........	0.950	3.96	0.10	8.52	0.950	4.25	0.29	8.72
0.2	0.936	4.02	0.21	8.61	0.936	4.32	0.40	8.80
0.3	0.911	4.10	0.40	8.77	0.911	4.40	0.59	8.95
0.4	0.889	4.15	0.57	8.89	0.889	4.45	0.75	9.06
0.5	0.869	4.18	0.72	9.01	0.869	4.48	0.89	9.16
0.6	0.852	4.21	0.85	9.11	0.852	4.51	1.01	9.26
0.7	0.836	4.22	0.97	9.20	0.836	4.53	1.13	9.35
0.8	0.821	4.24	1.08	9.28	0.821	4.55	1.24	9.44
0.9	0.808	4.25	1.18	9.36	0.808	4.56	1.34	9.52
1.0	0.795	4.26	1.28	9.44	0.795	4.57	1.44	9.60
1.5	0.745	4.29	1.66	9.77	0.745	4.60	1.82	9.90
2	0.707	4.30	1.95	0.03	0.707	4.62	2.11	0.15
3	0.653	4.32	2.36	0.42	0.653	4.63	2.53	0.53
4	0.614	4.32	2.65	0.72	0.614	4.64	2.81	0.81
5	0.585	4.33	2.87	0.98	0.585	4.64	3.03	1.06
6	0.562	4.33	3.04	1.18	0.562	4.65	3.21	1.25
7	0.543	4.33	3.18	1.34	0.543	4.65	3.35	1.41
8	0.527	4.33	3.29	1.48	0.527	4.65	3.46	1.54
9	0.512	4.33	3.40	1.61	0.512	4.65	3.56	1.67
10	0.500	4.33	3.48	1.72	0.500	4.65	3.65	1.78

θ	log p	$\log p_e$	θ	log p	$\log p_e$
0.860	4.20	0.79	0.850	4.51	1.03
0.792	4.30	1.32	0.794	4.60	1.46
0.735	4.40	1.79	0.730	4.70	1.98
0.690	4.50	2.18	0.680	4.80	2.41
0.649	4.60	2.53	0.638	4.90	2.76
0.617	4.70	2.82	0.605	5.00	3.06
0.591	4.80	3.07	0.576	5.10	3.33
0.569	4.90	3.28	0.553	5.20	3.52

atmospheres. $\theta_0 = 1.0$. $\log A = 4.2$.

	$\log g = 4.0$				$\log g = 4.5$			
θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	τ
1.000				1.000				0.00
0.996	3.90	9.85	8.36	0.996	4.20	0.09	8.59	0.01
0.993	4.07	9.99	8.50	0.993	4.36	0.22	8.72	0.02
0.989	4.17	0.08	8.58	0.989	4.45	0.30	8.79	0.03
0.985	4.24	0.15	8.64	0.985	4.52	0.37	8.86	0.04
0.982	4.29	0.20	8.68	0.982	4.57	0.41	8.90	0.05
0.978	4.33	0.24	8.71	0.978	4.62	0.45	8.94	0.06
0.975	4.37	0.28	8.74	0.975	4.65	0.49	8.97	0.07
0.972	4.40	0.32	8.77	0.972	4.68	0.53	8.99	0.08
0.968	4.43	0.35	8.80	0.968	4.71	0.56	9.02	0.09
0.965	4.45	0.37	8.83	0.965	4.73	0.58	9.04	0.10
0.950	4.54	0.49	8.93	0.950	4.83	0.71	9.13	0.15
0.936	4.60	0.60	9.00	0.936	4.89	0.81	9.21	0.2
0.911	4.69	0.77	9.14	0.911	4.98	0.97	9.33	0.3
0.889	4.74	0.92	9.24	0.889	5.03	1.10	9.42	0.4
0.869	4.78	1.06	9.34	0.869	5.08	1.24	9.51	0.5
0.852	4.81	1.18	9.44	0.852	5.11	1.36	9.60	0.6
0.836	4.83	1.30	9.52	0.836	5.13	1.47	9.68	0.7
0.821	4.85	1.40	9.60	0.821	5.15	1.57	9.76	0.8
0.808	4.86	1.50	9.68	0.808	5.17	1.66	9.83	0.9
0.795	4.87	1.60	9.75	0.795	5.18	1.76	9.90	1.0
0.745	4.91	1.98	0.04	0.745	5.22	2.14	0.19	1.5
0.707	4.93	2.27	0.27	0.707	5.24	2.42	0.41	2
0.653	4.95	2.68	0.65	0.653	5.26	2.84	0.77	3
0.614	4.95	2.97	0.91	0.614	5.27	3.14	1.03	4
0.585	4.96	3.20	1.13	0.585	5.27	3.35	1.23	5
0.562	4.96	3.37	1.33	0.562	5.28	3.53	1.41	6
0.543	4.96	3.52	1.49	0.543	5.28	3.69	1.57	7
0.527	4.96	3.63	1.62	0.527	5.28	3.80	1.69	8
0.512	4.97	3.74	1.74	0.512	5.28	3.91	1.81	9
0.500	4.97	3.83	1.84	0.500	5.28	4.01	1.92	10

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.842	4.83	1.25	0.832	5.14	1.50
0.792	4.90	1.64	0.790	5.20	1.81
0.730	5.00	2.14	0.725	5.30	2.32
0.677	5.10	2.58	0.670	5.40	2.78
0.633	5.20	2.95	0.626	5.50	3.16
0.596	5.30	3.28	0.587	5.60	3.50
0.566	5.40	3.56	0.556	5.70	3.79
0.540	5.50	3.81	0.529	5.80	

Table 11. Model stellar atmospheres.

$\theta_0 = 0.9. \ \log A = 3.4.$

		$\log g = 3.5$				$\log g = 4.0$				$\log g = 4.5$		
τ	θ	$\log p$	$\log p_e$	$\log \overline{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \overline{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \overline{\varkappa}$
0.00...	0.900				0.900				0.900			
0.01...	0.896	3.23	0.14	8.50	0.896	3.54	0.35	8.70	0.896	3.87	0.60	8.94
0.02...	0.893	3.42	0.29	8.62	0.893	3.72	0.50	8.83	0.893	4.03	0.73	9.06
0.03...	0.890	3.52	0.37	8.70	0.890	3.82	0.58	8.91	0.890	4.12	0.81	9.14
0.04...	0.887	3.59	0.43	8.76	0.887	3.89	0.65	8.97	0.887	4.19	0.88	9.20
0.05...	0.884	3.65	0.48	8.81	0.884	3.95	0.71	9.02	0.884	4.24	0.93	9.24
0.06...	0.881	3.69	0.53	8.85	0.881	3.99	0.75	9.05	0.881	4.29	0.98	9.28
0.07...	0.878	3.73	0.57	8.88	0.878	4.03	0.79	9.08	0.878	4.32	1.01	9.31
0.08...	0.875	3.76	0.60	8.91	0.875	4.06	0.82	9.11	0.875	4.35	1.04	9.34
0.09...	0.872	3.79	0.64	8.93	0.872	4.09	0.85	9.15	0.872	4.38	1.07	9.36
0.10...	0.869	3.81	0.67	8.96	0.869	4.11	0.88	9.17	0.869	4.40	1.10	9.38
0.15...	0.853	3.90	0.80	9.06	0.853	4.20	1.01	9.26	0.853	4.49	1.22	9.47
0.2 ...	0.843	3.97	0.90	9.14	0.843	4.27	1.10	9.34	0.843	4.56	1.31	9.54
0.3 ...	0.820	4.05	1.07	9.29	0.820	4.35	1.26	9.47	0.820	4.64	1.46	9.66
0.4 ...	0.800	4.10	1.22	9.40	0.800	4.41	1.41	9.58	0.800	4.70	1.59	9.75
0.5 ...	0.782	4.14	1.36	9.52	0.782	4.44	1.54	9.68	0.782	4.74	1.72	9.84
0.6 ...	0.767	4.16	1.47	9.61	0.767	4.47	1.65	9.77	0.767	4.77	1.82	9.92
0.7 ...	0.752	4.18	1.58	9.70	0.752	4.50	1.76	9.85	0.752	4.80	1.93	0.01
0.8 ...	0.739	4.20	1.68	9.79	0.739	4.51	1.85	9.93	0.739	4.82	2.03	0.08
0.9 ...	0.727	4.21	1.77	9.87	0.727	4.53	1.94	0.01	0.727	4.84	2.11	0.15
1.0 ...	0.716	4.22	1.85	9.94	0.716	4.54	2.02	0.08	0.716	4.85	2.20	0.21
1.5 ...	0.670	4.25	2.21	0.28	0.670	4.57	2.37	0.40	0.670	4.89	2.54	0.52
2 ...	0.636	4.27	2.46	0.54	0.636	4.59	2.63	0.65	0.636	4.91	2.80	0.75
3 ...	0.588	4.28	2.82	0.94	0.588	4.61	3.00	1.02	0.588	4.93	3.16	1.11
4 ...	0.553	4.29	3.08	1.25	0.553	4.62	3.26	1.32	0.553	4.94	3.43	1.40
5 ...	0.527	4.29	3.27	1.47	0.527	4.62	3.45	1.54	0.527	4.94	3.62	1.61
6 ...	0.506	4.29	3.40	1.66	0.506	4.62	3.60	1.72	0.506	4.94	3.77	1.79
7 ...	0.489	4.30	3.53	1.79	0.489	4.62	3.72	1.86	0.489	4.95	3.90	1.93
8 ...	0.474	4.30	3.61	1.89	0.474	4.63	3.82	1.98	0.474	4.95	4.01	2.05
9 ...	0.461	4.30	3.69	1.98	0.461	4.63	3.90	2.07	0.461	4.95	4.09	2.14
10 ...	0.450	4.30	3.74	2.03	0.450	4.63	3.96	2.13	0.450	4.95	4.15	2.21

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.776	4.15	1.41	0.768	4.47	1.64	0.756	4.79	1.90
0.747	4.20	1.62	0.756	4.50	1.73	0.749	4.80	1.95
0.699	4.30	2.02	0.699	4.60	2.18	0.691	4.90	2.39
0.661	4.40	2.35	0.657	4.70	2.53	0.648	5.00	2.75
0.631	4.50	2.62	0.623	4.80	2.82	0.613	5.10	3.06
0.605	4.60	2.86	0.593	4.90	3.10	0.583	5.20	3.33
0.582	4.70	3.08	0.569	5.00	3.33	0.557	5.30	3.58
0.561	4.80	3.28	0.548	5.10	3.54	0.534	5.40	3.80
0.543	4.90	3.48	0.530	5.20	3.74	0.512	5.50	

Table 11 (continued). Model stellar atmospheres.

$\theta_0 = 0.9.\ \log A = 3.8.$

	log g = 3.5				log g = 4.0				log g = 4.5			
τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00...	0.900				0.900				0.900			
0.01...	0.896	3.29	0.10	8.45	0.896	3.60	0.28	8.63	0.896	3.90	0.46	8.81
0.02...	0.893	3.47	0.22	8.56	0.893	3.78	0.40	8.75	0.893	4.08	0.59	8.92
0.03...	0.890	3.58	0.30	8.64	0.890	3.89	0.49	8.82	0.890	4.19	0.68	9.00
0.04...	0.887	3.65	0.36	8.69	0.887	3.96	0.55	8.88	0.887	4.27	0.75	9.07
0.05...	0.884	3.71	0.41	8.74	0.884	4.02	0.60	8.92	0.884	4.33	0.80	9.11
0.06...	0.881	3.75	0.45	8.78	0.881	4.06	0.64	8.96	0.881	4.37	0.84	9.15
0.07...	0.878	3.79	0.49	8.81	0.878	4.10	0.68	8.99	0.878	4.41	0.88	9.19
0.08...	0.875	3.82	0.53	8.84	0.875	4.13	0.72	9.02	0.875	4.44	0.92	9.22
0.09...	0.872	3.85	0.57	8.87	0.872	4.16	0.76	9.05	0.872	4.47	0.95	9.25
0.10...	0.869	3.87	0.60	8.89	0.869	4.19	0.79	9.07	0.869	4.49	0.98	9.26
0.15...	0.853	3.96	0.75	9.02	0.853	4.28	0.93	9.20	0.853	4.59	1.13	9.38
0.2 ...	0.843	4.03	0.85	9.11	0.843	4.34	1.03	9.28	0.843	4.66	1.22	9.46
0.3 ...	0.820	4.11	1.05	9.26	0.820	4.42	1.22	9.43	0.820	4.73	1.40	9.60
0.4 ...	0.800	4.16	1.21	9.39	0.800	4.47	1.38	9.55	0.800	4.79	1.56	9.72
0.5 ...	0.782	4.19	1.35	9.51	0.782	4.51	1.52	9.67	0.782	4.82	1.70	9.82
0.6 ...	0.767	4.21	1.47	9.61	0.767	4.53	1.64	9.76	0.767	4.85	1.82	9.91
0.7 ...	0.752	4.23	1.59	9.71	0.752	4.55	1.75	9.85	0.752	4.87	1.93	0.00
0.8 ...	0.739	4.25	1.69	9.80	0.739	4.57	1.85	9.94	0.739	4.89	2.03	0.08
0.9 ...	0.727	4.26	1.79	9.88	0.727	4.58	1.95	0.02	0.727	4.90	2.12	0.16
1.0 ...	0.716	4.27	1.87	9.95	0.716	4.59	2.04	0.09	0.716	4.92	2.21	0.23
1.5 ...	0.670	4.29	2.23	0.28	0.670	4.62	2.40	0.41	0.670	4.95	2.55	0.54
2 ...	0.636	4.31	2.48	0.54	0.636	4.64	2.65	0.65	0.636	4.97	2.82	0.77
3 ...	0.588	4.32	2.85	0.95	0.588	4.65	3.01	1.03	0.588	4.98	3.19	1.13
4 ...	0.553	4.32	3.10	1.25	0.553	4.66	3.28	1.34	0.553	4.99	3.45	1.42
5 ...	0.527	4.33	3.29	1.48	0.527	4.66	3.47	1.56	0.527	5.00	3.65	1.62
6 ...	0.506	4.33	3.44	1.66	0.506	4.66	3.62	1.73	0.506	5.00	3.80	1.80
7 ...	0.489	4.33	3.55	1.79	0.489	4.67	3.75	1.87	0.489	5.00	3.93	1.94
8 ...	0.474	4.33	3.63	1.90	0.474	4.67	3.84	1.98	0.474	5.00	4.03	2.06
9 ...	0.461	4.33	3.71	1.99	0.461	4.67	3.92	2.07	0.461	5.00	4.11	2.16
10 ...	0.450	4.33	3.76	2.04	0.450	4.67	3.99	2.14	0.450	5.01	4.19	2.23

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.783	4.19	1.34						
0.777	4.20	1.39	0.777	4.52	1.56	0.768	4.85	1.81
0.723	4.30	1.84	0.726	4.60	1.96	0.735	4.90	2.06
0.680	4.40	2.21	0.680	4.70	2.36	0.683	5.00	2.49
0.643	4.50	2.53	0.642	4.80	2.69	0.640	5.10	2.86
0.613	4.60	2.80	0.610	4.90	2.98	0.606	5.20	3.16
0.589	4.70	3.03	0.580	5.00	3.25	0.574	5.30	3.45
0.567	4.80	3.25	0.556	5.10	3.48	0.548	5.40	3.70
0.547	4.90	3.45	0.534	5.20	3.70	0.526	5.50	3.92

Table 11 (continued). Model stellar atmospheres.

$\theta_0 = 0.9.\ \log A = 4.2.$

	log g = 3.5				log g = 4.0				log g = 4.5			
τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00...	0.900				0.900				0.900			
0.01...	0.896	3.30	0.06	8.42	0.896	3.66	0.26	8.60	0.896	3.97	0.42	8.76
0.02...	0.893	3.49	0.18	8.53	0.893	3.84	0.37	8.71	0.893	4.16	0.55	8.88
0.03...	0.890	3.60	0.26	8.60	0.890	3.94	0.45	8.78	0.890	4.26	0.63	8.95
0.04...	0.887	3.67	0.32	8.65	0.887	4.01	0.50	8.83	0.887	4.33	0.69	9.00
0.05...	0.884	3.73	0.37	8.70	0.884	4.07	0.55	8.87	0.884	4.39	0.74	9.05
0.06...	0.881	3.77	0.41	8.74	0.881	4.11	0.60	8.91	0.881	4.43	0.78	9.09
0.07...	0.878	3.81	0.45	8.78	0.878	4.15	0.64	8.95	0.878	4.47	0.82	9.13
0.08...	0.875	3.84	0.49	8.81	0.875	4.18	0.68	8.98	0.875	4.51	0.86	9.16
0.09...	0.872	3.87	0.53	8.84	0.872	4.21	0.71	9.01	0.872	4.54	0.90	9.19
0.10...	0.869	3.90	0.57	8.86	0.869	4.23	0.74	9.03	0.869	4.57	0.94	9.22
0.15...	0.853	3.99	0.73	8.99	0.853	4.33	0.91	9.17	0.853	4.66	1.09	9.34
0.2 ...	0.843	4.05	0.83	9.07	0.843	4.39	1.01	9.25	0.843	4.71	1.18	9.42
0.3 ...	0.820	4.13	1.03	9.24	0.820	4.46	1.20	9.40	0.820	4.79	1.38	9.58
0.4 ...	0.800	4.18	1.20	9.38	0.800	4.51	1.37	9.54	0.800	4.84	1.55	9.71
0.5 ...	0.782	4.21	1.35	9.50	0.782	4.54	1.52	9.66	0.782	4.87	1.69	9.81
0.6 ...	0.767	4.23	1.47	9.60	0.767	4.57	1.64	9.76	0.767	4.90	1.81	9.91
0.7 ...	0.752	4.25	1.59	9.71	0.752	4.59	1.76	9.86	0.752	4.92	1.93	0.00
0.8 ...	0.739	4.26	1.69	9.79	0.739	4.60	1.86	9.94	0.739	4.93	2.03	0.09
0.9 ...	0.727	4.27	1.78	9.87	0.727	4.61	1.95	0.01	0.727	4.94	2.13	0.16
1.0 ...	0.716	4.28	1.87	9.95	0.716	4.62	2.04	0.09	0.716	4.95	2.21	0.23
1.5 ...	0.670	4.31	2.23	0.29	0.670	4.65	2.40	0.42	0.670	4.98	2.57	0.54
2 ...	0.636	4.32	2.49	0.54	0.636	4.66	2.66	0.66	0.636	5.00	2.83	0.78
3 ...	0.588	4.33	2.85	0.95	0.588	4.68	3.03	1.04	0.588	5.01	3.19	1.13
4 ...	0.553	4.34	3.11	1.26	0.553	4.68	3.29	1.34	0.553	5.02	3.47	1.42
5 ...	0.527	4.34	3.30	1.48	0.527	4.69	3.48	1.56	0.527	5.03	3.67	1.64
6 ...	0.506	4.34	3.45	1.67	0.506	4.69	3.63	1.74	0.506	5.03	3.82	1.81
7 ...	0.489	4.34	3.55	1.80	0.489	4.69	3.76	1.88	0.489	5.03	3.94	1.95
8 ...	0.474	4.35	3.65	1.91	0.474	4.69	3.86	2.00	0.474	5.03	4.05	2.07
9 ...	0.461	4.35	3.72	1.99	0.461	4.69	3.93	2.08	0.461	5.03	4.13	2.17
10 ...	0.450	4.35	3.78	2.04	0.450	4.69	4.00	2.14	0.450	5.03	4.21	2.24

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.785	4.21	1.32	0.781	4.54	1.52	0.776	4.89	1.74
0.738	4.30	1.72	0.749	4.60	1.79	0.768	4.90	1.80
0.693	4.40	2.10	0.696	4.70	2.23	0.710	5.00	2.28
0.655	4.50	2.43	0.652	4.80	2.61	0.661	5.10	2.70
0.623	4.60	2.73	0.619	4.90	2.91	0.620	5.20	3.05
0.598	4.70	2.97	0.589	5.00	3.18	0.586	5.30	3.36
0.575	4.80	3.19	0.565	5.10	3.41	0.558	5.40	3.62
0.554	4.90	3.40	0.543	5.20	3.64	0.534	5.50	3.86
0.536	5.00	3.59	0.523	5.30	3.80			

Table 12. Model stellar atmospheres.

$\theta_0 = 0.8.\ \log A = 3.8.$

	log g = 3.5				log g = 4.0				log g = 4.5			
τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00...	0.800				0.800				0.800			
0.01...	0.796	2.84	0.56	8.86	0.796	3.20	0.74	9.00	0.796	3.54	0.92	9.14
0.02...	0.793	3.04	0.68	8.96	0.793	3.40	0.87	9.10	0.793	3.75	1.05	9.25
0.03...	0.790	3.16	0.76	9.02	0.790	3.52	0.95	9.17	0.790	3.86	1.12	9.31
0.04...	0.787	3.24	0.82	9.08	0.787	3.60	1.01	9.22	0.787	3.94	1.18	9.37
0.05...	0.785	3.30	0.87	9.12	0.785	3.66	1.05	9.25	0.785	4.00	1.23	9.40
0.06...	0.782	3.34	0.91	9.16	0.782	3.70	1.09	9.30	0.782	4.05	1.28	9.44
0.07...	0.779	3.38	0.95	9.19	0.779	3.74	1.14	9.34	0.779	4.09	1.32	9.48
0.08...	0.777	3.41	0.99	9.22	0.777	3.78	1.17	9.36	0.777	4.12	1.35	9.50
0.09...	0.774	3.44	1.02	9.25	0.774	3.81	1.21	9.39	0.774	4.15	1.38	9.54
0.10...	0.772	3.47	1.05	9.28	0.772	3.83	1.23	9.42	0.772	4.18	1.42	9.56
0.15...	0.760	3.57	1.19	9.39	0.760	3.92	1.37	9.54	0.760	4.28	1.56	9.68
0.2 ...	0.749	3.63	1.30	9.48	0.749	3.99	1.49	9.63	0.749	4.34	1.67	9.78
0.3 ...	0.729	3.71	1.49	9.65	0.729	4.07	1.67	9.78	0.729	4.42	1.85	9.93
0.4 ...	0.711	3.76	1.65	9.80	0.711	4.12	1.84	9.93	0.711	4.47	2.01	0.07
0.5 ...	0.695	3.79	1.78	9.93	0.695	4.15	1.97	0.05	0.695	4.50	2.14	0.19
0.6 ...	0.681	3.82	1.90	0.04	0.681	4.17	2.08	0.16	0.681	4.53	2.27	0.29
0.7 ...	0.669	3.83	1.99	0.14	0.669	4.19	2.18	0.26	0.669	4.55	2.37	0.39
0.8 ...	0.657	3.85	2.09	0.25	0.657	4.21	2.27	0.35	0.657	4.56	2.46	0.48
0.9 ...	0.646	3.86	2.18	0.34	0.646	4.22	2.36	0.44	0.646	4.57	2.54	0.56
1.0 ...	0.636	3.86	2.25	0.42	0.636	4.23	2.44	0.51	0.636	4.58	2.62	0.63
1.5 ...	0.596	3.89	2.56	0.77	0.596	4.25	2.74	0.86	0.596	4.61	2.93	0.95
2 ...	0.566	3.90	2.78	1.05	0.566	4.27	2.98	1.13	0.566	4.63	3.17	1.22
3 ...	0.522	3.91	3.09	1.43	0.522	4.28	3.29	1.51	0.522	4.64	3.50	1.58
4 ...	0.492	3.91	3.27	1.67	0.492	4.28	3.50	1.76	0.492	4.65	3.72	1.84
5 ...	0.468	3.92	3.39	1.81	0.468	4.28	3.64	1.93	0.468	4.65	3.86	2.02
6 ...	0.450	3.92	3.47	1.88	0.450	4.29	3.74	2.03	0.450	4.65	3.98	2.13
7 ...	0.434	3.92	3.52	1.90	0.434	4.29	3.81	2.08	0.434	4.66	4.06	2.21
8 ...	0.421	3.92	3.55	1.90	0.421	4.29	3.86	2.12	0.421	4.66	4.13	2.27
9 ...	0.410	3.92	3.57	1.88	0.410	4.29	3.89	2.12	0.410	4.66	4.17	2.31
10 ...	0.400	3.93	3.59	1.85	0.400	4.29	3.91	2.12	0.400	4.66	4.22	2.34

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.718	3.75	1.59	0.710	4.12	1.84	0.707	4.49	2.05
0.701	3.80	1.73						
0.672	3.90	2.00	0.678	4.20	2.12	0.702	4.50	2.09
0.646	4.00	2.24	0.645	4.30	2.42	0.660	4.60	2.45
0.621	4.10	2.49	0.619	4.40	2.66	0.624	4.70	2.77
0.600	4.20	2.69	0.595	4.50	2.88	0.596	4.80	3.03
0.582	4.30	2.89	0.575	4.60	3.08	0.572	4.90	3.26
0.565	4.40	3.06	0.557	4.70	3.26	0.550	5.00	3.48
0.549	4.50	3.23	0.539	4.80	3.45	0.532	5.10	3.67
			0.523	4.90	3.62	0.514	5.20	3.86

Table 13. Model stellar atmospheres.

$\theta_0 = 0.7.\ \log A = 3.8.$

	$\log g = 3.5$				$\log g = 4.0$				$\log g = 4.5$			
τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00...	0.700				0.700				0.700			
0.01...	0.696	2.11	0.90	9.49	0.696	2.59	1.15	9.59	0.696	3.04	1.38	9.69
0.02...	0.693	2.35	1.05	9.55	0.693	2.80	1.28	9.66	0.693	3.23	1.50	9.77
0.03...	0.690	2.50	1.14	9.61	0.690	2.92	1.36	9.71	0.690	3.35	1.59	9.83
0.04...	0.688	2.59	1.21	9.66	0.688	3.01	1.43	9.75	0.688	3.43	1.65	9.87
0.05...	0.686	2.67	1.27	9.69	0.686	3.08	1.48	9.79	0.686	3.50	1.70	9.90
0.06...	0.684	2.73	1.31	9.73	0.684	3.14	1.52	9.82	0.684	3.55	1.74	9.93
0.07...	0.682	2.78	1.35	9.75	0.682	3.18	1.56	9.85	0.682	3.59	1.78	9.96
0.08...	0.680	2.82	1.39	9.77	0.680	3.22	1.60	9.87	0.680	3.63	1.81	9.99
0.09...	0.678	2.85	1.42	9.80	0.678	3.25	1.63	9.90	0.678	3.66	1.84	0.02
0.10...	0.676	2.87	1.45	9.83	0.676	3.28	1.66	9.93	0.676	3.69	1.87	0.04
0.15...	0.666	2.98	1.58	9.95	0.666	3.39	1.79	0.05	0.666	3.79	2.00	0.16
0.2 ...	0.656	3.05	1.69	0.05	0.656	3.46	1.90	0.14	0.656	3.85	2.10	0.25
0.3 ...	0.638	3.13	1.86	0.23	0.638	3.54	2.07	0.32	0.638	3.93	2.27	0.42
0.4 ...	0.622	3.18	2.00	0.39	0.622	3.59	2.22	0.48	0.622	3.98	2.42	0.57
0.5 ...	0.609	3.21	2.11	0.52	0.609	3.62	2.33	0.59	0.609	4.02	2.53	0.69
0.6 ...	0.596	3.23	2.21	0.65	0.596	3.64	2.43	0.72	0.596	4.04	2.63	0.81
0.7 ...	0.585	3.25	2.29	0.76	0.585	3.66	2.52	0.83	0.585	4.06	2.73	0.91
0.8 ...	0.575	3.26	2.36	0.85	0.575	3.67	2.60	0.93	0.575	4.07	2.81	1.01
0.9 ...	0.565	3.27	2.44	0.94	0.565	3.68	2.67	1.03	0.565	4.08	2.89	1.10
1.0 ...	0.557	3.28	2.50	1.01	0.557	3.69	2.73	1.10	0.557	4.09	2.95	1.18
1.5 ...	0.521	3.30	2.71	1.30	0.521	3.71	2.97	1.40	0.521	4.11	3.21	1.48
2 ...	0.495	3.32	2.84	1.46	0.495	3.72	3.13	1.60	0.495	4.13	3.39	1.70
3 ...	0.457	3.34	2.97	1.54	0.457	3.74	3.31	1.78	0.457	4.14	3.60	1.94
4 ...	0.430	3.36	3.03	1.49	0.430	3.75	3.38	1.80	0.430	4.15	3.71	2.03
5 ...	0.410	3.38	3.06	1.42	0.410	3.77	3.43	1.76	0.410	4.16	3.78	2.04
6 ...	0.394	3.40	3.09	1.35	0.394	3.78	3.46	1.70	0.394	4.17	3.82	2.02
7 ...	0.380	3.43	3.12	1.29	0.380	3.80	3.48	1.64	0.380	4.18	3.85	1.97
8 ...	0.369	3.45	3.15	1.23	0.369	3.81	3.50	1.58	0.369	4.19	3.87	1.91
9 ...	0.359	3.48	3.18	1.19	0.359	3.83	3.52	1.53	0.359	4.20	3.88	1.86
10 ...	0.350	3.51	3.21	1.14	0.350	3.85	3.54	1.47	0.350	4.21	3.89	1.81

θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$	θ	$\log p$	$\log p_e$
0.658	3.04	1.67	0.649	3.50	1.97	0.643	3.92	2.23
0.649	3.10	1.76						
0.634	3.20	1.92	0.631	3.60	2.15	0.626	4.00	2.40
0.619	3.30	2.09	0.614	3.70	2.32	0.606	4.10	2.59
0.605	3.40	2.24	0.598	3.80	2.49	0.588	4.20	2.78
0.592	3.50	2.38	0.583	3.90	2.65	0.571	4.30	2.96
0.580	3.60	2.52	0.569	4.00	2.82	0.556	4.40	3.12
0.568	3.70	2.66	0.556	4.10	2.96	0.540	4.50	3.30
0.556	3.80	2.80	0.543	4.20	3.11	0.526	4.60	3.45
0.544	3.90	2.93	0.530	4.30	3.26	0.512	4.70	3.60
0.533	4.00	3.07	0.518	4.40	3.39	0.499	4.80	3.75

SPECIAL STELLAR ATMOSPHERES

Table 14. Model solar atmospheres.

	log A = 3.0				log A = 3.4			
τ	θ	$\log p$	$\log p_e$	$\log \overline{\overline{\varkappa}}$	θ	$\log p$	$\log p_e$	$\log \overline{\overline{\varkappa}}$
0.00..........	1.041				1.041			
0.01..........	1.037	3.66	0.52	9.10	1.037	3.84	0.33	8.91
0.02..........	1.034	3.81	0.64	9.22	1.034	4.00	0.47	9.05
0.03..........	1.030	3.90	0.72	9.29	1.030	4.09	0.55	9.12
0.04..........	1.027	3.96	0.78	9.35	1.027	4.15	0.60	9.17
0.05..........	1.023	4.02	0.83	9.39	1.023	4.20	0.65	9.22
0.06..........	1.019	4.06	0.87	9.43	1.019	4.24	0.69	9.25
0.07..........	1.015	4.10	0.91	9.46	1.015	4.28	0.73	9.28
0.08..........	1.012	4.12	0.93	9.48	1.012	4.31	0.76	9.31
0.09..........	1.009	4.15	0.97	9.50	1.009	4.34	0.79	9.33
0.10..........	1.005	4.18	1.00	9.52	1.005	4.36	0.82	9.35
0.2	0.975	4.34	1.20	9.64	0.975	4.52	1.00	9.47
0.3	0.949	4.44	1.30	9.72	0.949	4.62	1.12	9.55
0.4	0.925	4.51	1.39	9.78	0.925	4.69	1.22	9.61
0.5	0.905	4.57	1.47	9.82	0.905	4.75	1.30	9.65
0.6	0.887	4.61	1.53	9.85	0.887	4.79	1.38	9.68
0.7	0.870	4.65	1.59	9.87	0.870	4.83	1.44	9.71
0.8	0.855	4.68	1.64	9.90	0.855	4.86	1.50	9.74
0.9	0.841	4.71	1.69	9.91	0.841	4.89	1.56	9.79
1.0	0.828	4.74	1.74	9.94	0.828	4.91	1.62	9.82
1.1	0.816	4.76	1.79	9.96	0.816	4.93	1.68	9.86
1.2	0.805	4.78	1.83	9.98	0.805	4.95	1.74	9.90
1.3	0.794	4.80	1.88	0.01	0.794	4.96	1.80	9.94
1.4	0.784	4.82	1.92	0.05	0.784	4.98	1.86	9.98
1.5	0.775	4.84	1.97	0.08	0.775	4.99	1.91	0.02
1.6	0.767	4.85	2.01	0.10	0.767	5.00	1.96	0.06
1.7	0.758	4.86	2.05	0.13	0.758	5.01	2.02	0.09
1.8	0.751	4.87	2.09	0.16	0.751	5.02	2.07	0.13
1.9	0.743	4.88	2.13	0.19	0.743	5.03	2.12	0.17
2.0	0.736	4.90	2.18	0.22	0.736	5.03	2.16	0.20
2.5								
3.0								

$\theta_0 = 1.041.\ \log g = 4.44.$

	$\log A = 3.8$				$\log A = 4.2$			
θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	τ
1.041				1.041				..........0.00
1.037	4.02	0.15	8.74	1.037	4.23	0.01	8.60	..........0.01
1.034	4.17	0.28	8.86	1.034	4.37	0.13	8.71	..........0.02
1.030	4.26	0.37	8.94	1.030	4.45	0.20	8.78	..........0.03
1.027	4.33	0.43	8.99	1.027	4.51	0.26	8.83	..........0.04
1.023	4.38	0.48	9.04	1.023	4.56	0.31	8.87	..........0.05
1.019	4.42	0.52	9.08	1.019	4.61	0.36	8.92	..........0.06
1.015	4.45	0.55	9.10	1.015	4.64	0.39	8.94	..........0.07
1.012	4.49	0.59	9.13	1.012	4.66	0.42	8.96	..........0.08
1.009	4.51	0.61	9.15	1.009	4.69	0.45	8.98	..........0.09
1.005	4.54	0.64	9.17	1.005	4.72	0.48	9.01	..........0.10
0.975	4.70	0.82	9.30	0.975	4.87	0.67	9.14	..........0.2
0.949	4.80	0.95	9.38	0.949	4.97	0.82	9.25	..........0.3
0.925	4.86	1.05	9.44	0.925	5.04	0.95	9.34	..........0.4
0.905	4.92	1.15	9.50	0.905	5.08	1.06	9.41	..........0.5
0.887	4.96	1.24	9.55	0.887	5.11	1.17	9.48	..........0.6
0.870	4.99	1.32	9.60	0.870	5.14	1.28	9.55	..........0.7
0.855	5.02	1.40	9.66	0.855	5.16	1.37	9.62	..........0.8
0.841	5.04	1.48	9.70	0.841	5.18	1.46	9.69	..........0.9
0.828	5.06	1.56	9.77	0.828	5.20	1.56	9.77	..........1.0
0.816	5.08	1.64	9.82	0.816	5.21	1.64	9.83	..........1.1
0.805	5.09	1.71	9.87	0.805	5.22	1.72	9.88	..........1.2
0.794	5.11	1.78	9.93	0.794	5.23	1.80	9.94	..........1.3
0.784	5.11	1.85	9.97	0.784	5.24	1.87	0.00	..........1.4
0.775	5.12	1.91	0.02	0.775	5.25	1.94	0.05	..........1.5
0.767	5.13	1.97	0.06	0.767	5.25	1.99	0.09	..........1.6
0.758	5.14	2.03	0.11	0.758	5.26	2.06	0.14	..........1.7
0.751	5.15	2.08	0.15	0.751	5.26	2.11	0.18	..........1.8
0.743	5.16	2.13	0.19	0.743	5.27	2.17	0.23	..........1.9
0.736	5.16	2.19	0.23	0.736	5.27	2.23	0.27	..........2.0
0.707	5.18	2.41	0.40					..........2.5
0.681	5.19	2.60	0.56					..........3.0

Table 15.

Model solar atmospheres. $\theta_0 = 1.041$. $\log g = 4.44$.
(Calculated with Rudkjøbing's opacity tables, cf. p.12).

	log A = 3.4				log A = 3.8				log A = 4.2			
τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00...	1.041				1.041				1.041			
0.01...	1.037	3.84	0.33	8.87	1.037	4.04	0.17	8.70	1.037	4.20	9.99	8.53
0.02...	1.034	4.00	0.47	9.01	1.034	4.19	0.30	8.83	1.034	4.36	0.13	8.66
0.03...	1.030	4.09	0.55	9.08	1.030	4.27	0.37	8.91	1.030	4.45	0.20	8.74
0.04...	1.027	4.16	0.61	9.15	1.027	4.33	0.43	8.96	1.027	4.52	0.27	8.80
0.05...	1.023	4.22	0.67	9.19	1.023	4.39	0.47	9.01	1.023	4.57	0.32	8.84
0.06...	1.019	4.26	0.71	9.23	1.019	4.43	0.53	9.04	1.019	4.61	0.36	8.88
0.07...	1.015	4.30	0.75	9.26	1.015	4.47	0.56	9.07	1.015	4.65	0.40	8.91
0.08...	1.012	4.33	0.78	9.28	1.012	4.50	0.59	9.10	1.012	4.68	0.43	8.93
0.09...	1.009	4.36	0.81	9.30	1.009	4.53	0.62	9.12	1.009	4.71	0.46	8.95
0.10...	1.005	4.38	0.83	9.32	1.005	4.55	0.65	9.14	1.005	4.73	0.48	8.97
0.15...	0.989	4.47	0.93	9.40	0.989	4.66	0.77	9.23	0.989	4.83	0.62	9.05
0.2 ...	0.975	4.54	1.02	9.45	0.975	4.73	0.85	9.28	0.975	4.90	0.69	9.11
0.3 ...	0.949	4.64	1.14	9.53	0.949	4.82	0.97	9.36	0.949	4.99	0.83	9.20
0.4 ...	0.925	4.71	1.24	9.58	0.925	4.89	1.08	9.41	0.925	5.05	0.96	9.30
0.5 ...	0.905	4.77	1.32	9.62	0.905	4.94	1.17	9.46	0.905	5.10	1.07	9.38
0.6 ...	0.887	4.82	1.39	9.66	0.887	4.99	1.26	9.52	0.887	5.14	1.19	9.45
0.7 ...	0.870	4.85	1.45	9.68	0.870	5.02	1.34	9.57	0.870	5.17	1.29	9.52
0.8 ...	0.855	4.89	1.52	9.72	0.855	5.05	1.42	9.63	0.855	5.19	1.38	9.58
0.9 ...	0.841	4.91	1.59	9.76	0.841	5.07	1.50	9.67	0.841	5.21	1.48	9.65
1.0 ...	0.828	4.94	1.65	9.80	0.828	5.09	1.58	9.72	0.828	5.22	1.57	9.72
1.5 ...	0.775	5.02	1.93	9.99	0.775	5.16	1.93	9.97	0.775	5.27	1.95	0.00
2 ...	0.736	5.06	2.18	0.16	0.736	5.19	2.20	0.20	0.736	5.29	2.24	0.23
3 ...	0.680	5.11	2.58	0.51	0.680	5.22	2.62	0.54	0.680	5.32	2.67	0.57
4 ...	0.640	5.13	2.88	0.76	0.640	5.24	2.93	0.79	0.640	5.33	2.97	0.82
5 ...	0.610	5.14	3.11	0.97	0.610	5.25	3.16	1.01	0.610	5.34	3.20	1.01
6 ...	0.585	5.15	3.29	1.14	0.585	5.25	3.34	1.18	0.585	5.34	3.38	1.18
7 ...	0.565	5.16	3.44	1.29	0.565	5.26	3.49	1.32	0.565	5.34	3.53	1.33
8 ...	0.548	5.16	3.58	1.43	0.548	5.26	3.63	1.45	0.548	5.35	3.67	1.47
9 ...	0.533	5.16	3.69	1.55	0.533	5.26	3.74	1.57	0.533	5.35	3.78	1.59
10 ...	0.520	5.16	3.79	1.65	0.520	5.26	3.84	1.67	0.520	5.35	3.88	1.68

θ	$\log p$
0.816	5.11
0.753	5.20
0.695	5.30
0.647	5.40
0.605	5.50
0.570	5.60
0.542	5.70
0.518	5.80

Table 16.

Model stellar atmospheres. $\theta_0 = 1.041$. $\log g = 3.0$. (Calculated with Rudkjøbing's opacity tables, cf. p. 12).

	$\log A = 3.4$				$\log A = 3.8$				$\log A = 4.2$			
τ	θ	$\log p$	$\log p_e$	$\log \varkappa$	θ	$\log p$	$\log p_e$	$\log \varkappa$	θ	$\log p$	$\log p_e$	$\log \varkappa$
0.00...	1.041				1.041				1.041			
0.01...	1.037	3.12	9.66	8.25	1.037	3.27	9.49	8.07	1.037	3.36	9.30	7.93
0.02...	1.034	3.26	9.82	8.36	1.034	3.41	9.62	8.18	1.034	3.51	9.43	8.04
0.03...	1.030	3.35	9.91	8.44	1.030	3.50	9.70	8.25	1.030	3.62	9.53	8.10
0.04...	1.027	3.41	9.95	8.50	1.027	3.57	9.77	8.31	1.027	3.69	9.59	8.16
0.05...	1.023	3.46	0.01	8.54	1.023	3.62	9.82	8.35	1.023	3.74	9.64	8.19
0.06...	1.019	3.50	0.06	8.58	1.019	3.66	9.86	8.39	1.019	3.79	9.69	8.22
0.07...	1.015	3.53	0.09	8.60	1.015	3.70	9.90	8.42	1.015	3.83	9.73	8.25
0.08...	1.012	3.56	0.12	8.63	1.012	3.73	9.94	8.44	1.012	3.86	9.77	8.28
0.09...	1.009	3.59	0.15	8.65	1.009	3.76	9.97	8.46	1.009	3.89	9.80	8.30
0.10...	1.005	3.61	0.16	8.67	1.005	3.78	9.99	8.48	1.005	3.91	9.83	8.32
0.15...	0.989	3.71	0.28	8.73	0.989	3.88	0.11	8.56	0.989	4.02	9.97	8.42
0.2 ...	0.975	3.78	0.36	8.78	0.975	3.94	0.18	8.62	0.975	4.09	0.08	8.50
0.3 ...	0.949	3.87	0.48	8.85	0.949	4.04	0.34	8.72	0.949	4.18	0.25	8.62
0.4 ...	0.925	3.94	0.57	8.91	0.925	4.10	0.46	8.80	0.925	4.24	0.41	8.73
0.5 ...	0.905	4.00	0.67	8.98	0.905	4.15	0.58	8.88	0.905	4.27	0.54	8.83
0.6 ...	0.887	4.04	0.76	9.03	0.887	4.19	0.70	8.96	0.887	4.30	0.67	8.91
0.7 ...	0.870	4.07	0.85	9.09	0.870	4.22	0.80	9.04	0.870	4.32	0.79	9.00
0.8 ...	0.855	4.10	0.92	9.15	0.855	4.24	0.90	9.11	0.855	4.34	0.90	9.10
0.9 ...	0.841	4.12	1.00	9.20	0.841	4.25	0.99	9.18	0.841	4.36	1.00	9.18
1.0 ...	0.828	4.14	1.09	9.25	0.828	4.27	1.09	9.25	0.828	4.37	1.10	9.26
1.5 ...	0.775	4.20	1.44	9.54	0.775	4.31	1.46	9.55	0.775	4.40	1.50	9.59
2 ...	0.736	4.23	1.71	9.76	0.736	4.34	1.76	9.81	0.736	4.42	1.79	9.84
3 ...	0.680	4.26	2.14	0.17	0.680	4.36	2.19	0.20	0.680	4.43	2.23	0.23
4 ...	0.640	4.27	2.44	0.47	0.640	4.36	2.48	0.49	0.640	4.44	2.52	0.50
5 ...	0.610	4.28	2.66	0.71	0.610	4.37	2.70	0.74	0.610	4.44	2.74	0.74
6 ...	0.585	4.28	2.84	0.93	0.585	4.37	2.89	0.95	0.585	4.44	2.93	0.96
7 ...	0.565	4.28	2.99	1.10	0.565	4.37	3.04	1.13	0.565	4.45	3.08	1.14
8 ...	0.548	4.28	3.11	1.24	0.548	4.37	3.16	1.27	0.548	4.45	3.21	1.28
9 ...	0.533	4.28	3.22	1.36	0.533	4.37	3.27	1.39	0.533	4.45	3.32	1.40
10 ...	0.520	4.28	3.31	1.48	0.520	4.37	3.36	1.49	0.520	4.45	3.41	1.51

θ	$\log p$
0.856	4.24
0.813	4.30
0.750	4.40
0.700	4.50
0.658	4.60
0.624	4.70
0.596	4.80
0.571	4.90

Table 17.

Model stellar atmosphere. $\theta_0 = 0.7$. $\log g = 4.2$. $\log A = 3.8$. (Calculated with Rudkjøbing's opacity tables, cf. p. 12).

τ	θ	$\log p$	$\log p_e$	$\log \bar{\varkappa}$
0.00	0.700			
0.01	0.696	2.76	1.24	9.59
0.02	0.693	2.97	1.37	9.67
0.03	0.690	3.10	1.46	9.72
0.04	0.688	3.19	1.52	9.78
0.05	0.686	3.27	1.58	9.82
0.06	0.684	3.32	1.62	9.86
0.07	0.682	3.36	1.66	9.89
0.08	0.680	3.40	1.69	9.91
0.09	0.678	3.43	1.72	9.94
0.10	0.676	3.46	1.75	9.96
0.15	0.666	3.56	1.88	0.08
0.2	0.656	3.63	1.98	0.17
0.3	0.638	3.71	2.16	0.34
0.4	0.622	3.76	2.30	0.50
0.5	0.609	3.79	2.41	0.62
0.6	0.596	3.81	2.51	0.75
0.7	0.585	3.83	2.61	0.86
0.8	0.575	3.84	2.69	0.95
0.9	0.565	3.85	2.76	1.03
1.0	0.557	3.86	2.82	1.11
1.5	0.521	3.89	3.09	1.41
2	0.495	3.90	3.24	1.60
3	0.457	3.92	3.44	1.83
4	0.430	3.93	3.53	1.88
5	0.410	3.94	3.58	1.86
6	0.394	3.95	3.61	1.81
7	0.380	3.96	3.64	1.76
8	0.369	3.98	3.67	1.71
9	0.359	3.99	3.68	1.66
10	0.350	4.00	3.69	1.61

θ	$\log p$
0.648	3.67
0.641	3.70
0.621	3.80
0.604	3.90
0.587	4.00
0.513	4.50

Table 18.

Model stellar atmosphere. $\theta_0 = 0.7$. $\log g = 2.5$. $\log A = 3.8$ (Calculated with Rudkjøbing's opacity tables, cf. p. 12).

τ	θ	$\log p$	$\log p_e$	$\log \overline{\varkappa}$
0.00	0.700			
0.01	0.696	1.37	0.48	9.30
0.02	0.693	1.57	0.60	9.36
0.03	0.690	1.70	0.71	9.42
0.04	0.688	1.79	0.77	9.46
0.05	0.686	1.86	0.83	9.49
0.06	0.684	1.92	0.87	9.52
0.07	0.682	1.96	0.91	9.55
0.08	0.680	2.00	0.95	9.59
0.09	0.678	2.03	0.99	9.62
0.10	0.676	2.06	1.02	9.64
0.15	0.666	2.17	1.15	9.77
0.2	0.656	2.23	1.25	9.87
0.3	0.638	2.31	1.40	0.06
0.4	0.622	2.36	1.54	0.20
0.5	0.609	2.39	1.64	0.33
0.6	0.596	2.41	1.72	0.44
0.7	0.585	2.43	1.79	0.55
0.8	0.575	2.44	1.85	0.62
0.9	0.565	2.45	1.91	0.69
1.0	0.557	2.46	1.95	0.75
1.5	0.521	2.50	2.11	0.93
2	0.495	2.52	2.17	0.96
3	0.457	2.57	2.25	0.91
4	0.430	2.61	2.30	0.82
5	0.410	2.67	2.36	0.74
6	0.394	2.72	2.42	0.68
7	0.380	2.77	2.47	0.63
8	0.369	2.83	2.53	0.61
9	0.359	2.88	2.58	0.58
10	0.350	2.93	2.63	0.55

θ	$\log p$
0.667	2.15
0.661	2.20
0.651	2.30
0.638	2.40
0.628	2.50
0.618	2.60
0.607	2.70
0.597	2.80
0.588	2.90
0.577	3.00
0.568	3.10
0.557	3.20