KURUCZ'S MODELS, KURUCZ'S FLUXES AND THE ATLAS CODE.

MODELS AND FLUXES AVAILABLE AT OAT

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1. INTRODUCTION

By far the most extensive grid of LTE models atmosphere available at present is that of Kurucz. On the whole there are 1200 blanketed models for G, F, A, B, and O stars, which have been partly published (Kurucz, 1979a) and partly unpublished (Kurucz, 1979b). However all circulate privately, because they are given on request by the author on a magnetic tape.

Other Kurucz's models can be computed directly with ATLAS code, whose eighth version is today available from Kurucz.

The succession of models and codes with scattered documentation and the large amount of material that can be available from Kurucz may generate some confusion. Furthermore the user could need more information than those supplied by the author of the code, or information in a different form. In this report we have collected and rearranged a great quantity of notes about the models and codes. They comes from papers of Kurucz and people that have used ATLAS, from the magnetic tapes received from Kurucz and from some personal experience.

In the last part of this paper we consider the material available on the DEC VAX 11/750 computer of the Astronet node of Trieste, and we give instructions to use it.

2. WHAT KURUCZ'S MODELS ARE.

The models, with the fundamental improvement of the line-blanketing, are the so-called "classical" models of a stellar atmosphere.
This means that they are computed with the following assumptions:

1) <u>Plane Parallel Layers.</u>
The thickness of the atmosphere is small compared to the size of the star as a whole.

2) <u>Homogeneous Layers except in the normal direction</u>.
Magnetic fields, granules, spicules, cells, spots are ignored

3) <u>Static atmosphere: Hydrostatic equilibrium.</u>
The pressure balances the gravitational attraction, therefore there is no relative motion of the layers in the normal direction and no net acceleration of the atmosphere. No expansion is allowed.

4) <u>Steady State</u>
The state of the gas and the transport of the radiation are constant with time. This assumption is a constraint on the state equation.

5) Local Thermodynamical Equilibrium
At each depth the state of the gas depends only from the local values of the radiation field (T,Ne), and has no connection with what the radiation in the other layers is. This assumption also influences the state equations.

6) Radiative+Convective Equilibrium
The flux of energy (radiative + convective) is constant with depth in the atmosphere. There is no creation of energy within the atmosphere.

7) The atomic abundances are specified and constant throughout the atmosphere.

3. THE 1200 MODELS

The 1200 LTE blanketed models available on magnetic tape are all computed with the previous hypotheses. Further assumptions, related to the state of the gas, the opacity, the convection and the turbulence, have been introduced.

1) The state of the gas:
The atmosphere is supposed formed of atoms of H I-II, He I-III, C I-IV, Na I-IV, Mg I-IV, Al I-IV, Si I-IV, K I-IV, Ca I-IV, Fe I-IV. Therefore the total particle density is formed by the number densities of these atoms and their contribution to the electron density. Molecular number densities are assumed to be negligible.

2) The opacity:
Continous opacities sources are H I-II, He I-III, C I-IV, N II-V, O II-VI, Ne I-VI, Mg I, Al I, Si I, H2+, H-, H2-, H and He Rayleigh scattering, and electron scattering.
Line opacity of about 1 million of lines is considered by using the opacity distribution functions (ODF) with microturbulence ξ=2 Km/s.

3) The convection
The mixing-length theory was used in the convection computations.

4) The turbulence
No turbulence pressure was considered.

Models with the same parameters Teff and log g differ in chemical composition and in the formulation of the mixing-length theory. A short explanation of the difference in the mixing-length theory is given in the next chapter.

The models are computed both with solar composition and with nine different metallicities as respect to the Sun. Table 1 shows the solar composition adopted by Kurucz. The values listed are logarithmic abundances intended as the logarithm of the ratio of the elemental number density to the total number density. Abundances (no logarithmic) for H and He are 0.9 and 0.1 respectively. To obtain the elemental abundances relative to H, $\log\varepsilon(H)=-0.05$ must be subtracted,i.e we must add 0.05 to the values of Table 1.

The metallicities [M/H] used in the grid are listed in Table 2.

Tables 3,4,5,6,7,8,9,10,11,12 assemble the models according to the metallicities.

Some models are purely radiative, namely the radiative flux only has been considered. They are indicated with an "R" in the tables.

Other models are radiative plus convective; a "C" letter represents them in the tables, if the convection theory adopted is that described in Kurucz (1970). We will refer to them as to the "old" convective models. "NC" letters indicates that the improved convection theory has been used (Kurucz,1979b). We will call them the "new" convective models. The number refers to the sequence number of the models on the tape. An asterisk indicates that the model is among the published ones.
Example: NC789 means that the sequence number of the model is 789 and that it is a "new" convective model. R122* indicates the model with number 122, radiative only and published.

The models 1-609 are computed with 40 optical depths. The models 610-1200 have 64 optical depths.

Models on the magnetic tape have a format different from that of the published ones. This format is shown in Table 38. It is the same for all the 1200 models and it permits to use the models directly as input data in the codes ATLAS, BALMER, WIDTH6, and SYNTHE.

The shortcomings of these models have been pointed out by Kurucz (Kurucz,1984 and Kurucz,1987). Here we recall the most important ones:

The omission of molecular line opacity and the underestimate of atomic line opacity should be the most important source of error for all the stars and in particular for late type stars.

Convection is important in F and G stars. The mixing-length theory is far from be a rigorous theory of the convection.

LTE models are not realistic for some stars, in particular the low gravity stars and the very hot stars.

The value of the microturbulent velocity used in the computation of the ODF's might not be correct for a particular studied star.

4. ATLAS CODE

The use of the ATLAS code permits the extension of the grid of models discussed in the previous chapter and permits the computation of models which can differ from the tabulated ones in some aspects:

1) The parameters Teff and log g
A model with parameters not included in the grid can be computed. However an interpolated model gives the same results.

2) The line opacity
ODF's different from those used in the 1200 models could be used, when available.

3) A mixture of different elements
Other elements and, for cool models, molecules could be taken into account in the state equation.

4) The mixing length to the scale height ratio
This parameter can be varied in the computation of the convective flux.

5) The turbulent pressure
Models with a turbulent pressure different from 0 can be computed

6) NLTE
Models which allow departure from LTE for the first 6 levels of the H atom and for H- can be computed. On the other hand NLTE as computed in ATLAS can be a good approximation only for A and B stars with no more than solar abundances and for cool Pop. II and III stars in which metals will not dominate the electrons. In fact the assumptions of detailed balance in the lines and of optically thick Lyman continuum strongly limit the validity of NLTE option in ATLAS (see also Chap. 7, LTE,NLTE control card).

ATLAS can also be used when results are wanted from an already calculted model: we mean surface fluxes or surface intensities, molecular densities, a model mapped on a new optical depth scale, and so on.

4.1 ATLAS versions

The first public version of ATLAS widely used was ATLAS5. It is extensively explained in the paper: "ATLAS: A Computer Program for Calculating Model Stellar Atmospheres" (Kurucz,1970). The physical and computational aspects of the model atmosphere calculations are described here in great detail and are the basis of all the successive versions.

In ATLAS5 only the line opacity of H was considered. The atmospheric layers were limited to 40 optical depths and the frequency integration points were suggested as 78. The program was presented as machine independent, but gave problems on UNIVAC and IBM computers. On the CDC 6400 it ran with an overlay structure; it did not give particular problems on the CDC 6600. The input support were the punch cards.

A good description of ATLAS5 has been given by Wright (1975) and by Wright and Argyros (1975), who did also some modifications and called SAM1 the modified version.

The new version known to the public is ATLAS6, but several different version of ATLAS6 probably exist. The big improvement was the inclusion of the atomic line opacity in the model computations. The effect of about one million of lines was considered by means of the line opacity distribution functions. The lines were extracted from the 1.700.000 lines of Kurucz-Peytremann (1975)list.

Probably the first ATLAS6 version was ATLAS5 with the only addition of the subroutine LINOP, which reads the file with the tables of ODF's and interpolates them to find the line opacity at the temperature and pressure points required in the course of model calculation. This code was used to compute the first published grid of blanketed models, i.e. the KPA grid (Kurucz et al.(1972)). The models listed are 92 and range in temperature from 8000 to 50000 K and in log gravity from 2 to 5. The distribution functions were computed in 86 intervals of wavelengths and were tabulated for 14 values of temperature and 9 values of gas pressure. Solar abundances and a microturbulence velocity of 2 Km/s were assumed.

A new version of ATLAS6 was used to compute the new grid of models published by Kurucz (1979a). The several modifications made to ATLAS5 are pointed out in this paper, namely changes in the temperature correction, radiation pressure, convection and corrections of some minor numerical instabilities and bugs.
The new grid covers a larger range in temperature (5500 to 50000 K) and in log gravity (1 to 5) than the previous grid and in addition to the solar abundances, 1/10 solar and 1/100 solar values are considered. Again a microturbulence velocity of 2 Km/s is assumed. The most significant improvement with respect to the previous grid is related to the more accurate values of ODF's, which were computed with the same number of lines and the same microturbulence velocity, but in a greater number of wavelength intervals. Furthermore the ODF's were tabulated for an extended temperature range with closer spacing (24 temperature values and 9 electron densities).

A successive ATLAS6 version, containing a modification of the standard mixing-length theory, became available. It circulated with 40 optical depths, but a version with 64 depths was used by Kurucz (1979b) to compute the unpublished convective models, which are part of the 1200 models available on magnetic tape.

In ATLAS5 (Kurucz,1970) and ATLAS6 (Kurucz,1979a) the convective flux is calculated assuming that the convecting elements are optically thick, and so the horizontal radiative energy loss of an element was determined using the diffusion approximation to radiative transfer. In the modified ATLAS6 version (Kurucz,1979b) a correction for optically thin bubbles after Mihalas (1978) was introduced. The efficiency parameter gamma adopted is obtained interpolating between the two extreme cases of optically thick and optically thin bubbles. A discussion on the convection used in ATLAS6 can be found in Lester et al.(1982).

ATLAS8 is the latest version of ATLAS available to the public. It was written to be squeezed, with an overlay structure, into a CDC6600 computer. Therefore the logical structure is partly altered with respect to the previous ones.

The most important change with respect to the new ATLAS6 version is related to the computation of the thermodynamic derivatives. They are more accurately calculated, because the necessary state variables are recomputed before use in the computation of the thermodynamic derivatives.

The VAX version of ATLAS8 is available in simple (ATLAS8) and in double precision (DATLAS8).

Some problems with exponent underflow or overflow may occur when the single precision is used. To suppress exponent error messages and allow the calculation to continue, the double precision version must be used. In order to be effective, it must be compiled with the G-floating option of the VMS. We remark that with the G-floating version the execution time increases by a factor of 4. Fortunately there are only special cases that need the G-floating VAX version, in particular the inclusion of the molecules in the state equation and the NLTE calculations.

5. THE TABLES IN ATLAS

A characteristic of ATLAS code is the use of tables which contain data computed with other utility programs or taken from the literature. These tables are either stored in the program or are supplied as input data from input files. The values required in the course of the model calculation are then obtained by interpolating in the tables. If the required values are off the limits of the tables they are obtained either extrapolating the tabulated data or using the boundary data of the table. The accuracy of the results can sometimes depend on the boundaries and spacings of the stored tables. In what follows we give a short list of the tables and their boundaries:

a) The Line-Absorption Distribution Functions and the Frequency Sets

For blanketed models the ODF's tables are the biggest ones to be used. They are stored on files that must be read as input data. The ODF are described in Kurucz (1970), Kurucz et al. (1974), Kurucz (1979a).

The whole wavelength range from 22.7 to 1000000 nm has been divided in wavelength intervals.

The tables of ODF read from ATLAS8 derive from two different divisions of the whole wavelength range, namely the BIG division with 114 intervals of about 10 nm and the LITTLE division with 335 intervals of about 2.5 nm. The set of the central wavelengths of each wavelength interval is the frequency set used in the frequency integrations required in the model calculations. In the last interval more frequency integration points have been assumed. In total, the BIG and the LITTLE frequency sets have 122 and 342 integration points respectively. The BIG division is used for model calculations, the LITTLE division both for model calculations and flux determinations, but the model computation is three times longer than with the BIG division. Table 13 and Table 14 list the boundaries of the BIG and LITTLE divisions, their width and their central wavelengths. The boundaries are often continuum absorption edges. The elements which produce the absorption discontinuities are also listed in Table 13 and in Table 14.

For each interval, line opacity is tabulated for 29 temperatures T and 9 electron densities Ne. In practice the line opacity was not computed for high Ne and low T or for low Ne and high T, because these combinations would not occur in model atmospheres. The distribution functions for these values have been obtained by extrapolating the calculated distribution functions. Table 15 indicates the adopted temperatures, electron densities and the values at which calculations were performed.

Many data points would be necessary to represent in detail in each interval the total line absorption coefficient $l(\lambda)$, which is a complex function of wavelength. $l(\lambda)$ was therefore replaced with distribution functions that have a much smoother variation with wavelength. The opacity values are reordered in the intervals to give a decreasing monotonic function $l'(\lambda)$. The distribution function f is the fraction of the given wavelength interval with line opacity $l(\lambda)\leq l'(\lambda)$. Therefore the f values, which indicate a fraction of the wavelength interval, are enclosed between 0 and 1. For computational reasons the f interval 0-1 was divided in 10 parts or steps with the following widths:

w(1)=0.016667=1/60
w(2)=0.033333=2/60
w(3)=0.050000=3/60
w(4)=0.100000=6/60
w(5)=0.100000=6/60
w(6)=0.100000=6/60
w(7)=0.100000=6/60
w(8)=0.166667=10/60
w(9)=0.166667=10/60
w(10)=0.166667=10/60

In each step the mean value of the reordered absorption line coefficient is assumed, so that it is an increasing step function in the interval 0-1.

Because there are 10 step values for each couple T,Ne, and the couples are 29x9, we get for each wavelength interval a table of 2610 values. The table is so arranged: it is subdivided in 10 subtables corresponding to the 10 steps. Each subtable has 9 columns and 29 rows; each row lists, for a given temperature, the line opacities corresponding to the 9 electron densities. Table 16 is an example of this tabulation for the first wavelength interval 22.74909-23.2 nm. The data are logarithmic numbers. For temperatures or electron densities outside of the limits of table 15, extrapolated line opacities are assumed.

Different ODF's tables must be used for different metallicities or different microturbulence values. If a particular scaled solar abundance is required, the corresponding ODF's can obtained by interpolating in a known set of ODF's tables with different metallicities.

b) The Rosseland Opacities

An opacity table is stored in the subroutine TTAUP. The Rosseland mean opacities are computed with the distribution functions for line opacities plus the continuum opacities. Therefore for each different metallicity or different microturbulence a different Rosseland opacity table must be used, i.e. to each ODF table should correspond an opacity table. The same opacity table corresponds to both the BIG and LITTLE divisions of the wavelength range. The opacity table can be either stored in the TTAUP subroutine or be read in input.

ATLAS8 accepts Rosseland opacities tabulated for 36 temperatures and 30 gas pressures. DATLAS8 supports tables for 40 temperatures and 30 gas pressures. Table 17 lists the temperatures and the gas pressures for which the Rosseland opacities are tabulated. For temperatures and pressures outside the limits of Table 17 extrapolated opacity values are assumed.

We remark that these tables are not critical. In the model calculations they are used as starting approximate opacities. Consistent Rosseland opacites are then computed in the course of the model computation. The tables are not used when computations of either models or fluxes start from already computed models.

c) The Partition Functions

Atomic partition functions and ionisation potentials (IP) are tabulated in the subroutine PFSAHA. Many of the partition functions are taken from Drawin and Felenbok (DF) (1965). For each element they are tabulated at a fixed energy cutoff ΔE=0.1 ev and for 10 values of temperature, which are derived from the formula:

IP*2000/22* 3
         * 5

* 7
* 9
* 11
* 13
* 15
* 17
* 19
* 21

Because such temperatures are different from those of the Drawin and Felenbok tables, interpolated values are tabulated. If, in the course of the model calculations, $\Delta E<0.1$, the partition function for $\Delta E=0.1$ is assumed. If $\Delta E>0.1$ an hydrogenic approximation is done (see Kurucz,1970).
For some elements not listed in DF, the partition functions have been computed by Kurucz either by summing over the states, using the Atomic Energy Levels (AEL), or by doing some guess (FAK). Statistical weight (G) has been assumed for some highly ionized atoms. Table 18 lists the elements and the partition function sources.

d) Tables for computing the radiation field

The mean intensity and the flux are computed by using the moment integrals of the specific intensity.

$$J_\nu(\tau_\nu)=(1/2)\,{}_0\!\int^\infty S(t)E_1|t-\tau|dt$$

$$H_\nu(\tau_\nu)=-(1/2)\,{}_0\!\int^\infty S(t)E_2|t-\tau|dt$$

The integration range $0-\infty$ is divided in N subintervals, and in each subinterval the source function is represented by a parabolic interpolation formula. The integral equation is reduced to a set of linear algebraic equations, so that the mean intensity and the flux are expressed as the multiplication of the source function vector by matrix operators. (see Kurucz, 1969 and Kurucz, 1970). Different matrices are obtained for different subintervals. The coefficients of the matrices are precomputed and then tabulated in ATLAS. In ATLAS8 there are 47 subintervals. The depth points are:

0., 0.0000032, 0.0000056, 0.00001, 0.000018, 0.000032, 0.000056, 0.0001, 0.00018, 0.00032, 0.00056, 0.001, 0.0018, 0.0032, 0.0056, 0.01, 0.016, 0.025, 0.042, 0.065, 0.096, 0.139, 0.196, 0.273, 0.375, 0.5, 0.63, 0.78, 0.95, 1.15, 1.35, 1.6, 1.85, 2.15, 2.45, 2.75, 3.15, 3.65, 4.25, 5.0, 6.2, 7.8, 10. ,12.5, 15., 17.5, 20.

There are therefore two matrices 47x47, one for the mean intensity and the other for the flux, corresponding to this set of depth points.

6. INPUT AND OUTPUT IN ATLAS8

Input data are read from units 1,5, and 9.
Output data are stored on units 6 and 7.

Unit 5 can be the terminal display and therefore the relevant input can be supplied as data in a command file. Unit 6 can be the default of the printing device.

From unit 9 the distribution functions are supplied.

From unit 1 a Rosseland opacity table can be read into.

From unit 5 a set of information, corresponding to the control cards of ATLAS5, must be supplied.

On unit 6 an output according to the PRINT control card is obtained.

On unit 7 the output corresponds to the PUNCH control card and it is in a form that can be used as input in subsequent runs of ATLAS and the other programs BALMER, WIDTH6, and SYNTHE.

7.THE CONTROL CARDS READ FROM UNIT 5

These cards can be divided in classes:

a) cards for computing a new model
b) optional cards which control the physical processes
c) cards which control the output
d) others

We remark that the data on these cards can be typed in a free-field format. Namely, after an identifying code word, the numbers can be in any format.

7.1 The Necessary Cards for Computing a new Model

There is a set of control cards that must be used when a new model has to be computed. These cards are related with the physical parameters of the atmosphere and to the operational procedures, namely they refer to:

1) TEFF and GRAVITY
2) STARTING MODEL
3) FREQUENCY SET
4) ITERATIONS NUMBER

If abundances different from those of Table 1 are used, the cards

5) ABUNDANCE SCALE or CHANGE
6) READ KAPPA

must be added.

Every set of control cards for each model must be closed with the card

7) BEGIN

By repeating the cards 1-7 other models can be computed in the same session.
The last control card which closes the session is:

8) END

In particular:

a) TEFF n1

Indicates the effective temperature n1 (in K) of the model

b) GRAVITY n1

Indicates the surface gravity n1 (in cm sec^{-2}) of the model.
If n1 is less than 10 the log is assumed.

e.g.

TEFF 10000 GRAVITY 4

c) THE STARTING MODEL

There are several options to get a starting model:

CALCULate n1 n2 n3

n1 is the number of depth points (maximum 64)
n2 is the value of log10 tauRoss at the first depth point.
n3 is the log10 of the spacing between two Rosseland depth points.

This card must come after having fixed TEFF and GRAVITY.
With this card the starting model has the temperature distribution of a gray atmosphere with the given Teff and log g parameters. TauRoss scale is computed starting with n2= log10(tauRoss(1)) and increasing each step by n3=log10 (dtauRoss). The maximum number of steps is n1.
The selection of a set of depth points is largely a matter of experience. For numerical stability reasons the number of depth points must be large. If the depth-points are

ill-chosen the model can "blow-up" and error message will occur. In this case an usable depth point grid must be obtained with a trial and error procedure. The following examples show two cards suggested by Kurucz:

CALCULate starting model 40 -4.5 0.166666667

CALCULate starting model 64 -5.825 0.125

READ STARTIng n1

n1 is the number of optical depths. Maximum 64. However ATLAS can be redimensioned with REDIME program (Kurucz,1970) to allow more than 64 depths.
This card must follow TEFF and GRAVITY options and must be followed by n1 cards that are the couples Rosseland depths,temperatures.

e.g.

```
READ STARTIng 64 TAUROS-T
0.000E+00  6042.7
1.607E-06  6270.3
2.199E-06  6315.2
*****************
*****************  64 lines in total
*****************
7.536E+01 27535.1
1.005E+02 29563.5
```

The Rosseland depths can be in logarithms.

READ DECK n1 or READ DECK6 n1

n1 is the number of of the optical depths. Maximum 64.
This card must follow the TEFF and GRAVITY cards and is followed by n1 cards.

For READ DECK each card contains:

RHOX,T,P,XNE,ABROSS,PRAD,VTURB

while for READ DECK6 the data are:

RHOX,T,P,XNE,ABROSS,ACCRAD,VTURB

where

RHOX= $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]: mass depth variable.

T=T(j) [K]: temperature

P=Pg(j) [dyne cm^{-2}]: gas pressure.

XNE= Ne(j) [cm^{-3}]: electron number density.

ABROSS= $K_{Ross}(j)$ [gm^{-1} cm^2] :Rosseland mass absorption coefficient.

PRAD=$(4\pi/c)\,{}_0\int^\infty K_\nu(j)d\nu$ [dyne cm^{-2}]: radiation pressure

ACCRAD=grad(j)=$(4\pi/c)\,{}_0\int^\infty (dK(\nu)/dM_j)d\nu$

$=(4\pi/c)\,{}_0\int^\infty (k(\nu)+l(\nu)+\sigma(\nu))H(\nu)d\nu$

[cm sec^{-1}] acceleration due to the absorption of radiation.

VTURB=$\xi(j)$ [Km s^{-1}]: turbulence velocity

With DECK6 option the last card is:

PRADK n

where

PRADK= PRADK0=PRAD(1)=$(4\pi/c)\,{}_0\int^\infty K_\nu(1)d\nu$ [dyne cm^{-2}]

radiation pressure at the surface.

e.g.:

```
TEFF  10000. GRAVITY 4.000 LTE
READ DECK6 40 RHOX,T,P,XNE,ABROSS,ACCRAD,VTURB
7.69880644E-05  5982.9 7.699E-01 5.429E+10 2.740E-02 2.377E+01 0.E+00
1.06438762E-04  6589.5 1.062E+00 1.900E+11 1.013E-01 2.275E+01 0.E+00
*********************************************************************
*********************************************************************
6.13801289E+00 28251.2 5.984E+04 7.648E+15 1.432E+01 2.611E+02 0.E+00
8.76529026E+00 31041.2 8.547E+04 9.939E+15 1.516E+01 2.515E+02 0.E+00
PRADK 1.3489E+01
```

The model in this option can have already converged or not. If it has not converged, it can be the result of previous iterations which have not lead to the convergence. In this case the model is used as new starting model.
Only the couples RHOX and T can be supplied, with the other data blank. In fact in a starting model the calculation will depend only on RHOX , T, ACCRAD, and VTURB and the model can get by with only RHOX and T if ACCRAD or VTURB is not critical.
If the model supplied is a converged model this option permits to obtain further data from the model, as surface flux or intensity distributions.

SCALE n1 n2 n3 n4 n5

where

n1 is the number of the depths points (maximum 64)
n2 is the value of log10 (tauRoss) at the first depth point
n3 is the log10 of the spacing between two Rosseland's depths
n4 is the new effective temperature
n5 is the new gravity

This card must follow TEFF, GRAVITY and READ DECK6 options. It permits scaling a model to a new effective temperature,gravity and set of depth points.

e.g.

```
TEFF  10000. GRAVITY 4.000 LTE
READ DECK6 64 RHOX,T,P,XNE,ABROSS,ACCRAD,VTURB
7.69880644E-05  5982.9 7.699E-01 5.429E+10 2.740E-02 2.377E+01 0.E+00
1.06438762E-04  6589.5 1.062E+00 1.900E+11 1.013E-01 2.275E+01 0.E+00
*********************************************************************
*********************************************************************
4.22687531E+00 25680.0 4.121E+04 5.794E+15 1.374E+01 2.533E+02 0.E+00
6.13801289E+00 28251.2 5.984E+04 7.648E+15 1.432E+01 2.611E+02 0.E+00
8.76529026E+00 31041.2 8.547E+04 9.939E+15 1.516E+01 2.515E+02 0.E+00
PRADK 1.3489E+01
SCALE MODEL 64 -5.825 0.125 9000 3.5
```

The starting model with parameters Teff=9000 log g=3.5 is obtained by scaling the model with parameters Teff=10000, gravity=4.
The numbers 64, -5.825, and 0.125 have the same significance as on a CALCULATE card.
This option can give a better starting model than the CALCULATE card.

d) FREQUENCIES, WAVELENGTHS AND WAVENUMBERS

The program can read either frequencies or wavelengths or wavenumbers. For frequencies the control card is:

FREQUEncies n1 n2 n3 name

n1 is the total number of the frequency set used
n2 is the first frequency point
n3 is the last frequency point
Name is the name used to identify the frequency set.

For blanketed models the name can be either BIG (122 points) or LITTLE (342 points). The frequency points are listed in the last column of tables 13 and 14. They are stored in the program and the integration weights are internally calculated. It is advisable to use the BIG set for model

calculations and the LITTLE set for surface flux or intensity calculations, with the corresponding model, already calculated, in input.
The user can adjust n2 and n3 such that only the sequential set of frequencies from frequency number n2 to frequency number n3 are used in calculating the integrals over the frequency. Thus if, for example, there is a region of very high opacity at the beginning and/or end of the set of frequencies, then this region can be excluded from calculations. An example is the region beyond the Lyman jump, <91.2nm, in cool stars. The model will not be affected by the exclusions of such regions, and the execution time of the program will be smaller. Furthermore, fatal errors due to overflows can occur in ATLAS8, if the emitted flux is too low.

e.g.

FREQUENCIES 122 26 122 BIG

For unblanketed models the previous control card could be substituted by:

<u>READ</u> <u>FREQUEncies</u> <u>n1</u> <u>n2</u> <u>n3</u> <u>name</u>

then this card is followed by n1 triplets of sequence number, either frequency, or wavelength (in nm), or wavenumber (in cm^{-1}*E25), and integration weight. The triplets can be in any order and on as many cards are necessary. Each card may contain any number of complete triplets.

Again for unblanketed models, instead of frequencies, equally spaced wavelengths or wavenumbers can be supplied. In this case only one control card is needed. It is:

<u>WAVELEngth</u> <u>n1</u> <u>n2</u> <u>n3</u>

where n1 is the starting wavelength or wavenumber, n2 is the wavelength or wavenumber spacing, n3 is the final wavelength or wavenumber. All wavelengths must be given in nanometers. The wavenumbers must be given in cm^{-1} and multiplied by E25.

examples:

for wavelengths: WAVELENGTH 500. 0.001 501.
for wavenumbers: WAVELENGTH 19960.E25 .04E25 20000.E25

e) <u>ITERATIONS</u> <u>n</u>

This control card indicates the number n of iterations that are supposed to be necessary to get a convergent model. Maximum is 15. However larger numbers can be obtained by

repeating the BEGIN card.
A model can be considered convergent when the absolute values of the percentage error in the flux and in the flux derivative are less than 1 and 10 respectively, for each depth.

ITERATION 1 must be used with SURFACE INTENSITY, SURFACE FLUX CORRECTION OFF, and MOLECULES ON + PRESSURE OFF control cards.

f) ABUNDANCE SCALE and ABUNDANCE CHANGE

There are two ways for changing the elemental abundances used in the model calculation:

ABUNDANCE SCALE n1

n1 is a scaling factor. Default: 1.0.
All the abundances except H and He are multiplied by the scaling factor before the calculation is begun.

e.g.

ABUNDANCE SCALE 0.1

simulates a metal deficient star. The default abundances are the solar ones and are listed in Table 1.
This card is necessary when ODF's computed with non solar metallicity are used.

ABUNDANCE CHANGE n1 n2, n3 n4, n5 n6, ...

n1,n3,.. are atomic numbers, n2, n4.. are the corresponding abundances (relative to the total number). A negative number is treated as a logarithm.
Using this card, the abundance of each individual element can be changed.

e.g.

ABUNDANCE CHANGE 1 0.5, 2 0.5, 6 -3

This card is necessary when ODF's with different H and He abundances and with solar metal abundances are used.
It can be used with solar ODF's when the abundances of some wanted elements have to be changed.

g) READ KAPPA

This card must be put before any option about the starting model. It tells to the program to read a Rosseland opacity table (KAPP*** file) from unit 1 (i.e. see Table 44).
This card must be used if the correct Rosseland opacity

table is not stored in the TTAUP subroutine of ATLAS code (see sec. 5 (b)).

h) BEGIN

This control card marks the end of input control cards and begins the model calculation.

i) END

This card is a call to EXIT

7.2 The Optional Cards which control the physical Processes

These cards correspond in ATLAS to a set of switches that can be either 0 or 1. The switches control the following items:

Items	names of the switches
OPACITY for different elements ON or OFF	IFOP
TEMPERATURE CORRECTION ON or OFF	IFCORR
PRESSURE INTEGRATION ON or OFF	IFPRES
FLUX FOR EVERY DEPTH or at SURFACE ONLY	IFSURF
FLUX or INTENSITY at SURFACE ONLY	IFSURF
SCATTERING in SOURCE FUNCTION ON or OFF	IFSCAT
CONVECTION ON or OFF	IFCONV
MOLECULES in STATE EQUATION ON or OFF	IFMOL
TURBULENCE PRESSURE ON or OFF	IFTURB
LTE or NLTE	IFNLTE

The control cards are:

a) OPACITY ON names
OFF names
IFOP switches

Default: 1,1,1,1,1,1,1,1,1,1,1,1,1,0,1,0,0,0,0,0.
This card fixes the opacity for the model. Theoretically there are 20 possible opacity sources, but only 15 are active. The opacity sources to be included in the calculation can be specified either with their names or with switches 0 and 1, which correspond respectively to OFF and ON options.

	names	meaning
1)	H1	(HI)
2)	H2PLUS	(H2+)
3)	HMINUS	(H-)
4)	HRAY	(Rayleigh scattering by HI)

5)	HE1	(HeI)
6)	HE2	(HeII)
7)	HEMINUS	(He-)
8)	HERAY	(Rayleigh scattering by HeI)
9)	COOL	(CI, MgI, AlI, and SiI)
10)	LUKE	(NI, O I, MgII, SiII, and CaII)
11)	HOT	(opacities for low-lying levels of C II-IV, N II-V, O II-VI, and Ne I-VI)
12)	ELECTRON	(electron scattering)
13)	H2RAY	(Rayleigh scattering by H2)
14)	HLINES	(H lines, for n<5)
15)	LINES	(line opacities with ODF's)
16)	LINESCAT	not present;(used by Kurucz to treat ODF's partially as scattering)
17)	XLINES	not present;(can be used for experimental line opacities)
18)	XLSCAT	not present;(can be used for experimental line scattering opacity)
19)	XCONT	not present;(can be used for experimental continuous opacity)
20)	XSCAT	not present;(can be used for experimental scattering opacity)

Example:

OPACITY OFF COOL, ELECTRON

b) CORRECTION ON (IFCORR=1)
OFF (IFCORR=0)

Default ON.
Indicates whether the temperature correction has to be performed or not.
OFF option is used with an already converged model, which is the input for further calculations. OFF is used with SURFACE INTENSITY, SURFACE FLUX, MOLECULES ON+PRESSURE OFF control cards. In all these cases ITERATION 1 must be set.

c) PRESSURE ON (IFPRES=1)
OFF (IFPRES=0)

Default ON. Pressure and number densities are computed.
OFF option has to be used with an already converged model when we want to know more physical quantities than those given in input or when we want to use the model for other computations as surface fluxes, surface intensities, synthetic spectra. With OFF option, the self-consistency of the input model is not changed.
OFF option, with MOLECULES ON card, permits reading input molecular or atomic number density/partition function data that have previously been calculated to save computing time. The number densities data must be put after the BEGIN control card (see also sect. 7.2 g).
With PRESSURE OFF, ITERATION 1 must be used. Also with PRESSURE OFF no convection is computed.

d) <u>SURFACE</u> <u>FLUX</u> (IFSURF=1)
<u>INTENSITY</u> (IFSURF=2)
<u>OFF</u> (IFSURF=0)

Default OFF.
With OFF the program calculates the flux for every depth. If a convergent model has to be computed SURFACE OFF is required.
Once a convergent model has been obtained the options SURFACE FLUX and SURFACE INTENSITY permit the calculation of flux or intensity respectively only at the surface, as in a spectrum calculation. In the option SURFACE INTENSITY the surface intensity of the model is calculated at specified $\cos\theta$ values (maximum 20), with θ the angle between the ray and the normal. The complete card for the surface intensity is:

SURFACE INTENSITY n1 n2,n3,n4,...

where n1 is the number of the $\cos\theta$ values and n2,n3,n4,.. are the $\cos\theta$ values.
e.g.

SURFACE INTENSITY 5 1.,.8,.6,.4,.3

With SURFACE INTENSITY or SURFACE FLUX cards, ITERATION 1, CORRECTION OFF are required. For purely radiative models either PRESSURE OFF, or CONVECTION OFF, or CONVECTION ON, MIXLTH=0 must be used.

e) <u>SCATTERING</u> <u>ON</u> (IFSCAT=1)
<u>OFF</u> (IFSCAT=0)

Default ON. Indicates whether in the source function the scattering term has to be considered or not. If OFF, the program solves the radiative transfer problem approximately by ignoring the scattering component. This option saves computer time and should be specified if the user only requires an approximate solution to the transfer problem, or if the scattering component is negligible.

f)<u>CONVECTION</u> <u>OFF</u> (IFCONV=0)
<u>ON</u> <u>n1</u> (IFCONV=1)

Default OFF.
The convective flux is calculated with the local mixing-length theory.
In the OFF case, MIXLTH=1, where MIXLTH is the ratio l/h of the mixing length to the pressure scale height. The convective flux is calculated in each iteration of the model to indicate its importance, but it is not included in the temperature correction. Thermodynamic quantities, such as sound velocity, are also computed.
If ON, n1 indicates the value of MIXLTH. The temperature correction is performed so as to keep the total flux

(radiative+convective) constant with depth. No convective flux at all is calculated with the control card CONVECTION ON, MIXLTH=0.

g)<u>MOLECULES</u> <u>ON</u> (IFMOL=1)
<u>OFF</u> (IFMOL=0)

Default OFF.
This option controls the solution of the LTE state equation. In the OFF case, the atmosphere is considered formed by HI, H+, He I-II-III, C I-II-III-IV, Na I-II-III-IV, Mg I-II-III-IV, Al I-II-III-IV, Si I-II-III-IV, K I-II-III-IV, Ca I-II-III-IV, Fe I-II-III-IV.
The program finds the state variables Ne (electron number density) and Na (atomic number density) with an iterative scheme based on Saha-Boltzmann equations. Elements which contribute less than E-5 of electrons are dropped from the calculation. When consistency is reached between Ne and Na the program finds the density RHO and, via the abundance values, the number densities of elements that affect the opacities.
With ON option the user can govern the mixture of the atmosphere, which can be formed both of atoms and molecules. After the BEGIN card, input data must be supplied, with a code identifying the atom and molecule. The end of the data is denoted by a 0. The code for identifying an atom is its atomic number followed by two decimal figures which indicate the charge of the atom. 00 indicates the neutral atom, 01 the first ionisation, 02 the second one etc. E.g. 26.02 corresponds to Fe III.
For molecules the code is the number formed by the atomic numbers of the elements ordered from the lower to the upper value. Numbers after the decimal point indicate the ionisation degree. An electron counts as element 100 and is idicated by 00. E.g. 608 corresponds to CO, 100 to H-, 101.01 to H2+, etc.
In the data cards for molecules, the code is followed by six coefficients that go into a polynomial form of the Saha equation. For atoms the internal table of atomic partition functions is used.
The maximum number of species allowed is 160 (atoms and molecules neutral and ionized), in which there must not be more than 25 different elements and 450 components (different elements+electrons, which form the atoms and the molecules, neutral and ionized).
The number densities of the neutral atoms are found by solving a set of non-linear equilibrium equations. With N different elements, we have N+2 equations, namely N equations with the constraint of the abundance , two equations with the constraint of the charge conservation and the total particle number respectively.
The solution of the system gives the number densities Ni of the neutral atoms of each considered element, the electron number density Ne and the atomic number density Na. With

Saha-Boltzmann equations the number densities of each considered species are calculated.
The MOLECULES ON option gives the same results as the MOLECULES OFF option if the mixture corresponding to the OFF case is considered, i.e. if only the atoms are included.

To include molecules in the state equation the corresponding six polynomial coefficients must be known. Therefore only molecules for which these data are available can be used. Kurucz (1970) lists these values for 100 molecules; he has modifyied later some of them and has supplied further values. Table 19 collects all the molecular data for state equation purposes, which are known to us.
The calculated number density/partition function values of the adopted atoms and molecules can be stored on a file and used in other runs of the model. To save the file, the control card PUNCH 5 must be used.
The number density/partition function values are read as input data, with the control cards MOLECULES ON + PRESSURE OFF. ITERATION 1 should be used. The molecular data must be put after the BEGIN card.

WITH MOLECULES ON option, GATLAS8 MUST BE USED!!!!

h)TURBULENCE OFF (IFTURB=0)
ON n1 n2 n3 n4 (IFTURB=1)

Default OFF.
This card indicates whether a turbulent pressure, caused by random motions of small gas elements ,has to be included in the pressure computation or not.
If ON, the turbulent pressure is:

PTURB=1/2*RHO*VTURB**2

where the turbulent velocity in Km/s is

VTURB=TRBFDG*RHO**TRBPOW+TRBSND*VELSND/1.E5+TRBCON

VELSND, the sound velocity in cm/s, and RHO, the particle density in gm cm^{-3}, are calculated internally in the program.
TRBFDG,TRBPOW,TRBSND,TRBCON are the parameters that must be given for determining the turbulent velocity. E.g.

TURBULENCE ON 0,0,0,5

i) LTE (NLTEON=0)
NLTE (NLTEON=1)

Default LTE. The control card

NLTE

leads to the solution of the equations of the statistical equilibrium for H and H-. A eight-level H atom is considered. The first 6 levels are allowed to depart from LTE. The lines are considered in detailed balance (Rij=0) and also the radiative rates from Lyman continuum are assumed to cancel (R1k=0).
We remark that for Teff> 15000 K the NLTE models computed with these assumptions are probably not correct, owing to the neglecting in the statistical equilibrium equations of the Lyman continuum and H lines , which start to be important at these temperatures. When the Lyman continuum is included in the calculations, NLTE and LTE energy distributions are close (Mihalas,1968); therefore LTE models computed with ATLAS are more correct than the corresponding NLTE ones.

For Teff < 15000 K, NLTE in H can be considered a good qualitative approximation, in cases where hydrogen is the dominant electron source, the Lyman continuum is optically thick and the H lines are in detailed balance. This means in A and B stars with no more than solar abundances, and in cool Pop II or III stars. For these objects H contributes more electrons than the metals. The main effect of the metal continuum opacity computed in LTE instead of NLTE is some error in the UV blocking, which can be partially accounted for by shifting Teff. Therefore, in these cases, with the appropriate Teff, NLTE option of ATLAS can give a good estimate of the NLTE behaviour of H.
The H NLTE calculations in ATLAS provide b factors for the first 6 levels of H atom and for H-. The resulting model and the b's can be used to compute NLTE Balmer profiles.

WITH NLTE option GATLAS8 MUST BE USED !!!!

7.3 Other Control Cards.

a) <u>READ DEPARTURE nl</u>

With this option the program reads a previously calculated set of departure coefficients b for nl depths. The READ DEPARTURE card must be followed by nl cards, each with RHOX, BHYD for n=1,6, and BMIN, where RHOX is the mass depth variable, BHYD are the H departure coefficients for the first 6 levels and BMIN is the departure coefficient of H-. The RHOX on these cards is a dummy for identification only.

b) <u>CALL</u>

This card allows a call to the subroutine DUMMYR , which must be completely written by the user who can supply additional data or options.

c) <u>TITLE</u>

A title for the model can be specified:

TITLE whatever the user wants (Max. 74 char.)

e.g.

TITLE SOLAR MODEL TAU1=-6 DLOGTAU=0.125

d) CHANGE n1 n2,n3, n4,..

With this card the user can map a model onto a set of n1 new depth points RHOX's (n2,n3,n4,...).
This card is used, only after a model has been defined, to change the depth point spacing, or to extrapolate to greater or smaller depths. The program interpolates all the necessary quantities onto the new RHOX scale and sets the number of depth points to n1.

7.4 The Cards Which Control the Output

I) PRINT n (IFPRNT): Output on Unit 6

The index n may have the integer values 0,1,2,3,4. Default 2 for each iteration.
This card must be set after the ITERATION control card and a value of n must correspond to each iteration. The amount of the printout is controlled by the value of the index.
PRINT 0 means no printout.
PRINT 3 and PRINT 4 produce a big amount of paper. A table is printed for each ODF step for each frequency. If the printout relative to these options is wanted, it should be printed for a chosen iteration and for a very small range of frequencies.
Tables 20-37 are examples of output.

Table 20 (IFPRNT=1,2,3,4) shows what is the first page of any printout. It gives:

Effective temperature, log10 surface gravity, LTE/NLTE model.
The title which labels the model.
Abundance scaling factor and abundances of H and He relative to the total number.
The abundances of all other elements (in logs relative to the total number) before the scaling factor is applied.
The adopted opacity switches for the 20 cases, indicating which opacities are considered for the model.
The values of the switches for the physical processes:
IFCORR
IFPRES
IFSURF
IFSCAT
IFCONV MIXLTH
IFMOL
IFTURB TRBFDG,TRBPOW,TRBSND,TRBCON
The number of iterations for the model,print and punch

switches for each iteration.
The name of the frequency set, the number of frequencies and the limits on frequency integration.
Frequency points and quadrature weights.

Table 21 (IFPRNT=1,2,3,4) shows the second printed page. It lists the starting model. Successive columns are:

	A depth point label j
RHOX	Mass depth variable: $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]
T	Temperature: T(j) [K]
P	Gas pressure: Pg(j) [dyne cm^{-2}]
XNE	Electron number density: Ne(j) [cm^{-3}]
ABROSS	Rosseland opacity: kRoss(j) [g^{-1} cm^2]
PRAD	Radiation pressure: Prad(j) [dyne cm^{-2}]
VTURB	Turbulent velocity: $V_{turb}(j)$ [Km/sec]
BHYD	Departure coefficients for 6 levels of H atom: b(H)(j)
BMIN	Departure coefficient for H^- : $b(H^-)(j)$

Table 22 (IFPRNT=1,2,3,4) lists the temperature correction results. In successive columns are given:

	A depth point label j
RHOX	Mass depth variable: $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]
T	Temperature: T(j) [K]
DTLAMB	Temperature correction with a lambda correction: $\Delta T_\Lambda(j)$ is based on the flux derivative and is valuable at shallow layers (tauRoss) <0.1)
DTSURF	Temperature correction by removing the flux error at the surface: $\Delta T_{SURF}(j)$ [K]
DTFLUX	Temperature correction with a flux correction related to one derived by Avrett and Krook (1963): $\Delta T_{FLUX}(j)$ [K]
T1	Total temperature correction: $\Delta T(j)=\Delta T_\Lambda(j)+\Delta T_{SURF}(j)+\Delta T_{FLUX}(j)$ [K]

CONV/TOTAL — Fraction of convective flux with respect to the total (radiative+convective) flux: Hconv(j)/(Hconv(j)+Hrad(j))

ERROR — Percentage of flux error: (Hrad(j)+Hconv(j)$-\mathcal{H}$)/($\mathcal{H}$ *100),

where $\mathcal{H} = (\sigma Te^4)/(4\pi)$

DERIV — Percentage error in the flux derivative: $(d(H_{RAD}(j)+H_{CONV}(j)))/d\tau_{Ross}(j)/(\mathcal{H}$ *100)

Table 23 (IFPRNT=1,2,3,4)is an example of the summary table printed at the end of each iteration. It gives:

	Depth identification number j
RHOX	Mass depth variable: $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]
TEMP	Temperature after the correction procedure: T'(j) [K]
PRESSURE	Gas pressure: Pg(j) [dyne cm^{-2}]
ELECTRON NUMBER	Electron number density:Ne(j) [cm^{-3}]
DENSITY	Gas density: $\rho(j)$ [gm cm^{-3}]
ROSSELAND MEAN	Rosseland mean opacity: kRoss(j) [gm^{-1} cm^2]
HEIGHT	Geometrical height in the atmosphere: X(j) [Km], arbitrarly 0 at the first RHOX. Only the differences in height are meaningful
ROSSELAND DEPTH	Rosseland mean optical depth: $\tau_{Ross}(j)$
FRACTION CONV FLUX	Fraction of convective flux to the total (radiative+convective) flux: Hconv(j)/(Hconv(j)+Hrad(j)). Is the same of CONV/TOTAL of Table 21
RADIATIVE ACCELERATION	Acceleration due to the absorption of radiation:
	$grad(j)=(4\pi/c)_0\int^\infty(dK(\nu)/dM_J)d\nu$
	$=(4\pi/c)_0\int^\infty(k_\nu+l_\nu+\sigma_\nu)H(\nu)d\nu$ [cm sec^{-2}]
PER CENT FLUX ERROR DERIV	Percentage error in the flux and flux derivative. They are the same of ERROR and DERIV of Table 21

Table 24 (IFPRNT=2,3,4) shows how the convection parameters are printed. In successive columns are listed:

	Depth identification number j
RHOX	Mass depth variable: $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]
PTOTAL	Total pressure: $Ptot(j)=Pgas+Prad+Pturb$ [dyne cm^{-2}]
PTURB	Turbulent pressure: $Pturb(j)=1/2\rho v^2{}_{turb}$ [dyne cm^{-2}]
GRADADB	Adiabatic gradient: $\nabla_A(j)=(\partial lnT/\partial lnP)_A$ $= -(\partial ln\rho/\partial lnT)_{Ptot}\ Ptot/(T\rho Cp)$
DLTDLP	Radiative gradient: $\nabla_R(j)=(\partial lnT/\partial lnP)_R$ $=(\partial T/\partial M)\ Ptot/(Tg)$ (g=gravity)
VELSND	Velocity of sound: [cm/sec] $Vs^2(j)=(Cp/Cv)(\partial Ptot/\partial Pg)_T/(\partial\rho/\partial Pg)_T$
DLRDLT	$\partial ln\rho/\partial lnT=(T/\rho)(\partial\rho/\partial T)$
HEATCP	Specific heat at constant pressure: $Cp(j)=(\partial E/\partial T)_{Ptot}-(Ptot/\rho^2)(\partial\rho/\partial T)$ E=EDENS is the total energy density (kinetic+radiative in an isotropic medium+atomic) per unit mass,i.e: $E(j)=(3/2\ Ntot/KT)/\rho+(3\ Prad)/\rho+(1/\rho)\ \Sigma_i(Ni[Ei+(d\ lnUi/d\ lnT)KT]$ Ei is the ground energy;(d lnUi/d lnT)KT is the internal energy of the atom i.
HSCALE	Pressure scale height: $h(j)=Ptot/(\rho g)$ [cm]
VCONV	Convective velocity: [cm sec^{-1}] $Vc(j)=-1/8gh\ (1/h)^2\ (\partial ln\rho/\partial lnT)_P\ (\nabla-\nabla_B)$ ∇ is the average temperature gradient (with respect to pressure) of all the matter at a given level (bubbles and surrounding matter) ∇_B is the temperature gradient (with respect to pressure) of a rising (or falling) element of matter (the bubble).
FLXCNV	Convective flux:[ergs cm^{-2} sec^{-1}] $Hconv(j)=(1/4\pi)(1/2)(1/h)\rho Cp\ T\ Vc(\nabla-\nabla_B)$

At the end the total flux is printed:

FLUX $Htot={}_0\int^{\infty}(Hrad(\nu)+Hconv(\nu))d\nu$

Table 25: (IFPRNT=2,3,4) shows what information about the radiation pressure and H and He populations can be obtained.

	Depth identification number j
XNATOM	Atomic number density Na=Ntot-Ne [cm^{-3}].
RADEN	Total radiation energy density: $Erad(j)=(4\pi/\rho c)\,{}_0\int^{\infty}J_\nu d\nu$ [dyne cm gm^{-1}]
PRADK	Total radiation pressure: [dyne cm^{-2}] $Pradk(j)={}_0\int^{M}grad(j)\ dM + pradk0$ $= prad(j)+pradk(1)$ $=(4\pi/c)\,{}_0\int^{\infty}K(\nu)d\nu$ pradk0 is the total radiation pressure at the surface.
XNFPH1	Number density/partition function for HI: n(HI)/U(HI)
XNFPH2	Number density/partition function for H+: n(HII)/U(HII)
XNFPHE1	Number density/partition function for HeI: n(HeI)/U(HeI)
XNFPHE2	Number density/partition function for He II: n(HeII)/U(HeII)
XNFPHE3	Number density/partition function for HeIII: n(HeIII)/U(HeIII)
VTURB	Turbulent velocity: V_{turb} [Km/s] (see sec. 7.2 h)

At the end of the page $PRADK0=(4\pi/c)K_\nu(0)d\nu$ is printed.

Table 26 (IFPRNT=2,3,4) indicates how the radiation field quantities at the surface of the atmosphere are printed.

The line opacity behaviour is shown for each wavelength interval. The $H\nu_i$ flux value in each step w_i is printed in successive rows. The last row refers to the fraction of 0-1 interval in which $l_\nu=0$ and the computed flux is the continuum flux.
For each step w_i the following data at surface (tau=0) are printed:

	The width of the step:w_i
HNUi	The corresponding Eddington flux at surface:
	$H_{\nu i}=(-1/2)\,{}_0\int^{\tau_{\nu i}} S_{\nu i}E_2(\tau_{\nu i}-t)dt+(1/2)\,{}_{\tau_{\nu i}}\int^{\infty} S_{\nu i}E_2(t-\tau_{\nu i})dt$
LOG HNUi	log10 $H_{\nu i}$ computed as log10(max(HNUi,1E-30))
MAGi	-2.5 log10 $H_{\nu i}$
	the ratio $H_{\nu i}$/Hcont
TAUONEi	log10(RHOX) for which $\tau_\nu=1$. It indicates the mean depth from which most of the flux we see at the surface comes. In fact the flux comes approximately from $0.1\leq\tau_\nu\leq2$.
TAUNUi	log10 of the monocromatic optical depth τ_ν at the last mass depth point: log10 τ_ν(RHOX(NRHOX))

After steps data,mean values in the whole interval are printed:

	Frequency identification number
WAVE	Wavelength in nanometers: λ
HLAMBDA	Eddington flux at surface [erg cm^{-2} sec^{-1} nm^{-1}]
	$H_\lambda=(c/\lambda^2)H_\nu$; c=2.997925E17 nm/sec
LOG H	log10 H_λ
MAG	-2.5 log10 H_λ
FREQUENCY	Frequency : ν [Hz]
HNU	Eddington flux at surface. It is the weighted sum of the $H_{\nu i}$ values:
	$H_\nu=\Sigma_i w_i H_{\nu i}$ [erg cm^{-2} sec^{-1} Hz^{-1}]
LOG H	log10 H_ν

MAG $-2.5 \log10 H_\nu$

The ratio $H_\nu/H_{\nu cont}$

Frequency identification number

Table 27 (IFPRNT=3) represents how the amount of information given in table 26 can be increased. For each step in each frequency monocromatic quantities for each depth are printed. For unblanketed models steps are dropped. The only step is the whole frequency interval.

Depth identification number j

RHOX Mass depth variable: $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]

TAUNU Optical depth in the step:

$$\tau_{\nu i}(j)=\Sigma_i(k_\nu+\sigma_\nu+l_{\nu i})dM$$

ABTOT The total opacity in the step:
$K_{tot}(j)=k_\nu+\sigma_\nu+l_{\nu i}$

ALPHA The scattering fraction of the source function in the step:

$$\alpha_{\nu i}(j)=\sigma_\nu/(k_\nu+\sigma_\nu+l_{\nu i})$$

BNU The Planck function:

$$B_\nu(j)=(2h\nu^3/c^2)(e^{-h\nu/KT}/(1-e^{-h\nu/KT}))$$

This is the same for all the steps, because it is independent from the line opacity.

SNU The source function in the step:

$$S_{\nu i}(j)=(k_\nu\bar{S}_\nu+l_{\nu i}B_\nu+\sigma_\nu J_{\nu i})/(k_\nu+\sigma_\nu+l_{\nu i})$$

JNU The mean intensity in the step:

$$J_{\nu i}(j)=(1/2)_0\int^{\tau_{\nu i}}S_{\nu i}E_1(\tau_{\nu i}-t)dt+(1/2)_{\tau_{\nu i}}\int^\infty S_{\nu i}E_1(t-\tau_{\nu i})dt$$

JMINS JNU-SNU in the step:

$$J_{\nu i}-S_{\nu i}=dH_{\nu i}/d\tau_{\nu i}=(1/3)d^2S_{\nu i}/d\tau^2{}_{\nu i}$$

HNU The Eddington flux in the step:

$$H_{\nu i}=(-1/2)_0\int^{\tau_{\nu i}}S_{\nu i}E_2(\tau_{\nu i}-t)dt+(1/2)_{\tau_{\nu i}}\int^\infty S_{\nu i}E_2(t-\tau_{\nu i})dt$$

Then there is a row indicating the values of the next step as in table 26, i.e. the step value, HNUi, log10(HNUi), MAGi, $H_{\nu i}/H_{\nu cont}$, TAUONEi, TAUNUi at the surface.

For blanketed models the printout of table 27 is scarsely meaningful, because it is related to the line opacity rearranged in the steps and therefore does not represent the real total behaviour in the frequency interval. It is useful for debugging. This printout can be useful for unblanketed models, or to list monocromatic quantities for an already converged blanketed model. With the converged model as input and by reading in only the wanted frequency or wavelength or wavenumber it is possible to get the behaviour with depth of the corresponding monocromatic quantities. In this case no lines have to be considered. In particular, the relation T-τ_{5000} can be obtained in this way.

Table 28 (IFPRNT=4) indicates another kind of information that can complete the results as shown in Table 26. A listing of the log10 opacity per gram of stellar material can be printed for each opacity source at each depth point for each step at each frequency. For blanketed models, only ALINESI changes with steps at a given frequency. For unblanketed models the only step is the whole frequency interval.
The last row in each page indicates the values of the next step, as in Table 25, i.e. the width of the step, HNUi, log10(HNUi), MAGi, $H_{\nu i}/H_{\nu cont}$, TAUONEi,TAUNUi.

Table 29 (IFPRINT=1,2,3,4, IFMOL=0) is an example of output printed only in the last iteration and with MOLECULES OFF. It shows how the different elements used in the state equation contribute electrons. The left side gives the fraction of the total electron density contributed by each element, i.e. the quantity Ne(Elem)/Ne(tot); on the right side there is the number of electrons contributed by each atom, i.e. the quantity Ne(Elem)/Natom(Elem).

Special Outputs.

a) Tables 30-33 are examples of printout obtained with the switches MOLECULES ON and PRESSURE ON

Table 30 (IFPRNT=1,2,3,4) shows the molecular input data as they are inserted after the BEGIN control card. At the end, the numbers of molecules used, components and equations are printed. The data, as shown in Table 30, are printed on the third page of the output, when the control card MOLECULES ON is given in input.

Table 31 (IFPRNT=1,2,3,4) is an example of printout present only in the last iteration. It gives:

RHOX	Mass depth variable: $M(j)={}_0\int^x \rho(x)dx$ [gm cm^{-2}]
T	Temperature:T(j) [K]
P	Gas pressure: Pg(j) [dyne cm^{-2}]
XNE	Electron number density: Ne [cm^{-3}]
XNATOM	Atomic number density. Na=Ntot-Ne [cm^{-3}]
RHO	Gas density: [gm cm^{-3}]

Table 32 (IFPRNT=1,2,3,4) is an example of printout present also only in the last iteration. Molecular number density for each element at each depth is listed.

Table 33 (IFPRNT=1,2,3,4 and IFPNCH=5) shows how more information about the molecular results can be obtained in the printed output. Molecular number densities/partition functions are printed for each depth and for each molecule. The total atomic number XNATOM and the density RHO are then printed for each depth.
These data are also stored on the unit 7 and can be used as input data in a different run of ATLAS and in other codes, with MOLECULES ON and PRESSURE OFF switches.

In conclusion, the most complete output relative to the molecular data can be obtained with MOLECULES ON, PRESSURE ON, IFPRNT=1, IFPNCH=5

b) NLTE

With NLTE option we get the output of tables 34, 35, and 36.

Table 34 (IFPRNT=1,2,3,4) shows what is printed for each iteration. The statistical equilibrium rates and the departure coefficient for H^- are listed. It gives:

RHOX	Mass depth variable
QELECT	Electron collision rate
QASSOC	Associative detachment rate
QCHARGE	Charge cancellation rate
QRDKHM	Radiative de-excitation rate
QRDHMK	Radiative excitation rate
BMIN	Departure coefficient for H^-

Table 35 (IFPRNT=1,2,3,4) shows a further printout for each iteration. Departure coefficients for the first six levels of the H atom are listed.

Table 36 (IFPRNT=2,3,4) indicates how all the radiative and collisional rates for H are listed for each depth; K represents the continuum.

c) SURFACE INTENSITY

The specific intensity at surface of a converged model can be printed for the μ_i=cosθ_i values specified in the SURFACE INTENSITY control card.

Table 37 (IFPRNT=2, IFSURF=2, IFCORR=0) shows how the surface specific intensity is printed. For each μ at each frequency the value

$$I_\nu(\mu)={}_0\int^\infty S_\nu e^{-\tau_\nu/\mu}(d\tau_\nu/\mu)$$

is listed.

II) <u>PUNCH</u> <u>n</u> (IFPNCH) Output on Unit 7

The index n may have the integer values 0,1,2,5. Default 0 for each iteration.
This card must be put after the ITERATION contol card and a value of n must correspond to each iteration. The amount of the output data is controlled by the value of the index.

PUNCH 0 means no output on unit 7

PUNCH 1,2,5 options save a computed model (IFCORR=1) on unit 7. It will be in the format of an ATLAS input file.

PUNCH 1 saves only the model, in the form listed in Table 38.

PUNCH 2 (IFCORR=1, IFSURF=0,1) saves on unit 7 both the surface flux at each frequency, and the model. The format of surface flux is shown in Table 39. In successive columns are stored:

the frequency ν
the flux H_ν, computed with the line opacity
the continuum flux $H_{\nu cont}$
the ratio $H_\nu/H_{\nu cont}$

The units for the fluxes are: [erg cm^{-2} sec^{-1} Hz^{-1}].
We want to remark that each monocromatic flux is the flux averaged over the wavelength interval of the line opacity distribution function. (See sect.8).
The model is saved after the surface fluxes. Its format is that of Table 38.

PUNCH 2 (IFCORR=0, ITERATION=1, IFSURF=1,2) saves on unit 7 only the surface flux (IFSURF=1) (Table 39) or the surface intensity (IFSURF=2) of the input model. Table 40 shows how the surface intensities at the chosen μ_i are saved. The meaning is the same as that of table 37.

PUNCH 5 needs MOLECULES ON option. Atomic and molecular number densities over partition functions, as listed in Table 33, are stored on unit 7. Successively the surface flux (Table 39) and the model (Table 38) are stored.

8. THE FLUXES.

With a suitable convergent model we should be able to reproduce the observations from a stellar atmosphere, as fluxes, colors, line profiles.

The fluxes computed with the 1200 LTE blanketed models can be obtained from Kurucz and are generally stored together with the models on the same magnetic tape. As models, part of the fluxes are published (Kurucz,1979a) and part are unpublished.

All fluxes are computed with ODF's tabulated for the LITTLE intervals (table 14) and are evaluated at the frequencies corresponding to the wavelengths listed in the last column of table 14; the wavelengths have been chosen near the centers of the distribution intervals.

There is a different format between the published fluxes and those on magnetic tape. Each model column of the published fluxes lists

$\log_{10}F_\lambda$ [erg cm^{-2} s^{-1} nm^{-1}]

and the per mil blocking fraction $(1-F_\lambda/F_{\lambda cont})$.

On the magnetic tape are stored successively for each wavelength the Eddington flux, including the lines, H_ν and the continuum Eddington flux $H_{\nu cont}$.

The conversion from fluxes on magnetic tape to published fluxes is given by:

$$\log_{10}F_\lambda=\log_{10}(4H_\nu c/\lambda^2)$$

The monocromatic flux H_ν is given by an integration over the distribution function; for computational reasons the integral is substituted by a sum over the N steps, with the widths of the steps as weigths.

$$H_\nu={}_0\int^1 H_\nu(f_\nu)df_\nu=\Sigma_i w_i H_{\nu i} \quad \text{with } \Sigma_i w_i=1 \text{ and } i=1,..,N$$

Therefore the monocromatic flux H_ν at the ν frequency is a weighted mean, that gives the flux averaged over the wavelength interval of the line opacity distribution function. Since the frequencies were chosen relatively close together, F_λ can be as well considered an average over the distribution function interval.

Surface fluxes for a given model can be computed directly with ATLAS8 program. The way to perform this kind of computation is shown in Example 3 of sect. 10.

9. THE MODELS, THE FLUXES, ATLAS CODE AND RELATIVE DATA AVAILABLE AT OAT.

The tape with the 1200 models and fluxes is available at OAT. It is recorded on 9 tracks at 1600 bpi in ASCII card images with 4000 character per block.
From this tape several files to be used with a VAX computer have been created.

a) The Models

The file with the models (10935 disk blocks) has been subdivided in 7 ASCII files and then converted in binary form. The ASCII files are stored only on magnetic tape, while the binary files are available both on tape and on disk.
Table 41 lists the filenames, the necessary disk blocks, and the models which are stored in them.
To extract one of the 1200 binary models from the disk, the program READMOD must be used. The instruction to run it is:

```
RUN USR:[SYNTH]READMOD
```

READMOD reads the wanted model in binary form and stores it on the user's directory in the same format as it were read from the original tape. The program asks for the name of the file where the model has to be stored and for the sequence number of the model, as it can be read in Tables 3-12.

31 additional models are available on tape and on disk in ASCII format. They have been computed by Kurucz with solar composition, but with ODF's with microturbulent velocities 0, 4, 10 Km/sec. These models are presented in table 42 and are stored on disk in the SYNTH account. To get one of them, a COPY instruction is sufficient.
Example: To get from disk the model (30000,4.5,ξ=4Km/s) the instructions are:

```
COPY USR:[SYNTH]M4KM3045.DAT *.*
TYPE M4KM3045.DAT
```

b) The Fluxes

The file with the fluxes (18392 disk blocks) has been also subdivided in 7 ASCII files available on tape; on disk are stored the binary files with fluxes from models 1-284 and 733-975 (the published models and the unpublished new convective models with solar composition). Table 43 lists the names of the files with the fluxes, the necessary disk blocks and the models which the fluxes refer to. To extract fluxes from one of the seven files, the programs FLUXSEL or FLUBINREAD can be used. The former is for the formatted files, while the latter is for the binary files. These programs permit to print and to save fluxes either in the same format that they have on the tape:

H_ν and $H_{\nu cont}$

or in the format of the published fluxes:

$\log_{10}F_\lambda$ and $\log_{10}F_{\lambda cont}$

The instruction to run the programs is:

RUN USR:[SYNTH]FLUXSEL

or

RUN USR:[SYNTH]FLUBINREAD

c) ATLAS code.

ATLAS8 is available at OAT. The files stored in the subdirectory:

DATA:[CASTELLI.ATLAS8]

are:

```
ATLAS8.FOR, ATLAS8.OBJ, ATLAS8.EXE  (simple precision)
DATLAS8.FOR, DATLAS8.OBJ, DATLAS8.EXE (double precision)
GATLAS8.OBJ, GATLAS8.EXE (G-floating form of DATLAS8)
TTAUP0KM.FOR (TTAUP with KAP0KM table)
TTAUP4KM.FOR (TTAUP with KAP4KM table)
TTAUP10K.FOR (TTAUP with KAP10K table)
ATLS0KM.EXE  (ATLAS8 with TTAUP0KM)
ATLS4KM.EXE  (ATLAS8 with TTAUP4KM)
ATLS10K.EXE  (ATLAS8 with TTAUP10K)
```

To run ATLAS8 the instruction is:

RUN DATA:[CASTELLI.ATLAS8]ATLAS8

In sect. 10 we describe the command files, which include the input and output files, and which permit to get a wanted model or flux.

At OAT are available 25 sets of ODF's tables computed both in the BIG and LITTLE intervals. Therefore, on the whole, there are 50 ODF's tables. Their characteristics are summarized in Table 44. The ODF's 1-10 are those used by Kurucz to compute the grid of the 1200 models, namely their metallicity is log[M/H]=0, -0.5, -1.0, -1.5, -2.0, -2.5, -3.0, -9.99, 0.5, 1.0. The microturbulence is 2 Km/s. The ODF with no H lines (n.11 in Table 44) was used by Lester and al. (1986) in the computation of theoretical uvbyβ indices. The ODF's 12-22 permit to compute models with solar metallicity, but with different H and He abundances, as listed in Table 44,columns 2 and 3. ODF's 23-25 have been computed with solar composition, but with microturbulences 0, 4, 10 Km/s. The ODF's names, listed in Table 44, are so codified:

B=binary
DF=Distribution Function
B=Big, L=little interval
P=+, M=-
00=log[M/H]=0 05=log[M/H]=0.5 10=log[M/H]=1.0 etc.

To each ODF, a KAP*** file, with the corresponding Rosseland opacities data, is associated. The KAP*** file names corresponding to the ODF's are listed in the last column of Table 44.
There are two ways to supply this table to ATLAS: either as input data, (see sect 7.1 g) or by inserting it into TTAUP subroutine in a DATA statement.

ODF's files are stored on magnetic tapes both in ASCII and in binary format. KAPP* files are stored in ASCII on magnetic tape.
On disk are stored the files BDFBP00.DAT and BDFLP00.DAT. They are in the directory:

DATA:[CASTELLI.DF]

In binary form, ODF's BIG and LITTLE require 2332 and 6852 disk blocks respectively. The standard version of ATLAS8 has TTAUP with KAPP00.DAT, therefore this Rosseland opacity table is not stored.

10. HOW TO RUN ATLAS CODE ON A VAX COMPUTER

The best way for running ATLAS8 on a VAX computer is to write a command file. In what follows we give three examples of command files which can be executed at OAT. The changes for other VAX computers are straightforward.

Example 1.

A model with parameters Teff=20000 K, log g=4, solar abundances and ODF's with microturbulence of 10 Km/s is computed in 15 iterations. The control cards which are read from unit 5 are the data of the command file.

```
ATL10K.COM
$ SET DEF user's directory
$ ASSIGN DATA:[CASTELLI.DF]BDFB10K.DAT FOR009
$ ASSIGN DATA:[CASTELLI.DF]KAP10K.DAT FOR001
$ ASSIGN PUNCH.MOD FOR007
$ RUN DATA:[CASTELLI.ATLAS8]ATLAS8
TITLE 10 KM/S MICROTURBULENCE
TEFF 20000 GRAVITY 4.000
FREQUENCIES 122 26 122 BIG
ITERATIONS 15
PRINT 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2
PUNCH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
READ KAPPA
CALCULATE STARTING 40 -4.5 0.16666666666
BEGIN
END
```

The READ KAPPA control card must be always put before defining the starting model.
The ODF file BDFB10K.DAT and the corresponding file KAP10K.DAT are stored in the subdirectory DATA:[CASTELLI.DF] and are assigned to the unit 9 and unit 1 respectively. The output will be stored on the file SYS$PRINT.DAT (unit 6) and PUNCH.MOD (unit 7). ATLAS8 is stored in the subdirectory DATA:[CASTELLI.ATLAS8].
This session runs in the user's subdirectory.
To execute this command file the possible commands are:

```
@ATL10K (interactive session)
SUBMIT ATL10K (batch session)
```

Example 2:

In this case the input data relative to the unit 5, i.e. the control cards, are stored in the file B0KM'P1'.DAT, where 'P1' is a parameter to be defined when the command file is executed. The output relative to unit 6 will be stored on the SYS$PRINT.DAT, as before, and that relative to unit 7 will be stored on the file C0KM'P1'.DAT, where 'P1' is a parameter. A model with ODF's with 0 Km/s is computed. The corresponding KAP0KM.DAT file is stored in a DATA statement of the TTAUP subroutine of ATLAS8 program. The so modified ATLAS8 code is named ATLAS0KM.

```
AT0KM.COM
$ SET DEF user's directory
$ ASSIGN B0KM'P1'.DAT FOR005
$ ASSIGN C0KM'P1'.DAT FOR007
$ ASSIGN DATA:[CASTELLI.DF]BDFB0KM.DAT FOR009
$ RUN DATA:[CASTELLI.ATLAS8]ATLAS0KM
```

The possible commands for executing this command file are :

```
@AT0KM 2540 2530   (interactive session)
SUBMIT AT0KM/PARAMETERS=(2540,2530)   (batch session)
```

The input data are read in the file B0KM2540.DAT and the output data on unit 7 will be saved on the file C0KM2530.DAT.
The input file B0KM2540.DAT could be the following:

```
FREQUENCIES 122 1 122 BIG
ITERATIONS 15
PRINT 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2
PUNCH 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
TEFF  25000. GRAVITY 4.000 LTE
TITLE 0 KM/S MICROTURBULENCE
OPACITY IFOP 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 0 0 0 0
CONVECTION OFF 1.00 TURBULENCE OFF 0.00 0.00 0.00 0.00
ABUNDANCE SCALE   1.000 ABUNDANCE CHANGE 1 0.900 2 0.100
READ DECK6 40 RHOX,T,P,XNE,ABROSS,ACCRAD,VTURB
 8.82871682E-05 13500.5 8.290E-01 2.220E+11 3.526E-01 6.066E+02 0.E+00
 1.29292384E-04 14272.7 1.216E+00 3.081E+11 3.526E-01 5.381E+02 0.E+00
 1.88389400E-04 14414.8 1.775E+00 4.452E+11 3.592E-01 5.356E+02 0.E+00
 2.73068988E-04 14571.0 2.576E+00 6.392E+11 3.676E-01 5.380E+02 0.E+00
 3.93837690E-04 14731.0 3.718E+00 9.126E+11 3.783E-01 5.467E+02 0.E+00
 5.65051741E-04 14894.8 5.335E+00 1.295E+12 3.915E-01 5.575E+02 0.E+00
 8.06047348E-04 15061.2 7.609E+00 1.827E+12 4.075E-01 5.707E+02 0.E+00
 1.14395702E-03 15230.2 1.079E+01 2.562E+12 4.272E-01 5.880E+02 0.E+00
 1.61486864E-03 15402.5 1.522E+01 3.572E+12 4.510E-01 6.104E+02 0.E+00
 2.26592645E-03 15581.3 2.133E+01 4.947E+12 4.797E-01 6.383E+02 0.E+00
 3.15960450E-03 15770.2 2.968E+01 6.801E+12 5.137E-01 6.722E+02 0.E+00
 4.37509036E-03 15976.0 4.100E+01 9.274E+12 5.531E-01 7.076E+02 0.E+00
 6.01363601E-03 16205.6 5.620E+01 1.253E+13 5.991E-01 7.487E+02 0.E+00
 8.21094587E-03 16459.9 7.648E+01 1.679E+13 6.516E-01 7.928E+02 0.E+00
 1.11525627E-02 16740.8 1.035E+02 2.234E+13 7.106E-01 8.383E+02 0.E+00
 1.50859570E-02 17049.2 1.395E+02 2.956E+13 7.766E-01 8.845E+02 0.E+00
 2.03440525E-02 17384.3 1.873E+02 3.893E+13 8.504E-01 9.330E+02 0.E+00
 2.73567159E-02 17744.9 2.507E+02 5.106E+13 9.325E-01 9.880E+02 0.E+00
 3.66869345E-02 18132.1 3.345E+02 6.668E+13 1.021E+00 1.046E+03 0.E+00
 4.90641110E-02 18560.0 4.448E+02 8.664E+13 1.118E+00 1.128E+03 0.E+00
 6.55279458E-02 19066.0 5.900E+02 1.119E+14 1.223E+00 1.233E+03 0.E+00
 8.77390876E-02 19686.6 7.834E+02 1.439E+14 1.331E+00 1.348E+03 0.E+00
 1.18349046E-01 20443.5 1.047E+03 1.852E+14 1.431E+00 1.438E+03 0.E+00
 1.60676733E-01 21356.1 1.407E+03 2.383E+14 1.526E+00 1.520E+03 0.E+00
 2.19794273E-01 22460.2 1.906E+03 3.070E+14 1.624E+00 1.607E+03 0.E+00
 3.02523673E-01 23783.4 2.599E+03 3.953E+14 1.709E+00 1.634E+03 0.E+00
 4.18655008E-01 25246.7 3.569E+03 5.114E+14 1.819E+00 1.677E+03 0.E+00
 5.80896139E-01 26972.4 4.915E+03 6.594E+14 1.931E+00 1.716E+03 0.E+00
```

```
 8.06285381E-01 28898.1 6.778E+03 8.487E+14 2.071E+00 1.760E+03 0.E+00
 1.11377072E+00 31062.1 9.299E+03 1.084E+15 2.254E+00 1.841E+03 0.E+00
 1.52156973E+00 33438.0 1.260E+04 1.368E+15 2.503E+00 1.976E+03 0.E+00
 2.04386282E+00 36090.5 1.674E+04 1.695E+15 2.836E+00 2.172E+03 0.E+00
 2.73360968E+00 39119.5 2.205E+04 2.087E+15 3.246E+00 2.415E+03 0.E+00
 3.69514990E+00 42722.6 2.931E+04 2.573E+15 3.386E+00 2.466E+03 0.E+00
 5.19302320E+00 46832.3 4.073E+04 3.285E+15 3.123E+00 2.278E+03 0.E+00
 7.41742182E+00 50997.5 5.814E+04 4.316E+15 2.832E+00 2.079E+03 0.E+00
 1.08680067E+01 55609.1 8.586E+04 5.849E+15 2.560E+00 1.875E+03 0.E+00
 1.64123383E+01 60663.2 1.314E+05 8.210E+15 2.358E+00 1.704E+03 0.E+00
 2.54136906E+01 66585.0 2.068E+05 1.177E+16 2.186E+00 1.555E+03 0.E+00
 3.97663994E+01 73136.6 3.285E+05 1.702E+16 2.083E+00 1.501E+03 0.E+00
PRADK 5.2869E+02
SCALE 40 -4.5 0.166666666666 25000 3.
BEGIN                    ITERATION  15 COMPLETED
END
```

This file is formed by the model 25000,4 obtained from a previous run of ATLAS and by some control cards, which complete the input. The control cards OPACITY IFOP ....,CONVECTION OFF..., TURBULENCE OFF .... ABUNDANCE SCALE..... had could be left out, because all these options are the default ones. The SCALE card indicates that a model with parameters 25000,3 will be computed.

This type of command file permits to change the input files without modifying the command file.

<u>Example 3:</u>

This command permits to compute the surface flux of the converged model Teff=10000, log g=4. ODF's with 0.316 metallicity with respect to the Sun, and computed in the LITTLE intervals, are used. ATLAS8 will scale the solar abundances as indicated by the control card ABUNDANCE SCALE 0.316. So the abundances will be in according to those used in ODF's. The corresponding KAPM05.DAT file is here not required; it is used only for model calculations. Because only the flux and not a model is wanted, the switch IFCORR is 0. The card PRESSURE OFF means that the input model is purely radiative. The convective flux will not be calculated.

```
SAMPFLUX.COM
$SET DEF user's directory
$ASSIGN FM051040.DAT FOR007
$ASSIGN DATA:[CASTELLI.DF]BDFLM05.DAT FOR009
$RUN DATA:[CASTELLI.ATLAS8]ATLAS8
FREQUENCIES 342 26 342 LITTLE
ITERATIONS 1 PRINT 2 PUNCH 2
PRESSURE OFF
CORRECTION OFF
SURFACE FLUX
```

```
TEFF  10000. GRAVITY 4.000 LTE
TITLE SAMPLE RUN
 OPACITY IFOP 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 0 0 0 0
 CONVECTION OFF  1.00 TURBULENCE OFF  0.00  0.00  0.00  0.00
ABUNDANCE SCALE   0.316 ABUNDANCE CHANGE 1 0.900 2 0.100
READ DECK6 64 RHOX,T,P,XNE,ABROSS,ACCRAD,VTURB
 7.13802456E-06   6420.6 6.319E-02 2.471E+10 2.007E-01 1.812E+01 0.E+00
 9.60401303E-06   6507.5 8.489E-02 3.298E+10 2.007E-01 1.752E+01 0.E+00
 1.30808658E-05   6534.7 1.150E-01 4.274E+10 1.941E-01 1.753E+01 0.E+00
 1.79600866E-05   6554.6 1.569E-01 5.494E+10 1.843E-01 1.748E+01 0.E+00
 2.48278375E-05   6588.8 2.156E-01 7.142E+10 1.777E-01 1.747E+01 0.E+00
 3.41767955E-05   6625.7 2.956E-01 9.268E+10 1.728E-01 1.748E+01 0.E+00
 4.69380248E-05   6669.1 4.052E-01 1.205E+11 1.699E-01 1.736E+01 0.E+00
 6.39932841E-05   6718.1 5.529E-01 1.567E+11 1.695E-01 1.719E+01 0.E+00
 8.64838585E-05   6770.3 7.492E-01 2.031E+11 1.713E-01 1.700E+01 0.E+00
 1.15717070E-04   6825.6 1.006E+00 2.623E+11 1.755E-01 1.682E+01 0.E+00
 1.53172819E-04   6882.4 1.338E+00 3.364E+11 1.818E-01 1.662E+01 0.E+00
 2.00702969E-04   6939.5 1.762E+00 4.282E+11 1.897E-01 1.639E+01 0.E+00
 2.60797533E-04   6996.2 2.302E+00 5.414E+11 1.996E-01 1.625E+01 0.E+00
 3.36170604E-04   7051.3 2.984E+00 6.790E+11 2.111E-01 1.620E+01 0.E+00
 4.30224725E-04   7104.9 3.842E+00 8.453E+11 2.244E-01 1.626E+01 0.E+00
 5.46859985E-04   7156.5 4.917E+00 1.044E+12 2.388E-01 1.639E+01 0.E+00
 6.91481109E-04   7208.5 6.259E+00 1.284E+12 2.558E-01 1.652E+01 0.E+00
 8.69514886E-04   7258.0 7.926E+00 1.568E+12 2.744E-01 1.669E+01 0.E+00
 1.08939398E-03   7305.5 1.000E+01 1.904E+12 2.946E-01 1.693E+01 0.E+00
 1.36025297E-03   7350.7 1.258E+01 2.297E+12 3.164E-01 1.724E+01 0.E+00
 1.69304095E-03   7393.1 1.579E+01 2.756E+12 3.398E-01 1.764E+01 0.E+00
 2.10269983E-03   7432.9 1.976E+01 3.289E+12 3.649E-01 1.813E+01 0.E+00
 2.60716607E-03   7470.5 2.470E+01 3.910E+12 3.921E-01 1.873E+01 0.E+00
 3.22861783E-03   7506.1 3.082E+01 4.631E+12 4.217E-01 1.946E+01 0.E+00
 3.99354706E-03   7540.3 3.840E+01 5.470E+12 4.546E-01 2.033E+01 0.E+00
 4.93414840E-03   7573.7 4.776E+01 6.449E+12 4.917E-01 2.137E+01 0.E+00
 6.08806917E-03   7608.7 5.927E+01 7.606E+12 5.351E-01 2.260E+01 0.E+00
 7.49567384E-03   7645.6 7.333E+01 8.968E+12 5.860E-01 2.405E+01 0.E+00
 9.20166634E-03   7687.4 9.041E+01 1.059E+13 6.467E-01 2.572E+01 0.E+00
 1.12375543E-02   7738.4 1.109E+02 1.261E+13 7.291E-01 2.777E+01 0.E+00
 1.36398403E-02   7788.9 1.349E+02 1.495E+13 8.218E-01 2.999E+01 0.E+00
 1.64833255E-02   7843.3 1.634E+02 1.773E+13 9.336E-01 3.264E+01 0.E+00
 1.98092908E-02   7901.1 1.967E+02 2.102E+13 1.065E+00 3.571E+01 0.E+00
 2.36891452E-02   7963.6 2.354E+02 2.493E+13 1.224E+00 3.937E+01 0.E+00
 2.81727593E-02   8031.5 2.801E+02 2.961E+13 1.418E+00 4.379E+01 0.E+00
 3.33235040E-02   8106.2 3.315E+02 3.527E+13 1.657E+00 4.928E+01 0.E+00
 3.91676426E-02   8190.0 3.897E+02 4.216E+13 1.960E+00 5.624E+01 0.E+00
 4.57137078E-02   8285.5 4.548E+02 5.067E+13 2.353E+00 6.529E+01 0.E+00
 5.29118143E-02   8398.8 5.264E+02 6.148E+13 2.885E+00 7.725E+01 0.E+00
 6.06345683E-02   8531.0 6.030E+02 7.513E+13 3.608E+00 9.320E+01 0.E+00
 6.87957332E-02   8685.2 6.839E+02 9.248E+13 4.611E+00 1.150E+02 0.E+00
 7.72164240E-02   8869.6 7.671E+02 1.148E+14 6.033E+00 1.447E+02 0.E+00
 8.57222974E-02   9086.7 8.508E+02 1.430E+14 8.008E+00 1.848E+02 0.E+00
 9.42692906E-02   9339.7 9.345E+02 1.778E+14 1.062E+01 2.356E+02 0.E+00
 1.02902107E-01   9624.4 1.019E+03 2.183E+14 1.385E+01 2.963E+02 0.E+00
 1.11864567E-01   9951.5 1.105E+03 2.637E+14 1.753E+01 3.640E+02 0.E+00
 1.21634603E-01  10327.9 1.199E+03 3.112E+14 2.079E+01 4.192E+02 0.E+00
 1.33219644E-01  10761.0 1.310E+03 3.585E+14 2.282E+01 4.509E+02 0.E+00
 1.47747636E-01  11256.3 1.449E+03 4.042E+14 2.300E+01 4.509E+02 0.E+00
```

```
 1.67822242E-01 11822.0 1.641E+03 4.533E+14 2.141E+01 4.163E+02 0.E+00
 1.97460115E-01 12469.5 1.925E+03 5.155E+14 1.914E+01 3.730E+02 0.E+00
 2.41677478E-01 13201.8 2.352E+03 6.020E+14 1.683E+01 3.284E+02 0.E+00
 3.09084326E-01 14023.3 3.006E+03 7.294E+14 1.497E+01 2.911E+02 0.E+00
 4.07590330E-01 14926.0 3.963E+03 9.094E+14 1.364E+01 2.646E+02 0.E+00
 5.49038410E-01 15913.1 5.342E+03 1.160E+15 1.284E+01 2.467E+02 0.E+00
 7.47598708E-01 16990.4 7.279E+03 1.499E+15 1.260E+01 2.401E+02 0.E+00
 1.01350343E+00 18159.7 9.875E+03 1.927E+15 1.248E+01 2.366E+02 0.E+00
 1.37373328E+00 19430.8 1.339E+04 2.465E+15 1.248E+01 2.352E+02 0.E+00
 1.85077035E+00 20806.7 1.805E+04 3.119E+15 1.247E+01 2.343E+02 0.E+00
 2.48615623E+00 22293.6 2.426E+04 3.921E+15 1.257E+01 2.354E+02 0.E+00
 3.32196188E+00 23905.3 3.242E+04 4.893E+15 1.276E+01 2.380E+02 0.E+00
 4.41609621E+00 25648.6 4.309E+04 6.065E+15 1.311E+01 2.431E+02 0.E+00
 5.83007240E+00 27533.3 5.689E+04 7.461E+15 1.357E+01 2.492E+02 0.E+00
 7.64237547E+00 29562.6 7.456E+04 9.110E+15 1.421E+01 2.430E+02 0.E+00
PRADK 1.3497E+01
BEGIN                    ITERATION   6 COMPLETED
END
```

11. SOME USEFUL RELATIONS.

In this chapter we want to recall some relations which permit to change a model not computed with ATLAS in a model in ATLAS format and viceversa.

1) <u>The mass depth points RHOX(J).</u>

a) From the gas density $\rho(J)$ and from the geometrical height Z(J)

$$RHOX(J)=M(J)=\int_0^z \rho Z(J)dZ(J) \quad [gm\ cm^{-2}]$$

Then:

```
RHOX(1)=RHO(1)*Z(1)
RHOX(J)=RHOX(J-1)+0.5*(RHO(J-1)+RHO(J))*(Z(J)-Z(J-1))
```

for J=2,NRHOX, where NRHOX is the number of the depth points

b) From the total pressure Ptot(J) and gravity g:

RHOX(J)=PTOTAL(J)/g

We remark that in ATLAS8:

Ptot(J)=RHOX(J)*g+PRADK0

with PRADK0 total radiation pressure at the surface.

Then from ATLAS8 data:

RHOX(J)=(Ptot(J)-PRADK0)/g

2) <u>The total hydrogen number density N(Htot):</u>

a) From the total atomic number density Na.

Na=XNATOM(J)=Ntot-Ne=(Pgas(J)/KT(J))-Ne(J)

$Na=\Sigma_i Ni=N(Htot)*\Sigma_i(Ni/N(Htot))=N(Htot)*\varepsilon_i$

$N(Htot)=Na/\Sigma_i\varepsilon_i$ with $\varepsilon_i=Ni/N(Htot)$

b) From the gas density ρ=RHO(J):

By definition:

$\rho=\Sigma_i m_i N_i$ and $m_i=\mu_i/6.024E23$ [gr]

Ni is the atomic number density of the i element, and m_i and μ_i are its atomic mass and weight respectively.

Then:

$\rho=\Sigma_i\mu_i N_i/6.024E23$

where

$Ni=(Ni/N(Htot))*N(Htot)=\varepsilon_i*N(Htot)$ with $\varepsilon_i=Ni/N(Htot)$ (11.1)

or

$Ni=(Ni/Na)*Na=\varepsilon_i*Na$ with $\varepsilon_i=Ni/Na$ (11.2)

The abundances in ATLAS are given by (11.2). The relation between (11.1) and (11.2) is:

(Ni/N(Htot))=(Ni/Na)/(N(Htot)/Na)

log(Ni/N(Htot))=log(Ni/Na)-log(N(Htot)/Na)

From (11.1)

$\rho=(N(Htot)/6.024E23)\Sigma_i\mu_i\varepsilon_i$

and

$N(Htot)=(6.024E23\rho)/\Sigma_i\mu_i\varepsilon_i$

$\Sigma_i\mu_i\varepsilon_i$ and $\Sigma_i\varepsilon_i$ are listed in Table 45 for the different ATLAS metallicities.

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Table 1: Solar Abundances

1	H	-0.05	2	He	-1.00	3	Li	-11.45	4	Be	-10.99	5	B	-9.25
6	C	-3.48	7	N	-3.99	8	O	-3.22	9	F	-7.49	10	Ne	-4.60
11	Na	-5.81	12	Mg	-4.51	13	Al	-5.65	14	Si	-4.50	15	P	-6.62
16	S	-4.84	17	Cl	-6.40	18	Ar	-5.40	19	K	-7.00	20	Ca	-5.72
21	Sc	-8.98	22	Ti	-7.31	23	V	-7.95	24	Cr	-6.35	25	Mn	-6.85
26	Fe	-4.50	27	Co	-7.55	28	Ni	-5.77	29	Cu	-7.60	30	Zn	-7.63
31	Ga	-9.21	32	Ge	-8.73	33	As	-9.70	34	Se	-8.80	35	Br	-9.40
36	Kr	-8.80	37	Rb	-9.42	38	Sr	-9.23	39	Y	-10.43	40	Zr	-9.63
41	Nb	-9.75	42	Mo	-10.15	43	Tc	-20.00	44	Ru	-10.48	45	Rh	-10.50
46	Pd	-10.48	47	Ag	-11.38	48	Cd	-10.08	49	In	-10.34	50	Sn	-10.34
51	Sb	-10.40	52	Te	-10.00	53	I	-10.60	54	Xe	-10.00	55	Cs	-10.90
56	Ba	-10.15	57	La	-10.24	58	Ce	-10.41	59	Pr	-10.42	60	Nd	-10.23
61	Pm	-20.00	62	Sm	-10.39	63	Eu	-11.56	64	Gd	-10.93	65	Tb	-11.60
66	Dy	-10.94	67	Ho	-11.50	68	Er	-11.29	69	Tm	-11.62	70	Yb	-11.24
71	Lu	-11.21	72	Hf	-11.40	73	Ta	-11.70	74	W	- 9.48	75	Re	-11.40
76	Os	-11.30	77	Ir	- 9.84	78	Pt	-10.40	79	Au	-11.73	80	Hg	- 9.05
81	Tl	-11.85	82	Pb	-10.18	83	Bi	-11.25	84	Po	-20.00	85	At	-20.00
86	Rn	-20.00	87	Fr	-20.00	88	Ra	-20.00	89	Ac	-20.00	90	Th	-11.23
91	Pa	-20.00	92	U	-11.45	93	Np	-20.00	94	Pu	-20.00	95	Am	-20.00
96	Cm	-20.00	97	Bk	-20.00	98	Cf	-20.00	99	Es	-20.00			

Table 2: The metallicity values used in the grid of the 1200 models

	log[M/H]	[M/H]
1)	0.0	1
2)	-0.5	0.316 ≈1/3
3)	-1.0	0.100 =1/10
4)	-1.5	0.032 ≈1/30
5)	-2.0	0.010 =1/100
6)	-2.5	0.003 ≈1/300
7)	-3.0	0.001 =1/1000
8)	-9.99	0
9)	0.5	3.162 ≈3
10)	1.0	10 =10

TABLE 3: MODELS WITH ODF'S WITH SOLAR ABUNDANCES (LOG [M/H]=0) AND ξ =2 KM/S.

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.90	3.95	4.0	4.44	4.5	5.0
5500	C1* NC733	C2* NC734	C3* NC735	C4* NC736	C5* NC737	C6* NC738	C7* NC739	C8* NC740			C9* NC741		C10* NC742	
5770												C11* NC743		
6000		C12* NC744	C13* NC745	C14* NC746	C15* NC747	C16* NC748	C17* NC749	C18* NC750			C19* NC751		C20* NC752	
6500			C21* NC753	C22* NC754	C23* NC755	C24* NC756	C25* NC757	C26* NC758			C27* NC759		C28* NC780	
7000			C29* NC761	C30* NC762	C31* NC763	C32* NC764	C33* NC765	C34* NC766			C35* NC767		C36* NC768	
7500			C37* NC769	C38* NC770	C39* NC771	C40* NC772	C41* NC773	C42* NC774			C43* NC775		C44* NC776	
8000			R45* NC777	R46* NC778	R47* NC779	R48* NC780	C49* NC781	C50* NC782			C51* NC783		C52* NC784	
8500			R53* NC785	R54* NC786	R55* NC786	R56* NC788	R57* NC789	R58* NC790			R59* NC791		R60* NC792	
9000				R61*	R62*	R63*	R64*	R65*			R66*		R67*	
9400									R68*	R69*	R70*			
9500				R71*	R72*	R73*	R74*	R76*	R75*		R77*		R78*	
10000				R79*	R80*	R81*	R82*	R83*			R84*		R85*	
10500											R86*			
11000					R87*	R88*	R89*	R90*			R91*		R92*	
11500											R93*			
12000					R94*	R95*	R96*	R97*			R98*		R99*	
12500											R100*			
13000					R101*	R102*	R103*	R104*			R105*		R106*	
14000					R107*	R108*	R109*	R110*			R111*		R112*	
15000					R113*	R114*	R115*	R116*			R117*		R118*	
16000					R119*	R120*	R121*	R122*			R123*		R124*	
17000					R125*	R126*	R127*	R128*			R129*		R130*	
18000						R131*	R132*	R133*			R134*		R135*	
20000						R136*	R137*	R138*			R139*		R140*	
22500							R141*	R142*			R143*		R144*	
25000							R145*	R146*			R147*		R148*	R149*
30000								R150*			R151*		R152*	R153*
35000								R154*			R155*		R156*	R157*
40000											R158*		R159*	R160*
45000													R161*	R162*
50000													R163*	R164*

TABLE 4 : MODELS WITH ODF WITH 1/3*SOLAR ABUNDANCE (LOG [M/H]=-0.5) AND WITH ξ =2 KM/S.

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500	NC793	NC794	NC795	NC796	NC797	NC798	NC799	NC800	NC801	NC802
6000	NC803	NC804	NC805	NC806	NC807	NC808	NC809	NC810	NC811	NC812
6500		NC813	NC814	NC815	NC816	NC817	NC818	NC819	NC820	NC821
7000		NC822	NC823	NC824	NC825	NC826	NC827	NC828	NC829	NC830
7500		NC831	NC832	NC833	NC834	NC835	NC836	NC837	NC838	NC839
8000			NC840	NC841	NC842	NC843	NC844	NC845	NC846	NC847
			R376	R377	R378	R379	R380	R381	R382	R383
8500				NC848	NC849	NC850	NC851	NC852	NC853	NC854
			R384	R385	R386	R387	R388	R389	R390	R391
9000			R392	R393	R394	R395	R396	R397	R398	R399
9500				R400	R401	R402	R403	R404	R405	R406
10000				R407	R408	R409	R410	R411	R412	R413
11000				R414	R415	R416	R417	R418	R419	R420
12000				R421	R422	R423	R424	R425	R426	R427
13000				R428	R429	R430	R431	R432	R433	R434
14000				R435	R436	R437	R438	R439	R440	R441
15000					R442	R443	R444	R445	R446	R447
16000					R448	R449	R450	R451	R452	R453
18000					R454	R455	R456	R457	R458	R459
20000						R460	R461	R462	R463	R464

TABLE 5.:MODELS WITH ODF WITH 1/10*SOLAR ABUNDANCE (LOG [M/H]=-1)
AND WITH ξ =2 KM/S.

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500					R165*	C166*	C167*	C168*	C169*	C170*
	NC855	NC856	NC857	NC858	NC859	NC860	NC861	NC862	NC863	NC864
6000					C171*	C172*	C173*	C174*	C175*	C176*
		NC865	NC866	NC867	NC868	NC869	NC870	NC871	NC872	NC873
6500					C177*	C178*	C179*	C180*	C181*	C182*
		NC874	NC875	NC876	NC877	NC878	NC879	NC880	NC881	NC882
7000					C183*	C184*	C185*	C186*	C187*	C188*
		NC883	NC884	NC885	NC886	NC887	NC888	NC889	NC890	NC891
7500					C189*	C190*	C191*	C192*	C193*	C194*
			NC892	NC893	NC894	NC895	NC896	NC897	NC898	NC899
8000					R195*	C196*	C197*	C198*	C199*	C200*
			R285	R286	R287	R288	R289	R290	R291	R292
			NC900	NC901	NC902	NC903	NC904	NC905	NC906	NC907
8500					R201*	R202*	R203*	R204*	R205*	R206*
			R293	R294	R295	R296	R297	R298	R299	R300
				NC908	NC909	NC910	NC911	NC912	NC913	NC914
9000					R207*	R208*	R209*	R210*	R211*	R212*
			R301	R302	R303	R304	R305	R306	R307	R308
9500					R213*	R214*	R215*	R216*	R217*	R218*
			R309	R310	R311	R312	R313	R314	R315	R316
10000					R219*	R220*	R221*	R222*	R223*	R224*
			R317	R318	R319	R320	R321	R322	R323	R324
11000				R325	R326	R327	R328	R329	R330	R331
12000				R332	R333	R334	R335	R336	R337	R338
13000				R339	R340	R341	R342	R343	R344	R345
14000				R346	R347	R348	R349	R350	R351	R352
15000					R353	R354	R355	R356	R357	R358
16000					R359	R360	R361	R362	R363	R364
18000					R365	R366	R367	R368	R369	R370
20000						R371	R372	R373	R374	R375

TABLE 6 :MODELS WITH ODF WITH 1/30*SOLAR ABUNDANCE (LOG [M/H]=-1.5)
AND WITH ξ = 2 Km/s

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500	NC915	NC916	NC917	NC918	NC919	NC920	NC921	NC922	NC923	NC924
6000	NC925	NC926	NC927	NC928	NC929	NC930	NC931	NC932	NC933	NC934
6500		NC935	NC936	NC937	NC938	NC939	NC940	NC941	NC942	NC943
7000		NC944	NC945	NC946	NC947	NC948	NC949	NC950	NC951	NC952
7500		NC953	NC954	NC955	NC956	NC957	NC958	NC959	NC960	NC961
8000			NC962	NC963	NC964	NC965	NC966	NC967	NC968	NC969
8500					NC970	NC971	NC972	NC973	NC974	NC975

TABLE 7.:MODELS WITH ODF WITH 1/100*SOLAR ABUNDANCE (LOG [M/H]=-2)
AND WITH ξ =2 KM/S.

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500					C225*	C226*	C227*	C228*	C229*	C230*
	NC976	NC977	NC978	NC979	NC980	NC981	NC982	NC983	NC984	NC985
6000					C231*	C232*	C233*	C234*	C235*	C236*
		NC986	NC987	NC988	NC989	NC990	NC991	NC992	NC993	NC994
6500					C237*	C238*	C239*	C240*	C241*	C242*
		NC995	NC996	NC997	NC998	NC999	NC1000	NC1001	NC1002	NC1003
7000					C243*	C244*	C245*	C246*	C247*	C248*
		NC1004	NC1005	NC1006	NC1007	NC1008	NC1009	NC1010	NC1111	NC1112
7500					C249*	C250*	C251*	C252*	C253*	C254*
		NC1012	NC1013	NC1014	NC1015	NC1016	NC1017	NC1018	NC1019	NC1020
8000					C255*	C256*	C257*	C258*	C259*	C260*
				NC1021	NC1022	NC1023	NC1024	NC1025	NC1026	NC1027
8500					R261*	R262*	R263*	R264*	R265*	R266*
					NC1028	NC1029	NC1030	NC1031	NC1032	NC1033
9000					R267*	R268*	R269*	R270*	R271*	R272*
9500					R273*	R274*	R275*	R276*	R277*	R278*
10000					R279*	R280*	R281*	R282*	R283*	R284*

TABLE 8 :MODELS WITH ODF WITH 1/300*SOLAR ABUNDANCE (LOG [M/H]=-2.5)
AND WITH ξ =2 Km/s

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500	NC1034	NC1035	NC1036	NC1037	NC1038	NC1039	NC1040	NC1041	NC1042	NC1043
6000	NC1044	NC1045	NC1046	NC1047	NC1048	NC1049	NC1050	NC1051	NC1052	NC1053
6500		NC1054	NC1055	NC1056	NC1057	NC1058	NC1059	NC1060	NC1061	NC1062
7000		NC1063	NC1064	NC1065	NC1066	NC1067	NC1068	NC1069	NC1070	NC1071
7500			NC1072	NC1073	NC1074	NC1075	NC1076	NC1077	NC1078	NC1079
8000					NC1080	NC1081	NC1082	NC1083	NC1084	NC1085
8500					NC1086	NC1087	NC1088	NC1089	NC1090	NC1091

TABLE 9 :MODELS WITH ODF'S WITH 1/1000*SOLAR ABUNDANCE (LOG [M/H]=-3.)
AND WITH ξ =2 KM/S.

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500	NC1092	NC1093	NC1094	NC1095	NC1096	NC1097	NC1098	NC1099	NC1100	NC1101
6000	NC1102	NC1103	NC1104	NC1105	NC1106	NC1107	NC1108	NC1109	NC1110	NC1111
6500		NC1112	NC1113	NC1114	NC1115	NC1116	NC1117	NC1118	NC1119	NC1120
7000		NC1121	NC1122	NC1123	NC1124	NC1125	NC1126	NC1127	NC1128	NC1129
7500				NC1130	NC1131	NC1132	NC1133	NC1134	NC1135	NC1136
8000					NC1137	NC1138	NC1139	NC1140	NC1141	NC1142
8500					NC1143	NC1144	NC1145	NC1146	NC1147	NC1148

TABLE 10 :MODELS WITH ODF'S WITH 0*SOLAR ABUNDANCE (LOG [M/H]=-9.99)
AND WITH ξ =2 KM/S.

log g / T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
5500	NC1149	NC1150	NC1151	NC1152	NC1153	NC1154	NC1155	NC1156	NC1157	NC1158
6000		NC1159	NC1160	NC1161	NC1162	NC1163	NC1164	NC1165	NC1166	NC1167
6500			NC1168	NC1169	NC1170	NC1171	NC1172	NC1173	NC1174	NC1175
7000				NC1176	NC1177	NC1178	NC1179	NC1180	NC1181	NC1182
7500					NC1183	NC1184	NC1185	NC1186	NC1187	NC1188
8000					NC1189	NC1190	NC1191	NC1192	NC1193	NC1194
8500					NC1195	NC1196	NC1197	NC1198	NC1199	NC1200

TABLE 11 :MODELS WITH ODF'S WITH 3*SOLAR ABUNDANCE (LOG [M/H]=0.5)
AND WITH ξ=2 KM/S.

log g T (K)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.3	4.5
5500	NC670	NC671	NC672	NC673	NC674	NC675	NC676	NC677	NC678		NC679
6000	NC680	NC681	NC682	NC683	NC684	NC685	NC686	NC687	NC688		NC689
6500		NC690	NC691	NC692	NC693	NC694	NC695	NC696	NC697		NC698
7000		NC699	NC700	NC701	NC702	NC703	NC704	NC705	NC706		NC707
7500		NC708	NC709	NC710	NC711	NC712	NC713	NC714	NC715		NC716
8000			NC717	NC718	NC719	NC720	NC721	NC722	NC723		NC724
				R465	R466	R467	R468	R469	R470		R471
8500			NC725	NC726	NC727	NC728	NC729	NC730	NC731		NC732
				R472	R473	R474	R475	R476	R477		R478
9000				R479	R480	R481	R482	R483	R484		R485
9500				R486	R487	R488	R489	R490	R491		R492
10000					R493	R494	R495	R496	R497	R498	R499
11000					R500	R501	R502	R503	R504		R505
12000					R506	R507	R508	R509	R510		R511
13000					R512	R513	R514	R515	R516		R517
14000					R518	R519	R520	R521	R522		R523
15000						R524	R525	R526	R527		R528
16000							R529	R530	R531		R532
18000								R533	R534		R535
20000								R536	R537		R538

TABLE 12 :MODELS WITH ODF'S WITH 10*SOLAR ABUNDANCE (LOG [M/H]=1.0)
AND WITH ξ=2 KM/S.

log g T	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.3	4.5
5500	NC610	NC611	NC612	NC613	NC614	NC615	NC616	NC617	NC618		NC619
6000	NC620	NC621	NC622	NC623	NC624	NC625	NC626	NC627	NC628		NC629
6500		NC630	NC631	NC632	NC633	NC634	NC635	NC636	NC637		NC638
7000		NC639	NC640	NC641	NC642	NC643	NC644	NC645	NC646		NC647
7500			NC648	NC649	NC650	NC651	NC652	NC653	NC654		NC655
8000				NC656	NC657	NC658	NC659	NC660	NC661		NC662
			R539	R540	R541	R542	R543	R544	R545		R546
8500				NC663	NC664	NC665	NC666	NC667	NC668		NC669
				R547	R548	R549	R550	R551	R552		R553
9000					R554	R555	R556	R557	R558		R559
9500						R560	R561	R562	R563		R564
10000						R565	R566	R567	R568	R569	R570
11000						R571	R572	R573	R574		R575
12000						R576	R577	R578	R579		R580
13000						R581	R582	R583	R584		R585
14000						R586	R587	R588	R589		R590
15000						R591	R592	R593	R594		R595
16000						R596	R597	R598	R599		R600
18000						R601	R602	R603	R604		R605
20000							R606	R607	R608		R609

Table 13. The "Big" subdivision of the spectral wavelength range 22.794 - 1000000 nm.

	lami(nm)		lamf(nm)	edge	dlam(nm)	lamc(nm)
1	22.79400	HeII	23.20000		0.40600	22.9
2	23.20000		23.65200	OIII	0.45221	23.4
3	23.65200		25.00700	OIII	1.35523	24.3
4	25.00700		25.46600	NIII	0.45870	25.2
5	25.46600		25.90000	CIII+NeII	0.43886	25.6
6	25.90000		26.14316	NIII	0.24316	26.0
7	26.14316		27.10000		0.95684	26.6
8	27.10000		28.09263	NeII	0.99263	27.5
9	28.09263		28.65871	NIII	0.56608	28.3
10	28.65871		29.95849	CIII	1.29978	29.3
11	29.95849		30.26260	NeII	0.30411	30.1
12	30.26260		31.70000		1.43740	30.9
13	31.70000		33.50000		1.80000	32.5
14	33.50000		34.96998	OII	1.46998	34.2
15	34.96998		35.25000	OII+CIII	0.28002	35.1
16	35.25000		36.14101	OII	0.89101	35.6
17	36.14101		37.00000		0.85899	36.5
18	37.00000		38.01600	OII	1.01600	37.5
19	38.01600		38.96642	OII	0.95042	38.4
20	38.96642		41.15492	OII	2.18850	40.0
21	41.15492		41.87992	NII	0.72500	41.5
22	41.87992		43.30000		1.42008	42.5
23	43.30000		45.90000		2.60000	44.5
24	45.90000		48.52000	CII+NII	2.62000	47.2
25	48.52000		50.43022	HeI	1.91022	49.4
26	50.43022		50.87630	CII	0.44608	50.6
27	50.87630		52.50000		1.62370	51.6
28	52.50000		55.50000		3.00000	54.0
29	55.50000		57.41000	NeI+CII	1.91000	56.4
30	57.41000		60.00000		2.59000	58.7
31	60.00000		62.50000		2.50000	61.2
32	62.50000		65.53786	CII	3.03786	64.0
33	65.53786		68.80000		3.26214	67.1
34	68.80000		72.24011	CII	3.42401	70.5
35	72.24011		75.00000		2.75989	73.6
36	75.00000		79.00000		4.00000	77.0
37	79.00000		83.00000		4.00000	81.0
38	83.00000		87.00000		4.00000	85.0
39	87.00000		91.17638	HI+OI	4.17638	89.0
40	91.17638		95.00000		3.82362	93.0
41	95.00000		100.00000		5.00000	97.5
42	100.00000		105.00000		5.00000	102.5
43	105.00000		110.09203	CI	5.09203	107.5
44	110.09203		115.00000		4.90797	112.5
45	115.00000		120.00000		5.00000	117.5
46	120.00000		123.96176	CI	3.96176	121.9
47	123.96176		130.00000		6.03824	126.9
48	130.00000		135.00000		5.00000	132.5
49	135.00000		140.00000		5.00000	137.5
50	140.00000		144.40176	CI	4.40176	142.2
51	144.40176		152.00002	SiI	7.59824	148.2

52	152.00002	157.00000		4.99998	154.5
53	157.00000	162.15071	MgI	5.15071	159.5
54	162.15071	167.67209	SiI	5.52138	164.9
55	167.67209	175.00000		7.32791	171.3
56	175.00000	183.00000		8.00000	179.0
57	183.00000	191.00000		8.00000	187.0
58	191.00000	197.84471	SiI	6.84471	194.4
59	197.84471	207.75641	AlI	9.91170	202.8
60	207.75641	215.00000		7.24359	211.3
61	215.00000	225.00000		10.00000	220.0
62	225.00000	235.00000		10.00000	230.0
63	235.00000	245.00000		10.00000	240.0
64	245.00000	251.38152	MgI	6.38152	248.1
65	251.38152	265.00000		13.61848	258.1
66	265.00000	275.00000		10.00000	270.0
67	275.00000	285.00000		10.00000	280.0
68	285.00000	295.00000		10.00000	290.0
69	295.00000	305.00000		10.00000	300.0
70	305.00000	315.00000		10.00000	310.0
71	315.00000	325.00000		10.00000	320.0
72	325.00000	335.00000		10.00000	330.0
73	335.00000	345.00000		10.00000	340.0
74	345.00000	355.00000		10.00000	350.0
75	355.00000	364.70551	HI	9.70551	359.8
76	364.70551	367.50000		2.79449	366.1
77	367.50000	370.00000		2.50000	368.7
78	370.00000	372.50000		2.50000	371.2
79	372.50000	375.00000	MgI?	2.50000	373.7
80	375.00000	385.00000		10.00000	380.0
81	385.00000	395.00000		10.00000	390.0
82	395.00000	410.00000		15.00000	402.5
83	410.00000	430.00000		20.00000	420.0
84	430.00000	450.00000		20.00000	440.0
85	450.00000	470.00000		20.00000	460.0
86	470.00000	490.00000		20.00000	480.0
87	490.00000	510.00000		20.00000	500.0
88	510.00000	530.00000		20.00000	520.0
89	530.00000	550.00000		20.00000	540.0
90	550.00000	570.00000		20.00000	560.0
91	570.00000	590.00000		20.00000	580.0
92	590.00000	620.00000		30.00000	605.0
93	620.00000	650.00000		30.00000	635.0
94	650.00000	680.00000		30.00000	665.0
95	680.00000	710.00000		30.00000	695.0
96	710.00000	750.00000		40.00000	730.0
97	750.00000	790.00000		40.00000	770.0
98	790.00000	820.58740	HI	30.58740	805.2
99	820.58740	850.00000		29.41260	835.2
100	850.00000	900.00000		50.00000	875.0
101	900.00000	950.00000		50.00000	925.0
102	950.00000	1000.00000		50.00000	975.0
103	1000.00000	1050.00000		50.00000	1025.0
104	1050.00000	1100.00000		50.00000	1075.0
105	1100.00000	1150.00000		50.00000	1125.0
106	1150.00000	1200.00000		50.00000	1175.0
107	1200.00000	1250.00000		50.00000	1225.0
108	1250.00000	1300.00000		50.00000	1275.0

109	1300.00000	1350.00000		50.00000	1325.0
110	1350.00000	1400.00000		50.00000	1375.0
111	1400.00000	1458.82214	HI	58.82214	1429.4
112	1458.82214	1500.00000		41.17786	1479.4
113	1500.00000	1600.00000		100.00000	1550.0
114	1600.00000	1000000.00000		998400.00000	1650.0
115					1675.0
116					1800.0
117					2700.0
118					4000.0
119					5000.0
120					6500.0
121					10000.0
122					20000.0

Table 14. The "Little" subdivision of the spectral wavelength range 22.794 - 1000000 nm.

	lami(nm)		lamf(nm)	edge	dlam(nm)	lamc(nm)
1	22.79400	HeII	23.20000		0.40600	22.9
2	23.20000		23.65200	OIII	0.45221	23.4
3	23.65200		25.00700	OIII	1.35523	24.3
4	25.00700		25.46600	NIII	0.45870	25.2
5	25.46600		25.90000	CIII+NeII	0.43886	25.6
6	25.90000		26.14316	NIII	0.24316	26.0
7	26.14316		27.10000		0.95684	26.6
8	27.10000		28.09263	NeII	0.99263	27.5
9	28.09263		28.65871	NIII	0.56608	28.3
10	28.65871		29.95849	CIII	1.29978	29.3
11	29.95849		30.26260	NeII	0.30411	30.1
12	30.26260		31.70000		1.43740	30.9
13	31.70000		33.50000		1.80000	32.5
14	33.50000		34.96998	OII	1.46998	34.2
15	34.96998		35.25000	OII+CIII	0.28002	35.1
16	35.25000		36.14101	OII	0.89101	35.6
17	36.14101		37.00000		0.85899	36.5
18	37.00000		38.01600	OII	1.01600	37.5
19	38.01600		38.96642	OII	0.95042	38.4
20	38.96642		41.15492	OII	2.18850	40.0
21	41.15492		41.87992	NII	0.72500	41.5
22	41.87992		43.30000		1.42008	42.5
23	43.30000		45.90000		2.60000	44.5
24	45.90000		48.52000	CII+NII	2.62000	47.2
25	48.52000		50.43022	HeI	1.91022	49.4
26	50.43022		50.87630	CII	0.44608	50.6
27	50.87630		52.50000		1.62370	51.6
28	52.50000		55.50000		3.00000	54.0
29	55.50000		57.41000	NeI+CII	1.91000	56.4
30	57.41000		60.00000		2.59000	58.7
31	60.00000		62.50000		2.50000	61.2
32	62.50000		65.53786	CII	3.03786	64.0
33	65.53786		68.80000		3.26214	67.1
34	68.80000		72.24011	CII	3.42401	70.5
35	72.24011		75.00000		2.75989	73.6
36	75.00000		79.00000		4.00000	77.0
37	79.00000		83.00000		4.00000	81.0
38	83.00000		87.00000		4.00000	85.0
39	87.00000		91.17638	HI+OI	4.17638	89.0
40	91.17638		93.00000		1.82362	92.0
41	93.00000		95.00000		2.00000	94.0
42	95.00000		97.50000		2.50000	96.2
43	97.50000		100.00000		2.50000	98.7
44	100.00000		102.50000		2.50000	101.2
45	102.50000		105.00000		2.50000	103.7
46	105.00000		107.50000		2.50000	106.2
47	107.50000		110.09203	CI	2.59203	108.7
48	110.09203		112.50000		2.40797	111.2
49	112.50000		115.00000		2.50000	113.7
50	115.00000		117.50000		2.50000	116.2
51	117.50000		120.00000		2.50000	118.7

52	120.00000	122.00000		2.00000	121.0
53	122.00000	123.96176	CI	1.96176	122.9
54	123.96176	127.00000		3.03824	125.4
55	127.00000	130.00000		3.00000	128.5
56	130.00000	132.50000		2.50000	131.2
57	132.50000	135.00000		2.50000	133.7
58	135.00000	137.50000		2.50000	136.2
59	137.50000	140.00000		2.50000	138.7
60	140.00000	142.20000		2.20000	141.0
61	142.20000	144.40176	CI	2.20176	143.3
62	144.40176	147.00000		2.59824	145.7
63	147.00000	149.50000		2.50000	148.2
64	149.50000	152.00002	SiI	2.50002	150.7
65	152.00002	154.50000		2.49998	153.2
66	154.50000	157.00000		2.50000	155.7
67	157.00000	159.50000		2.50000	158.2
68	159.50000	162.15071	MgI	2.65071	160.8
69	162.15071	165.00000		2.84929	163.5
70	165.00000	167.67209	SiI	2.67209	166.3
71	167.67209	170.00000		2.32791	168.8
72	170.00000	172.50000		2.50000	171.2
73	172.50000	175.00000		2.50000	173.7
74	175.00000	177.50000		2.50000	176.2
75	177.50000	180.00000		2.50000	178.7
76	180.00000	183.00000		3.00000	181.5
77	183.00000	185.00000		2.00000	184.0
78	185.00000	187.50000		2.50000	186.2
79	187.50000	191.00000		3.50000	189.2
80	191.00000	193.00000		2.00000	192.0
81	193.00000	195.00000		2.00000	194.0
82	195.00000	197.84471	SiI	2.84471	196.4
83	197.84471	200.00000		2.15529	198.9
84	200.00000	202.50000		2.50000	201.2
85	202.50000	205.00000		2.50000	203.7
86	205.00000	207.75641	AlI	2.75641	206.3
87	207.75641	210.00000		2.24359	208.8
88	210.00000	212.50000		2.50000	211.2
89	212.50000	215.00000		2.50000	213.7
90	215.00000	217.50000		2.50000	216.2
91	217.50000	220.00000		2.50000	218.7
92	220.00000	222.50000		2.50000	221.2
93	222.50000	225.00000		2.50000	223.7
94	225.00000	227.50000		2.50000	226.2
95	227.50000	230.00000		2.50000	228.7
96	230.00000	232.50000		2.50000	231.2
97	232.50000	235.00000		2.50000	233.7
98	235.00000	237.50000		2.50000	236.2
99	237.50000	240.00000		2.50000	238.7
100	240.00000	242.50000		2.50000	241.2
101	242.50000	245.00000		2.50000	243.7
102	245.00000	247.50000		2.50000	246.2
103	247.50000	250.00000		2.50000	248.7
104	250.00000	251.38152	MgI	1.38152	250.6
105	251.38152	252.50000		1.11848	251.9
106	252.50000	255.00000		2.50000	253.7
107	255.00000	257.50000		2.50000	256.2
108	257.50000	260.00000		2.50000	258.7

109	260.00000	262.50000		2.50000	261.2
110	262.50000	265.00000		2.50000	263.7
111	265.00000	267.50000		2.50000	266.2
112	267.50000	270.00000		2.50000	268.7
113	270.00000	272.50000		2.50000	271.2
114	272.50000	275.00000		2.50000	273.7
115	275.00000	277.50000		2.50000	276.2
116	277.50000	280.00000		2.50000	278.7
117	280.00000	282.50000		2.50000	281.2
118	282.50000	285.00000		2.50000	283.7
119	285.00000	287.50000		2.50000	286.2
120	287.50000	290.00000		2.50000	288.7
121	290.00000	292.50000		2.50000	291.2
122	292.50000	295.00000		2.50000	293.7
123	295.00000	297.50000		2.50000	296.2
124	297.50000	300.00000		2.50000	298.7
125	300.00000	302.50000		2.50000	301.2
126	302.50000	305.00000		2.50000	303.7
127	305.00000	307.50000		2.50000	306.2
128	307.50000	310.00000		2.50000	308.7
129	310.00000	312.50000		2.50000	311.2
130	312.50000	315.00000		2.50000	313.7
131	315.00000	317.50000		2.50000	316.2
132	317.50000	320.00000		2.50000	318.7
133	320.00000	322.50000		2.50000	321.2
134	322.50000	325.00000		2.50000	323.7
135	325.00000	327.50000		2.50000	326.2
136	327.50000	330.00000		2.50000	328.7
137	330.00000	332.50000		2.50000	331.2
138	332.50000	335.00000		2.50000	333.7
139	335.00000	337.50000		2.50000	336.2
140	337.50000	340.00000		2.50000	338.7
141	340.00000	342.50000		2.50000	341.2
142	342.50000	345.00000		2.50000	343.7
143	345.00000	347.50000		2.50000	346.2
144	347.50000	350.00000		2.50000	348.7
145	350.00000	352.50000		2.50000	351.2
146	352.50000	355.00000		2.50000	353.7
147	355.00000	357.50000		2.50000	356.2
148	357.50000	360.00000		2.50000	358.7
149	360.00000	362.50000		2.50000	361.2
150	362.50000	364.70551	HI	2.20551	363.6
151	364.70551	367.50000		2.79449	366.1
152	367.50000	370.00000		2.50000	368.7
153	370.00000	372.50000		2.50000	371.2
154	372.50000	375.00000	MgI	2.50000	373.7
155	375.00000	377.50000		2.50000	376.2
156	377.50000	380.00000		2.50000	378.7
157	380.00000	382.50000		2.50000	381.2
158	382.50000	385.00000		2.50000	383.7
159	385.00000	387.50000		2.50000	386.2
160	387.50000	390.00000		2.50000	388.7
161	390.00000	392.50000		2.50000	391.2
162	392.50000	395.00000		2.50000	393.7
163	395.00000	397.50000		2.50000	396.2
164	397.50000	400.00000		2.50000	398.7
165	400.00000	402.50000		2.50000	401.2

166	402.50000	405.00000	2.50000	403.7
167	405.00000	407.50000	2.50000	406.2
168	407.50000	410.00000	2.50000	408.7
169	410.00000	412.50000	2.50000	411.2
170	412.50000	415.00000	2.50000	413.7
171	415.00000	417.50000	2.50000	416.2
172	417.50000	420.00000	2.50000	418.7
173	420.00000	422.50000	2.50000	421.2
174	422.50000	425.00000	2.50000	423.7
175	425.00000	427.50000	2.50000	426.2
176	427.50000	430.00000	2.50000	428.7
177	430.00000	432.50000	2.50000	431.2
178	432.50000	435.00000	2.50000	433.7
179	435.00000	437.50000	2.50000	436.2
180	437.50000	440.00000	2.50000	438.7
181	440.00000	442.50000	2.50000	441.2
182	442.50000	445.00000	2.50000	443.7
183	445.00000	447.50000	2.50000	446.2
184	447.50000	450.00000	2.50000	448.7
185	450.00000	452.50000	2.50000	451.2
186	452.50000	455.00000	2.50000	453.7
187	455.00000	457.50000	2.50000	456.2
188	457.50000	460.00000	2.50000	458.7
189	460.00000	462.50000	2.50000	461.2
190	462.50000	465.00000	2.50000	463.7
191	465.00000	467.50000	2.50000	466.2
192	467.50000	470.00000	2.50000	468.7
193	470.00000	472.50000	2.50000	471.2
194	472.50000	475.00000	2.50000	473.7
195	475.00000	477.50000	2.50000	476.2
196	477.50000	480.00000	2.50000	478.7
197	480.00000	482.50000	2.50000	481.2
198	482.50000	485.00000	2.50000	483.7
199	485.00000	487.50000	2.50000	486.2
200	487.50000	490.00000	2.50000	488.7
201	490.00000	492.50000	2.50000	491.2
202	492.50000	495.00000	2.50000	493.7
203	495.00000	497.50000	2.50000	496.2
204	497.50000	500.00000	2.50000	498.7
205	500.00000	505.00000	5.00000	502.5
206	505.00000	510.00000	5.00000	507.5
207	510.00000	515.00000	5.00000	512.5
208	515.00000	520.00000	5.00000	517.5
209	520.00000	525.00000	5.00000	522.5
210	525.00000	530.00000	5.00000	527.5
211	530.00000	535.00000	5.00000	532.5
212	535.00000	540.00000	5.00000	537.5
213	540.00000	545.00000	5.00000	542.5
214	545.00000	550.00000	5.00000	547.5
215	550.00000	555.00000	5.00000	552.5
216	555.00000	560.00000	5.00000	557.5
217	560.00000	565.00000	5.00000	562.5
218	565.00000	570.00000	5.00000	567.5
219	570.00000	575.00000	5.00000	572.5
220	575.00000	580.00000	5.00000	577.5
221	580.00000	585.00000	5.00000	582.5
222	585.00000	590.00000	5.00000	587.5

223	590.00000	595.00000	5.00000	592.5
224	595.00000	600.00000	5.00000	597.5
225	600.00000	605.00000	5.00000	602.5
226	605.00000	610.00000	5.00000	607.5
227	610.00000	615.00000	5.00000	612.5
228	615.00000	620.00000	5.00000	617.5
229	620.00000	625.00000	5.00000	622.5
230	625.00000	630.00000	5.00000	627.5
231	630.00000	635.00000	5.00000	632.5
232	635.00000	640.00000	5.00000	637.5
233	640.00000	645.00000	5.00000	642.5
234	645.00000	650.00000	5.00000	647.5
235	650.00000	655.00000	5.00000	652.5
236	655.00000	660.00000	5.00000	677.5
237	660.00000	665.00000	5.00000	662.5
238	665.00000	670.00000	5.00000	667.5
239	670.00000	675.00000	5.00000	672.5
240	675.00000	680.00000	5.00000	677.5
241	680.00000	685.00000	5.00000	682.5
242	685.00000	690.00000	5.00000	687.5
243	690.00000	695.00000	5.00000	692.5
244	695.00000	700.00000	5.00000	697.5
245	700.00000	705.00000	5.00000	702.5
246	705.00000	710.00000	5.00000	707.5
247	710.00000	720.00000	10.00000	715.0
248	720.00000	730.00000	10.00000	725.0
249	730.00000	740.00000	10.00000	735.0
250	740.00000	750.00000	10.00000	745.0
251	750.00000	760.00000	10.00000	755.0
252	760.00000	770.00000	10.00000	765.0
253	770.00000	780.00000	10.00000	775.0
254	780.00000	790.00000	10.00000	785.0
255	790.00000	800.00000	10.00000	795.0
256	800.00000	810.00000	10.00000	805.0
257	810.00000	820.58740 HI	10.58740	815.2
258	820.58740	830.00000	9.41260	825.2
259	830.00000	840.00000	10.00000	835.0
260	840.00000	850.00000	10.00000	845.0
261	850.00000	860.00000	10.00000	855.0
262	860.00000	870.00000	10.00000	865.0
263	870.00000	880.00000	10.00000	875.0
264	880.00000	890.00000	10.00000	885.0
265	890.00000	900.00000	10.00000	895.0
266	900.00000	910.00000	10.00000	905.0
267	910.00000	920.00000	10.00000	915.0
268	920.00000	930.00000	10.00000	925.0
269	930.00000	940.00000	10.00000	935.0
270	940.00000	950.00000	10.00000	945.0
271	950.00000	960.00000	10.00000	955.0
272	960.00000	970.00000	10.00000	965.0
273	970.00000	980.00000	10.00000	975.0
274	980.00000	990.00000	10.00000	985.0
275	990.00000	1000.00000	10.00000	995.0
276	1000.00000	1010.00000	10.00000	1005.0
277	1010.00000	1020.00000	10.00000	1015.0
278	1020.00000	1030.00000	10.00000	1025.0
279	1030.00000	1040.00000	10.00000	1035.0

280	1040.00000	1050.00000		10.00000	1045.0
281	1050.00000	1060.00000		10.00000	1055.0
282	1060.00000	1070.00000		10.00000	1065.0
283	1070.00000	1080.00000		10.00000	1075.0
284	1080.00000	1090.00000		10.00000	1085.0
285	1090.00000	1100.00000		10.00000	1095.0
286	1100.00000	1110.00000		10.00000	1105.0
287	1110.00000	1120.00000		10.00000	1115.0
288	1120.00000	1130.00000		10.00000	1125.0
289	1130.00000	1140.00000		10.00000	1135.0
290	1140.00000	1150.00000		10.00000	1145.0
291	1150.00000	1160.00000		10.00000	1155.0
292	1160.00000	1170.00000		10.00000	1165.0
293	1170.00000	1180.00000		10.00000	1175.0
294	1180.00000	1190.00000		10.00000	1185.0
295	1190.00000	1200.00000		10.00000	1195.0
296	1200.00000	1210.00000		10.00000	1205.0
297	1210.00000	1220.00000		10.00000	1215.0
298	1220.00000	1230.00000		10.00000	1225.0
299	1230.00000	1240.00000		10.00000	1235.0
300	1240.00000	1250.00000		10.00000	1245.0
301	1250.00000	1260.00000		10.00000	1255.0
302	1260.00000	1270.00000		10.00000	1265.0
303	1270.00000	1280.00000		10.00000	1275.0
304	1280.00000	1290.00000		10.00000	1285.0
305	1290.00000	1300.00000		10.00000	1295.0
306	1300.00000	1310.00000		10.00000	1305.0
307	1310.00000	1320.00000		10.00000	1315.0
308	1320.00000	1330.00000		10.00000	1325.0
309	1330.00000	1340.00000		10.00000	1335.0
310	1340.00000	1350.00000		10.00000	1345.0
311	1350.00000	1360.00000		10.00000	1360.0
312	1360.00000	1370.00000		10.00000	1370.0
313	1370.00000	1380.00000		10.00000	1380.0
314	1380.00000	1390.00000		10.00000	1390.0
315	1390.00000	1400.00000		10.00000	1395.0
316	1400.00000	1410.00000		10.00000	1405.0
317	1410.00000	1420.00000		10.00000	1415.0
318	1420.00000	1430.00000		10.00000	1425.0
319	1430.00000	1440.00000		10.00000	1435.0
320	1440.00000	1450.00000		10.00000	1445.0
321	1450.00000	1458.82214	HI	8.82214	1454.4
322	1458.82214	1470.00000		11.17786	1464.4
323	1470.00000	1480.00000		10.00000	1475.0
324	1480.00000	1490.00000		10.00000	1485.0
325	1490.00000	1500.00000		10.00000	1495.0
326	1500.00000	1520.00000		20.00000	1510.0
327	1520.00000	1540.00000		20.00000	1530.0
328	1540.00000	1560.00000		20.00000	1550.0
329	1560.00000	1580.00000		20.00000	1570.0
330	1580.00000	1600.00000		20.00000	1590.0
331	1600.00000	1620.00000		20.00000	1610.0
332	1620.00000	1640.00000		20.00000	1630.0
333	1640.00000	1660.00000		20.00000	1650.0
334	1660.00000	1680.00000		20.00000	1670.0
335	1680.00000	1000000.00000		998320.00000	1690.0
336					1800.0

337	2700.0
338	4000.0
339	5000.0
340	6500.0
341	10000.0
342	20000.0

Table 15: Temperatures and electron number densities used to compute ODF's tables

		log Ne								
log T	T	17	16	15	14	13	12	11	10	9
3.48	3019.95							+	+	+
3.52	3311.31							+	+	+
3.56	3630.78					+	+	+	+	+
3.60	3981.07					+	+	+	+	+
3.64	4365.16				+	+	+	+	+	+
3.68	4786.30				+	+	+	+	+	+
3.72	5248.07				+	+	+	+	+	+
3.76	5754.40		+	+	+	+	+	+	+	+
3.80	6309.57		+	+	+	+	+	+	+	+
3.84	6918.31		+	+	+	+	+	+	+	+
3.88	7585.78		+	+	+	+	+	+	+	+
3.92	8317.64		+	+	+	+	+	+	+	+
3.96	9120.11		+	+	+	+	+	+	+	+
4.00	10000.00	+	+	+	+	+	+	+	+	+
4.05	11220.18	+	+	+	+	+	+	+	+	+
4.10	12589.25	+	+	+	+	+	+	+	+	+
4.15	14125.37	+	+	+	+	+	+	+	+	+
4.20	15848.93	+	+	+	+	+	+	+	+	+
4.25	17782.79	+	+	+	+	+	+	+	+	+
4.30	19952.62	+	+	+	+	+	+	+	+	+
4.35	22387.21	+	+	+	+	+	+	+	+	+
4.40	25118.86	+	+	+	+	+	+	+	+	+
4.45	28183.83	+	+	+	+	+	+	+	+	
4.50	31622.78	+	+	+	+	+	+	+	+	
4.60	39810.72	+	+	+	+	+	+	+		
4.70	50118.72	+	+	+	+	+	+			
4.80	63095.73	+	+	+	+	+				
4.90	79432.82	+	+	+	+					
5.00	100000.00	+	+	+						

Table 16: The tabulated ODF in the interval 22.794-23.200 nm

1 22.794 23.200

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-3.4740	-2.6665	-1.8591	-1.0517	-0.2442	0.5632	1.3706	2.1780	2.9855
-3.0162	-2.0894	-1.1625	-0.2357	0.6912	1.6181	2.5449	3.4718	4.4281
-1.8601	-0.9171	0.0259	0.9689	1.9119	2.8549	3.7979	4.7494	5.6044
-0.7301	0.2264	1.1829	2.1394	3.0958	4.0639	5.0015	5.8040	6.2505
0.4113	1.4360	2.4607	3.4854	4.4466	5.3398	6.0433	6.3044	6.3410
1.7084	2.7007	3.6929	4.6821	5.5474	6.1560	6.3275	6.3366	6.3437
2.8382	3.8180	4.7708	5.6561	6.2028	6.3071	6.3295	6.3332	6.3472
3.8455	4.7717	5.6277	6.1982	6.3150	6.3303	6.3185	6.3340	6.3325
4.7073	5.5570	6.1266	6.3138	6.3125	6.3196	6.3146	6.3357	6.3153
5.4195	6.0380	6.2454	6.3100	6.3134	6.3270	6.3112	6.3209	6.2785
5.9333	6.1996	6.2655	6.3206	6.2922	6.2955	6.3062	6.1552	5.5656
6.1425	6.2176	6.2603	6.2933	6.2908	6.2469	5.9758	5.2076	4.3829
6.1937	6.2147	6.2651	6.2734	6.2127	5.7961	4.9956	4.2955	4.2480
6.1960	6.1928	6.2435	6.1684	5.6938	4.8801	4.4250	4.2975	4.1692
6.1580	6.0726	5.6870	4.9375	4.5715	4.2068	3.4037	2.6005	1.7973
5.8711	5.1529	4.6554	4.2359	3.3679	2.3054	1.2429	0.1803	-0.8822
4.9229	4.4362	3.6356	2.4703	1.0976	-0.2750	-1.6477	-3.0204	-4.3930
4.0664	3.0478	1.9086	0.9735	0.0385	-0.8966	-1.8316	-2.7667	-3.7017
2.9342	1.9276	1.0622	0.1967	-0.6687	-1.5341	-2.3995	-3.2649	-4.1304

-------------------end of step 1 (w=0.016667=1/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
1.6469	1.7227	1.7986	1.8745	1.9504	2.0263	2.1022	2.1780	2.2539
-2.2914	-1.5770	-0.8627	-0.1483	0.5660	1.2804	1.9947	2.7091	3.6812
-2.5619	-1.6219	-0.6820	0.2579	1.1978	2.1378	3.0777	4.0498	4.9529
1.4318	1.6677	1.9035	2.1394	2.3752	3.3310	4.2983	5.1507	5.5753
1.8742	2.1675	2.4607	2.7540	3.7583	4.7011	5.4020	5.6475	5.6857
1.4448	2.2397	3.0345	4.0032	4.9374	5.5230	5.6745	5.6932	5.6886
2.2496	3.2177	4.1602	5.0388	5.5712	5.6949	5.7106	5.7072	5.7025
3.2601	4.2220	5.0674	5.5665	5.7002	5.7159	5.7075	5.7170	5.7171
4.1677	5.0477	5.5520	5.6891	5.7214	5.7291	5.7267	5.7235	5.7264
4.9198	5.5326	5.6706	5.7157	5.7294	5.7288	5.7289	5.7320	5.6839
5.4216	5.6890	5.6907	5.7258	5.7393	5.7425	5.7232	5.5781	5.0108
5.6497	5.7237	5.7018	5.7379	5.7396	5.6969	5.4108	4.6891	3.9490
5.7148	5.7293	5.7012	5.7363	5.6661	5.2632	4.4853	3.7929	3.1311
5.7339	5.7438	5.6985	5.6352	5.1738	4.4200	3.7495	3.1587	2.5678
5.7309	5.6477	5.1726	4.5313	3.8612	3.2038	2.3434	1.4030	0.6225
5.4474	4.8144	4.1701	3.4161	2.4740	1.4436	0.4132	-0.6172	-1.6475
4.6258	3.8695	2.9774	1.9222	0.7407	-0.4408	-1.6223	-2.8039	-3.9854
3.7429	2.7149	1.5312	0.5286	-0.4740	-1.4766	-2.4792	-3.4818	-4.4843
2.6232	1.5715	0.6362	-0.2991	-1.2343	-2.1696	-3.1049	-4.0402	-4.9755

-------------------end of step 2 (w=0.033333=2/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
2.8842	2.7833	2.6824	2.5816	2.4807	2.3798	2.2789	2.1780	2.0772
1.1164	1.2628	1.4092	1.5556	1.7019	1.8483	1.9947	2.1411	2.9721
-0.1943	0.2395	0.6734	1.1072	1.5411	1.9750	2.4088	3.3626	4.2732
2.7090	2.5191	2.3292	2.1394	1.9495	2.6776	3.6416	4.5006	4.9368
3.0802	2.7705	2.4607	2.1510	3.1190	4.0651	4.7856	5.0297	5.0674
1.9845	2.2397	2.4949	3.4000	4.3295	4.9267	5.0824	5.1003	5.1009
1.1334	2.6884	3.6297	4.4618	4.9976	5.1167	5.1284	5.1317	5.1303
2.7456	3.7147	4.5652	5.0102	5.1372	5.1551	5.1509	5.1509	5.1528
3.6633	4.5599	5.0625	5.1317	5.1664	5.1723	5.1733	5.1740	5.1715
4.4418	5.0606	5.1953	5.1576	5.1836	5.1874	5.1901	5.1916	5.1490
4.9655	5.2272	5.2231	5.1768	5.2032	5.2048	5.1932	5.0509	4.5024
5.1951	5.2706	5.2363	5.2005	5.2180	5.1795	4.9008	4.2138	3.4700
5.2657	5.2895	5.2490	5.2093	5.1563	4.7653	4.0647	3.2088	2.4391
5.2922	5.3023	5.2449	5.1270	4.6901	3.9930	3.1973	2.3406	1.4838
5.3048	5.2264	4.7655	4.0799	3.2830	2.4197	1.4700	0.5203	-0.4295
5.0513	4.4617	3.6434	2.8054	1.8401	0.8486	-0.1428	-1.1343	-2.1257
4.2825	3.4394	2.4612	1.4434	0.3234	-0.7966	-1.9166	-3.0366	-4.1566
3.3632	2.3242	1.1839	0.0958	-0.9922	-2.0803	-3.1684	-4.2564	-5.3445
2.3418	1.2340	0.2141	-0.8058	-1.8257	-2.8456	-3.8655	-4.8854	-5.9053

-------------------end of step 3 (w=0.05000=3/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
2.8842	2.7833	2.6824	2.5816	2.4807	2.3798	2.2789	2.1780	2.0772
1.5505	1.6245	1.6986	1.7726	1.8467	1.9207	1.9947	2.0688	2.0003
1.0651	1.2471	1.4291	1.6110	1.7930	1.9750	2.1569	2.1716	2.8157
2.7090	2.5191	2.3292	2.1394	1.9495	2.1196	2.3436	3.0721	3.5154
3.4010	2.9309	2.4607	1.9906	2.1424	2.7027	3.4048	3.6598	3.6994
2.3931	2.2397	2.0862	2.5507	3.1044	3.6213	3.7630	3.7897	3.8203
-1.0403	1.9320	3.0160	3.6620	3.8357	3.8864	3.9034	3.9466	3.9854
2.1784	3.1652	3.9820	4.2552	4.0499	4.0233	4.0648	4.0997	4.1452
3.1384	4.0407	4.5108	4.4168	4.1765	4.1758	4.2176	4.2508	4.2573
3.9398	4.5674	4.6655	4.4089	4.3115	4.3201	4.3399	4.3419	4.3018
4.4882	4.7539	4.7217	4.5580	4.4326	4.4263	4.4088	4.2860	3.8497
4.7387	4.8183	4.7587	4.6213	4.5145	4.4638	4.2270	3.6586	2.8701
4.8255	4.8487	4.7945	4.6615	4.5058	4.1780	3.5243	2.6799	1.8083
4.8632	4.8747	4.8112	4.6056	4.1747	3.4619	2.5868	1.7105	0.8343
4.9021	4.8190	4.3828	3.5749	2.6982	1.7774	0.8183	-0.1407	-1.0998
4.6598	4.0491	3.1456	2.1880	1.2118	0.2115	-0.7888	-1.7891	-2.7894
3.8638	2.9571	1.9223	0.9040	-0.1677	-1.2393	-2.3110	-3.3827	-4.4543
2.9451	1.8896	0.7697	-0.3322	-1.4341	-2.5359	-3.6378	-4.7397	-5.8416
1.9661	0.8750	-0.1678	-1.2106	-2.2534	-3.2962	-4.3390	-5.3818	-6.4246

-------------------end of step 4 (w=0.10000=6/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
2.8842	2.7833	2.6824	2.5816	2.4807	2.3798	2.2789	2.1780	2.0772
1.5505	1.6245	1.6986	1.7726	1.8467	1.9207	1.9947	2.0688	1.9393
1.0651	1.2471	1.4291	1.6110	1.7930	1.9750	2.1569	1.9975	1.9340
2.7090	2.5191	2.3292	2.1394	1.9495	2.1196	2.0251	2.1105	2.5619
3.4010	2.9309	2.4607	1.9906	1.9864	1.9143	2.3815	2.6426	2.6853
2.4183	2.2397	2.0610	1.9686	2.0889	2.5346	2.6806	2.7147	2.7378
-3.9385	-0.6061	2.3817	2.8090	2.7729	2.7345	2.7507	2.7685	2.7913
1.1783	2.5693	3.3558	3.3783	2.9241	2.8031	2.8102	2.8451	2.8740
2.5463	3.4540	3.8869	3.5134	2.9883	2.8769	2.9015	2.9226	2.9251
3.3567	3.9945	4.0399	3.5669	3.0610	2.9730	2.9767	2.9744	2.9525
3.9232	4.1924	4.0966	3.6159	3.1511	3.0525	3.0334	3.0062	2.6565
4.1862	4.2692	4.1468	3.6802	3.2177	3.1352	3.0418	2.5368	1.9033
4.2908	4.3249	4.1888	3.7173	3.3152	3.0775	2.4971	1.8419	1.2226
4.3558	4.3742	4.2142	3.7271	3.1894	2.5473	1.8493	1.1648	0.4804
4.4454	4.3716	3.8992	2.9543	2.0515	1.2298	0.3918	-0.6462	-1.5842
4.3096	3.6995	2.7417	1.6834	0.6564	-0.3674	-1.3912	-2.4150	-3.4388
3.5446	2.5962	1.5384	0.4240	-0.6831	-1.7902	-2.8973	-4.0044	-5.1115
2.6074	1.5674	0.4730	-0.7784	-2.0298	-3.2812	-4.5326	-5.7840	-7.0353
1.7088	0.6432	-0.4914	-1.6260	-2.7606	-3.8952	-5.0298	-6.1644	-7.2991

-------------------end of step 5 (w=0.1000=6/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
2.8842	2.7833	2.6824	2.5816	2.4807	2.3798	2.2789	2.1780	2.0772
1.5505	1.6245	1.6986	1.7726	1.8467	1.9207	1.9947	2.0688	1.9393
1.0651	1.2471	1.4291	1.6110	1.7930	1.9750	2.1569	1.9975	1.8410
2.7090	2.5191	2.3292	2.1394	1.9495	2.1196	2.0251	1.7963	2.2051
3.4010	2.9309	2.4607	1.9906	1.9864	1.9143	1.9959	2.2748	2.3302
2.4183	2.2397	2.0610	1.9686	1.8834	2.1497	2.3076	2.3381	2.3447
-6.8368	-3.5043	1.9158	2.3314	2.3610	2.3444	2.3453	2.3541	2.3702
0.0585	2.1821	2.9852	2.9144	2.5128	2.3756	2.3695	2.3863	2.3984
2.1508	3.0770	3.5259	3.0455	2.5433	2.4071	2.4012	2.4122	2.4211
2.9735	3.6250	3.6741	3.0750	2.5758	2.4301	2.4253	2.4275	2.4204
3.5407	3.8180	3.7166	3.1054	2.6040	2.4507	2.4502	2.3687	1.8994
3.7998	3.8858	3.7510	3.1275	2.6172	2.4929	2.2663	1.6772	1.0961
3.8993	3.9287	3.7823	3.1289	2.6327	2.1910	1.5742	1.0398	0.5090
3.9480	3.9685	3.7943	3.1220	2.2748	1.5742	1.0413	0.4276	-0.1862
4.0232	3.9644	3.4198	2.1295	1.2222	0.4495	-0.4489	-1.3474	-2.2458
3.9019	3.2785	2.2138	0.9735	-0.1484	-1.2243	-2.3001	-3.3759	-4.4517
3.2085	2.2350	1.0442	-0.3947	-1.6610	-2.9274	-4.1937	-5.4600	-6.7264
2.3329	1.2332	-0.0531	-1.5634	-3.0736	-4.5839	-6.0941	-7.6044	-9.1146
1.4151	0.2738	-1.0951	-2.4640	-3.8328	-5.2017	-6.5706	-7.9395	-9.3083

-------------------end of step 6 (w=0.1000=6/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
2.8842	2.7833	2.6824	2.5816	2.4807	2.3798	2.2789	2.1780	2.0772
1.5505	1.6246	1.6986	1.7726	1.8467	1.9207	1.9947	2.0688	1.9393
1.0651	1.2471	1.4291	1.6110	1.7930	1.9750	2.1569	1.9975	1.8410
2.7090	2.5191	2.3292	2.1394	1.9495	2.1196	2.0251	1.7853	1.9426
3.4010	2.9309	2.4607	1.9906	1.9864	1.9143	1.7158	2.0135	2.0755
2.4183	2.2397	2.0610	1.9686	1.8834	1.8659	2.0446	2.0826	2.0866
-9.7350	-6.4026	-0.2753	1.8623	2.0564	2.0738	2.0836	2.0965	2.1129
-1.0613	1.7496	2.6977	2.5509	2.2134	2.1124	2.1083	2.1246	2.1380
1.8068	2.8121	3.2431	2.6937	2.2405	2.1379	2.1350	2.1443	2.1553
2.7032	3.3668	3.3949	2.7272	2.2686	2.1578	2.1559	2.1575	2.1496
3.2748	3.5580	3.4360	2.7453	2.2833	2.1762	2.1784	2.0765	1.5005
3.5363	3.6227	3.4577	2.7551	2.3062	2.1963	1.9450	1.3214	0.6742
3.6331	3.6665	3.4775	2.7650	2.3069	1.8419	1.1824	0.5334	0.0048
3.6853	3.7029	3.4828	2.7410	1.8967	1.1305	0.4696	-0.1113	-0.6922
3.7508	3.7008	3.0848	1.6769	0.5726	-0.1960	-1.0955	-1.9950	-2.8946
3.8222	2.9511	1.8373	0.3702	-0.8042	-1.9970	-3.1098	-4.2226	-5.3353
2.8814	1.8936	0.6420	-1.0346	-2.3009	-3.7272	-5.0734	-6.4197	-7.7660
1.9594	0.8468	-0.5015	-2.1696	-3.8377	-5.5058	-7.1740	-8.8421	-9.9500
1.0545	-0.0758	-1.4582	-2.8407	-4.2231	-5.6055	-6.9879	-8.3704	-9.7528

-------------------end of step 7 (w=0.1000=6/60)-------------------

-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500	-9.9500
2.8842	2.7833	2.6824	2.5816	2.4807	2.3798	2.2789	2.1780	2.0772
1.5505	1.6245	1.6986	1.7726	1.8467	1.9207	1.9947	2.0688	1.9393
1.0651	1.2471	1.4291	1.6110	1.7930	1.9750	2.1569	1.9975	1.8410
2.7090	2.5191	2.3292	2.1394	1.9495	2.1196	2.0251	1.7853	1.6385
3.4010	2.9309	2.4607	1.9906	1.9864	1.9143	1.6104	1.7368	1.7993
2.4183	2.2397	2.0610	1.9686	1.8834	1.5635	1.7629	1.8088	1.8130

```
-9.9500 -9.9500 -4.1397 -1.2983  1.7056  1.7831  1.8093  1.8185  1.8330
-2.5543  0.3264  2.3397  2.1551  1.8894  1.8292  1.8266  1.8374  1.8503
 1.2191  2.5201  2.8893  2.3198  1.9298  1.8460  1.8437  1.8566  1.8629
 2.4028  3.0881  3.0408  2.3531  1.9455  1.8622  1.8634  1.8713  1.8617
 2.9897  3.2818  3.0735  2.3711  1.9650  1.8810  1.8871  1.7773  1.2834
 3.2579  3.3490  3.0841  2.3826  1.9950  1.8916  1.6392  1.0293  0.3254
 3.3559  3.3835  3.0935  2.4174  1.9733  1.5310  0.8611  0.1400 -0.4691
 3.4078  3.4122  3.0964  2.3731  1.5652  0.7810  0.0503 -0.5622 -1.1747
 3.4591  3.4098  2.6935  1.3004  0.1555 -0.6437 -1.5757 -2.5076 -3.4396
 3.3302  2.6370  1.4545 -0.0811 -1.3549 -2.4772 -3.5995 -4.7217 -5.8440
 2.5050  1.5319  0.2119 -1.4845 -2.9996 -4.5148 -6.0299 -7.5450 -9.0602
 1.5608  0.5085 -0.9395 -2.7577 -4.5759 -6.3940 -8.2122 -9.9500 -9.9500
 0.6935 -0.3944 -1.8689 -3.3434 -4.8179 -6.2924 -7.7669 -9.2414 -9.9500
---------------------end of step 8 (w=0.166667=10/60)------------------
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
 2.8842  2.7833  2.6824  2.5816  2.4807  2.3798  2.2789  2.1780  2.0772
 1.5505  1.6245  1.6986  1.7726  1.8467  1.9207  1.9947  2.0688  1.9393
 1.0651  1.2471  1.4291  1.6110  1.7930  1.9750  2.1569  1.9975  1.8410
 2.7090  2.5191  2.3292  2.1394  1.9495  2.1196  2.0251  1.7853  1.3099
 3.4010  2.9309  2.4607  1.9906  1.9864  1.9143  1.6104  1.4045  1.4979
 2.4183  2.2397  2.0610  1.9686  1.8834  1.4817  1.4578  1.5077  1.5189
-9.9500 -9.9500 -8.9700 -6.1287  0.3774  1.4845  1.5099  1.5302  1.5441
-4.4206 -1.5399  1.6142  1.6912  1.5657  1.5279  1.5385  1.5511  1.5602
 0.4793  2.1643  2.4210  1.8783  1.6129  1.5519  1.5561  1.5640  1.5675
 2.0348  2.7741  2.6112  1.9207  1.6347  1.5709  1.5673  1.5798  1.5591
 2.6804  2.9901  2.6484  1.9416  1.6538  1.5894  1.5865  1.4687  0.9712
 2.9616  3.0512  2.6585  1.9614  1.6785  1.5832  1.3313  0.6861 -0.0788
 3.0682  3.0906  2.6606  2.0003  1.6400  1.2154  0.4887 -0.2382 -0.9931
 3.1054  3.1159  2.6880  1.9500  1.2276  0.4049 -0.3226 -1.0787 -1.8349
 3.1727  3.1086  2.2553  0.8708 -0.2009 -1.0781 -2.0675 -3.0570 -4.0464
 3.0164  2.3135  0.9888 -0.4203 -1.7554 -3.0567 -4.3579 -5.6591 -6.9604
 2.1631  1.1821 -0.2484 -1.9526 -3.6690 -5.3853 -7.1017 -8.8181 -9.9500
 1.2422  0.1622 -1.3704 -3.3062 -5.2419 -7.1776 -9.1134 -9.9500 -9.9500
 0.3499 -0.6891 -2.3845 -4.0800 -5.7754 -7.4708 -9.1662 -9.9500 -9.9500
-------------------end of step 9 (w=0.166667=10/60)--------------------
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
-9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500 -9.9500
 2.8842  2.7833  2.6824  2.5816  2.4807  2.3798  2.2789  2.1780  2.0772
 1.5505  1.6245  1.6986  1.7726  1.8467  1.9207  1.9947  2.0688  1.9393
 1.0651  1.2471  1.4291  1.6110  1.7930  1.9750  2.1569  1.9975  1.8410
 2.7090  2.5191  2.3292  2.1394  1.9495  2.1196  2.0251  1.7853  1.2576
 3.4010  2.9309  2.4607  1.9906  1.9864  1.9143  1.6104  0.9985  1.1592
 2.4183  2.2397  2.0610  1.9686  1.8834  1.4817  1.0030  1.1694  1.1691
-9.9500 -9.9500 -9.9500 -9.9500 -4.1856  1.0346  1.1202  1.1342  1.2076
-6.2869 -3.4062 -0.1140  0.6937  1.1864  1.1495  1.1719  1.2199  1.2360
-0.2605  1.6116  1.8523  1.4185  1.2462  1.2145  1.2298  1.2364  1.2479
 1.6240  2.4283  2.1058  1.4720  1.2913  1.2444  1.2494  1.2544  1.2305
 2.3278  2.6628  2.1637  1.5004  1.3083  1.2678  1.2536  1.1247  0.6271
 2.6256  2.7358  2.1911  1.5372  1.3301  1.2509  0.9808  0.3262 -0.4295
 2.7483  2.7755  2.2003  1.5736  1.2834  0.8686  0.1498 -0.6386 -1.3397
 2.8026  2.8042  2.2150  1.5143  0.8590  0.0689 -0.7355 -1.4151 -2.0947
 2.8561  2.7627  1.7674  0.4533 -0.5558 -1.3921 -2.4212 -3.4503 -4.4793
 2.6683  1.9343  0.5458 -0.7968 -2.0453 -3.8516 -5.6579 -7.4642 -9.2705
 1.8203  0.8144 -0.7083 -2.5235 -4.7357 -6.9479 -9.1601 -9.9500 -9.9500
 0.8966 -0.2104 -2.0296 -4.2657 -6.5018 -8.7378 -9.9500 -9.9500 -9.9500
 0.0174 -1.0760 -3.0575 -5.0390 -7.0206 -9.0021 -9.9500 -9.9500 -9.9500
----------------------end of step 10 (w=0.166667=10/60)------------------
```

Table 17: Temperatures and total pressure used to compute Rosseland opacities tables.

log T	T	log P	P
3.500	3162.280	-2.000	0.010
3.525	3349.654	-1.500	0.032
3.550	3548.134	-1.000	0.100
3.575	3758.374	-0.500	0.316
3.600	3981.072	0.000	1.000
3.625	4216.965	0.500	3.162
3.650	4466.836	1.000	10.000
3.675	4731.513	1.250	17.783
3.700	5011.872	1.500	31.623
3.725	5308.844	1.750	56.234
3.750	5623.413	2.000	100.000
3.775	5956.621	2.250	177.828
3.800	6309.573	2.500	316.228
3.825	6683.439	2.750	562.341
3.850	7079.458	3.000	1000.000
3.875	7498.942	3.200	1584.893
3.900	7943.282	3.400	2511.886
3.925	8413.951	3.600	3981.072
3.950	8912.509	3.800	6309.573
3.975	9440.609	4.000	10000.000
4.000	10000.000	4.200	15848.932
4.050	11220.185	4.400	25118.864
4.100	12589.254	4.600	39810.717
4.150	14125.375	4.800	63095.735
4.200	15848.932	5.000	100000.000
4.250	17782.794	5.200	158489.319
4.300	19952.623	5.400	251188.643
4.350	22387.211	5.600	398107.170
4.400	25118.864	5.800	630957.345
4.450	28183.829	6.000	1000000.000
4.500	31622.777		
4.600	39810.717		
4.700	50118.724		
4.800	63095.735		
4.900	79432.824		
5.000	100000.000		
------Added in DATLAS8			
5.100	125892.541		
5.200	158489.319		
5.300	199526.231		
5.400	251188.643		

Table 18. Ions with partition functions and references.

1	HI (DF)	HII (G)				
2	HeI (DF)	HeII(DF)	HeIII(G)			
3	LiI (DF)	LiII(DF)	LiIII(DF)	LiIV(G)		
4	BeI (AEL)	BeII(AEL)	BeIII(AEL)	BeIV(AEL)		
5	BI (AEL)	BII (AEL)	BIII (AEL)	BIV (G)		
6	CI (DF)	CII (DF)	CIII (DF)	CIV (DF)	CV (G)	CVI (G)
7	NI (DF)	NII (DF)	NIII (DF)	NIV (DF)	NV (DF)	NVI (G)
8	OI (DF)	OII (DF)	OIII (DF)	OIV (DF)	OV (DF)	OVI (AEL)
9	FI (DF)	FII (DF)	FIII (DF)	FIV (DF)	FV (DF)	FVI (AEL)
10	NeI (DF)	NeII(DF)	NeIII(DF)	NeIV(DF)	NeV (AEL)	NeVI (AEL)
11	NaI (DF)	NaII(DF)	NaIII(DF)	NaIV(DF)	NaV (AEL)	NaVI (AEL)
12	MgI (DF)	MgII(DF)	MgIII(DF)	MGIV(AEL)	MgV (AEL)	MgVI (AEL)
13	AlI (DF)	AlII(DF)	AlIII(DF)	AlIV(DF)	AlV (AEL)	AlVI (AEL)
14	SiI (DF)	SiII(DF)	SiIII(DF)	SiIV(DF)	SiV (FAK)	SiVI (FAK)
15	PI (AEL)	PII (AEL)	PIII (AEL)	PIV (AEL)	PV (AEL)	PVI (G)
16	SI (DF)	SII (DF)	SIII (DF)	SIV (DF)	SV (DF)	SVI (DF)
17	ClI (DF)	ClII(DF)	ClIII(DF)	ClIV(DF)	ClV (DF)	
18	AI (DF)	AII (DF)	AIII (DF)	AIV (DF)	AV (DF)	
19	KI (DF)	KII (DF)	KIII (DF)	KIV (DF)	KV (DF)	
20	CaI (DF)	CaII(DF)	CaIII(DF)	CaIV(DF)	CaV (DF)	
21	ScI (AEL)	ScII(AEL)	ScIII(AEL)	ScIV(FAK)	ScV (FAK)	
22	TiI (DF)	TiII(DF)	TiIII(DF)	TiIV(DF)	TiV (FAK)	
23	VI (AEL)	VII (AEL)	VIII (AEL)	VIV (AEL)	V V (AEL)	
24	CrI (DF)	CrII(DF)	CrIII(DF)	CrIV(DF)	CrV (DF)	
25	MnI (AEL)	MnII(AEL)	MnIII(AEL)	MnIV(AEL)	MnV (AEL)	
26	FeI (DF)	FeII(DF)	FeIII(DF)	FeIV(AEL)	FeV (AEL)	
27	CoI (DF)	CoII(DF)	CoIII(DF)	CoIV(FAK)	CoV (FAK)	
28	NiI (DF)	NiII(DF)	NiIII(DF)	NiIV(FAK)	NiV (FAK)	
29	CuI (DF)	CuII(DF)	CuIII(DF)			
30	ZnI (DF)	ZnII(DF)	ZnIII(DF)			
31	GaI (AEL)	GaII(AEL)	GaIII(AEL)			
32	GeI (AEL)	GeII(AEL)	GeIII(AEL)			
33	AsI (AEL)	AsII(AEL)	AsIII(AEL)			
34	SeI (AEL)	SeII(AEL)	SeIII(AEL)			
35	BrI (DF)	BrII(DF)	BrIII(DF)			
36	KrI (DF)	KrII(DF)	KrIII(DF)			
37	RbI (DF)	RbII(DF)	RbIII(DF)			
38	SrI (DF)	SrII(DF)	SrIII(FAK)			
39	YI (AEL)	YII (AEL)	YIII (AEL)			
40	ZrI (DF)	ZrII(DF)	ZrIII(DF)			
41	NbI (AEL)	NbII(AEL)	NbIII(AEL)			
42	MoI (DF)	MoII(DF)	MoIII(AEL)			
43	TcI (AEL)	TcII(AEL)	TcIII(AEL)			
44	RuI (AEL)	RuII(AEL)	RuIII(AEL)			
45	RhI (AEL)	RhII(AEL)	RhIII(AEL)			
46	PdI (AEL)	PdII(AEL)	PdIII(AEL)			
47	AgI (DF)	AgII(DF)	AgIII(DF)			
48	CdI (DF)	CdII(DF)	CdIII(DF)			
49	InI (DF)	InII(DF)	InIII(DF)			
50	SnI (AEL)	SnII(AEL)	SnIII(AEL)			
51	SbI (AEL)	SbII(AEL)	SbIII(AEL)			
52	TeI (AEL)	TeII(AEL)	TeIII(AEL)			
53	JI (DF)	JII (DF)	JIII (AEL)			
54	XI (DF)	XII (DF)	XIII (DF)			
55	CsI (DF)	CsII(DF)	CsIII(DF)			
56	BaI (DF)	BaII(DF)	BaIII(FAK)			
57	LaI (AEL)	LaII(AEL)	LaIII(AEL)			
58	CeI (AEL)	CeII(AEL)	CeIII(AEL)			
59	PrI (FAK)	PrII(AEL)	PrIII(AEL)			
60	NdI (AEL)	NdII(AEL)	NdIII(FAK)			
61	PmI (AEL)	PmII(FAK)	PmIII(FAK)			
62	SmI (AEL)	SmII(AEL)	SmIII(AEL)			
63	EuI (AEL)	EuII(AEL)	EuIII(FAK)			
64	GdI (AEL)	GdII(AEL)	GdIII(AEL)			
65	TbI (AEL)	TbII(FAK)	TbIII(FAK)			
66	DyI (FAK)	DyII(AEL)	DyIII(FAK)			
67	HoI (FAK)	HoII(FAK)	HoIII(AEL)			
68	ErI (AEL)	ErII(AEL)	ErIII(FAK)			
69	TmI (AEL)	TmII(AEL)	TmIII(AEL)			
70	YbI (AEL)	YbII(AEL)	YbIII(AEL)			
71	LuI (AEL)	LuII(AEL)	LuIII(AEL)			
72	HfI (AEL)	HfII(AEL)	HfIII(AEL)			
73	TaI (AEL)	TaII(AEL)	TaIII(AEL)			
74	WI (AEL)	WII (AEL)	WIII (FAK)			
75	ReI (AEL)	ReII(AEL)	ReIII(FAK)			
76	OsI (AEL)	OsII(AEL)	OsIII(FAK)			
77	IrI (AEL)	IrII(FAK)	IrIII(FAK)			
78	PtI (AEL)	PtII(AEL)	PtIII(FAK)			
79	AuI (AEL)	AuII(AEL)	AuIII(AEL)			
80	HgI (DF)	HgII(DF)	HgIII(DF)			
81	TlI (AEL)	TlII(AEL)	TlIII(AEL)			
82	PbI (DF)	PbII(DF)	PbIII(DF)			
83	BiI (AEL)	BiII(AEL)	BiIII(AEL)			
84	PoI (AEL)	PoII(FAK)	PoIII(FAK)			
85	AtI (FAK)	AtII(FAK)	AtIII(FAK)			
86	RnI (AEL)	RnII(FAK)	RnIII(FAK)			
87	FrI (FAK)	FrII(FAK)	FrIII(FAK)			
88	RaI (AEL)	RaII(AEL)	RaIII(FAK)			
89	AcI (AEL)	AcII(AEL)	AcIII(AEL)			
90	ThI (AEL)	ThII(FAK)	ThIII(FAK)			
91	PaI (AEL)	PaII(FAK)	PaIII(FAK)			
92	UI (AEL)	UII (FAK)	UIII (FAK)			
93	NpI (FAK)	NpII(FAK)	NpIII(FAK)			
94	PuI (FAK)	PuII(FAK)	PuIII(FAK)			
95	AmI (FAK)	AmII(FAK)	AmIII(FAK)			
96	CmI (FAK)	CmII(FAK)	CmIII(FAK)			
97	BkI (FAK)	BkII(FAK)	BkIII(FAK)			
98	CfI (FAK)	CfII(FAK)	CfIII(FAK)			
99	EsI (FAK)	EsII(FAK)	EsIII(FAK)			

Table 19: Constants for molecular partition functions

	CODE	A	B	C	D	E	F
H-	100.00	0.756	3.6829E+01	2.4337E-05	1.1141E-08	2.1938E-12	1.5292E-16
H2	101.00	4.478	4.6641E+01	1.8212E-03	5.1150E-07	8.3297E-11	5.1844E-15
H2+	101.01	-10.948	9.2120E+00	1.9386E-03	4.7676E-07	7.4004E-11	4.5518E-15
LiH	103.00	2.429	4.4942E+01	2.2453E-03	5.5182E-07	8.0615E-11	4.7616E-15
BeH	104.00	2.211	4.3816E+01	1.9892E-03	4.9231E-07	7.3716E-11	4.4348E-15
BH	105.00	3.001	4.6403E+01	1.8826E-03	4.6424E-07	6.9646E-11	4.1526E-15
CH	106.00	3.465	4.5508E+01	1.6980E-03	3.8478E-07	5.8550E-11	3.6153E-15
CH+	106.01	-7.168	1.0780E+01	1.7657E-03	4.3978E-07	6.7350E-11	4.0777E-15
NH	107.00	3.47	4.5255E+01	1.8611E-03	4.9980E-07	7.9515E-11	4.9182E-15
OH	108.00	4.392	4.5892E+01	1.8453E-03	5.0935E-07	8.1825E-11	5.0831E-15
OH+	108.01	-9.206	9.6977E+00	1.6123E-03	3.9163E-07	5.9474E-11	3.5847E-15
FH	109.00	5.869	4.6645E+01	1.5717E-03	4.1562E-07	6.6450E-11	4.1190E-15
NaH	111.00	2.050	4.4709E+01	2.4163E-03	6.1037E-07	9.0492E-11	5.3705E-15
MgH	112.00	1.34	4.3452E+01	2.2352E-03	5.5901E-07	8.3104E-11	4.9314E-15
AlH	113.00	3.05	4.5851E+01	2.1457E-03	5.4325E-07	7.8096E-11	4.3341E-15
SiH	114.00	3.060	4.4814E+01	1.7271E-03	3.9057E-07	5.3819E-11	3.0029E-15
SiH+	114.01	-4.952	9.8662E+00	1.4878E-03	3.0290E-07	3.8910E-11	2.0723E-15
PH	115.00	3.300	4.4680E+01	1.8595E-03	4.6737E-07	6.8061E-11	4.0256E-15
SH	116.00	3.55	4.5350E+01	1.9723E-03	5.2543E-07	8.3191E-11	5.1476E-15
ClH	117.00	4.434	4.5898E+01	1.5825E-03	4.0531E-07	6.3983E-11	3.9606E-15
Li2	303.00	1.095	4.4533E+01	2.6336E-03	6.5371E-07	9.4532E-11	5.5650E-15
LiO	308.00	3.599	4.6142E+01	2.2259E-03	5.3905E-07	7.6894E-11	4.4727E-15
LiF	309.00	5.904	4.6714E+01	2.3070E-03	5.7063E-07	8.2626E-11	4.8369E-15
LiCl	317.00	4.959	4.6136E+01	2.6086E-03	6.9954E-07	1.0618E-10	6.3774E-15
BeO	408.00	4.596	4.6777E+01	1.9489E-03	4.7026E-07	7.2325E-11	4.4196E-15
BeF	409.00	6.305	4.5612E+01	2.0201E-03	4.8061E-07	6.8880E-11	4.0195E-15
BeCl	417.00	4.899	4.5188E+01	2.3767E-03	6.2258E-07	9.3904E-11	5.6190E-15
B2	505.00	2.775	4.7647E+01	2.3946E-03	6.0992E-07	8.9752E-11	5.2339E-15
BN	507.00	4.002	4.6300E+01	2.1331E-03	5.2970E-07	7.7658E-11	4.5615E-15
BO	508.00	8.142	4.8023E+01	1.7285E-03	3.9084E-07	5.4649E-11	3.1075E-15
BF	509.00	8.499	4.8234E+01	1.8910E-03	4.3591E-07	6.1263E-11	3.4901E-15
BS	516.00	5.117	4.7420E+01	1.8949E-03	4.3323E-07	5.9586E-11	3.2733E-15
BCl	517.00	5.117	4.7698E+01	2.3363E-03	6.0581E-07	9.0605E-11	5.3453E-15
C-	600.00	1.263	3.6803E+01	-1.0807E-04	-3.5475E-08	-3.5725E-12	-1.4641E-16
C2	606.00	6.21	4.9635E+01	3.4889E-03	1.0588E-06	1.7292E-10	1.0735E-14
CN	607.00	7.76	4.7854E+01	1.8650E-03	4.6317E-07	7.2948E-11	4.5174E-15
CN+	607.01	-6.410	1.0531E+01	2.0566E-03	4.8615E-07	7.1121E-11	4.2107E-15
CO	608.00	11.091	4.8914E+01	1.2133E-03	1.6990E-07	1.3763E-11	4.5299E-16
CF	609.00	4.966	4.7368E+01	2.0173E-03	4.7759E-07	6.7404E-11	3.8474E-15
CAl	613.00	3.617	4.6928E+01	2.6572E-03	7.1162E-07	1.0458E-10	5.9272E-15
CSi	614.00	4.64	4.8733E+01	3.5377E-03	9.9928E-07	1.5245E-10	9.0345E-15
CP	615.00	6.895	4.7509E+01	2.1172E-03	4.9533E-07	7.2805E-11	4.4007E-15
CS	616.00	7.355	4.8536E+01	1.7529E-03	3.7872E-07	5.1956E-11	2.9409E-15
CCl	617.00	3.340	4.7009E+01	2.4592E-03	6.5348E-07	9.8261E-11	5.8172E-15
N2	707.00	9.759	4.8708E+01	1.9370E-03	4.9854E-07	7.6174E-11	4.6475E-15
N2+	707.01	-5.821	1.1867E+01	1.9567E-03	5.0892E-07	8.1631E-11	5.1181E-15
NO	708.00	6.497	4.7373E+01	1.9956E-03	4.9814E-07	7.3915E-11	4.4017E-15
NO+	708.01	-2.767	1.2522E+01	1.6744E-03	3.9514E-07	5.7795E-11	3.4403E-15
NF	709.00	2.819	4.6770E+01	2.2411E-03	5.5102E-07	7.9899E-11	4.6459E-15
NMg	712.00	3.402	4.4556E+01	2.8603E-03	7.8534E-07	1.2044E-10	7.2820E-15
NAl	713.00	3.727	4.7680E+01	2.3545E-03	5.9644E-07	8.7844E-11	5.1682E-15
SiN	714.00	5.658	4.7117E+01	1.7960E-03	3.6727E-07	5.0042E-11	2.8886E-15
NP	715.00	7.111	4.7683E+01	2.2458E-03	5.5753E-07	7.9113E-11	4.5753E-15
NS	716.00	4.8	4.6990E+01	2.2957E-03	5.9392E-07	8.9837E-11	5.4041E-15
O-	800.00	1.462	3.6449E+01	-6.6246E-05	-2.6997E-08	-4.8284E-12	-3.0166E-16
O2	808.00	5.116	4.8632E+01	1.6412E-03	3.4362E-07	4.6858E-11	2.6408E-15
O2+	808.01	-6.956	1.2330E+01	1.5129E-03	3.0628E-07	4.0032E-11	2.2035E-15
NaO	811.00	3.079	4.6421E+01	2.6221E-03	6.8505E-07	1.0200E-10	6.0540E-15
MgO	812.00	3.53	4.7490E+01	4.4046E-03	1.5814E-06	3.4953E-10	2.6721E-14
AlO	813.00	5.27	4.7491E+01	1.8257E-03	3.3193E-07	4.4069E-11	2.5856E-15
SiO	814.00	8.260	4.8482E+01	1.5553E-03	2.9270E-07	3.3106E-11	1.5597E-15
PO	815.00	6.071	4.7307E+01	2.4172E-03	6.2096E-07	8.9966E-11	5.2500E-15
SO	816.00	5.359	4.7493E+01	1.7257E-03	3.6371E-07	5.0705E-11	2.9300E-15
ClO	817.00	2.745	4.6832E+01	2.1078E-03	5.1344E-07	7.4414E-11	4.3173E-15
CaO	820.00	4.76	4.6516E+01	2.3415E-03	5.7606E-07	1.0223E-10	7.2806E-15
TiO	822.00	6.87	4.7769E+01	2.1368E-03	4.8935E-07	6.1006E-11	3.1236E-15
FeO	826.00	4.20	4.6551E+01	1.5838E-03	3.1740E-07	3.9635E-11	2.1789E-15
F-	900.00	3.399	3.7551E+01	-2.9184E-04	-1.1414E-07	-2.0819E-11	-1.4085E-15
F2	909.00	1.592	4.8632E+01	2.0165E-03	4.6054E-07	6.4288E-11	3.6296E-15
NaF	911.00	4.953	4.6717E+01	2.7566E-03	7.4062E-07	1.1213E-10	6.7066E-15
FMg	912.00	3.200	4.5468E+01	2.5089E-03	6.5244E-07	9.7170E-11	5.7561E-15
FAl	913.00	6.790	4.7788E+01	2.1362E-03	5.0666E-07	7.1400E-11	4.0530E-15
FSi	914.00	5.420	4.6897E+01	2.1060E-03	4.9864E-07	6.8598E-11	3.7971E-15
FS	916.00	3.338	4.6706E+01	1.9206E-03	4.3001E-07	5.8063E-11	3.2077E-15
FCl	917.00	2.616	4.7680E+01	2.1411E-03	5.3239E-07	7.8152E-11	4.5625E-15
Na2	1111.00	.730	4.5152E+01	3.6917E-03	1.0752E-06	1.7017E-10	1.0459E-14
NaCl	1117.00	4.222	4.6147E+01	3.0037E-03	8.5128E-07	1.3301E-10	8.0960E-15
MgS	1216.00	2.4	4.6796E+01	3.9803E-03	9.4542E-07	1.2089E-10	6.2056E-15
MgCl	1217.00	2.701	4.4998E+01	2.8447E-03	7.9686E-07	1.2369E-10	7.4944E-15
Al-	1300.00	0.346	3.5531E+01	-3.7596E-04	-2.5139E-07	-5.2240E-11	-3.5563E-15
Al2	1313.00	1.604	4.7559E+01	2.9097E-03	7.7812E-07	1.1753E-10	6.9499E-15
AlS	1316.00	3.84	4.7214E+01	2.5392E-03	6.7606E-07	9.9652E-11	5.6716E-15
AlCl	1317.00	5.074	4.7276E+01	2.5438E-03	6.7568E-07	1.0182E-10	6.0055E-15
Si2	1414.00	3.252	4.7179E+01	2.0256E-03	4.5186E-07	5.7418E-11	2.9577E-15
SiS	1416.00	6.42	4.7977E+01	1.8341E-03	3.9455E-07	5.1100E-11	2.7117E-15
SiCl	1417.00	4.002	4.6541E+01	2.5534E-03	6.8459E-07	1.0209E-10	5.9733E-15
P2	1515.00	5.033	4.8223E+01	2.6898E-03	7.0362E-07	1.0075E-10	5.8493E-15
PS	1516.00	5.637	4.6919E+01	2.7644E-03	7.4350E-07	1.0948E-10	6.4205E-15
S-	1600.00	2.077	3.6385E+01	-1.2387E-04	-5.1457E-08	-1.0011E-11	-6.7042E-16
S2	1616.00	4.369	4.7747E+01	1.9271E-03	4.1963E-07	5.6886E-11	3.1854E-15
SCl	1617.00	2.749	4.7565E+01	3.5631E-03	1.0897E-06	1.7573E-10	1.0805E-14
CaS	1620.00	3.46	4.5835E+01	2.2131E-03	4.3330E-07	6.9347E-11	5.0501E-15
FeS	1626.00	3.31	4.6416E+01	2.5933E-03	6.8170E-07	9.8815E-11	5.7791E-15
Cl-	1700.00	3.616	3.7416E+01	-2.9016E-04	-8.8805E-08	-1.3209E-11	-7.5220E-16
Cl2	1717.00	2.476	4.8021E+01	2.4184E-03	6.5374E-07	1.0061E-10	6.0420E-15
Fe-	2600.00	0.250	3.5999E+01	-7.9764E-04	-2.9422E-07	-5.2961E-11	-3.3781E-15
H2-	10100.00	1.976	8.1380E+01	2.1429E-03	5.2145E-07	7.7080E-11	4.5316E-15
CH2	10106.00	7.849	9.2455E+01	3.1402E-03	6.6306E-07	9.2666E-11	5.3624E-15
NH2	10107.00	7.355	9.1785E+01	2.9965E-03	6.8466E-07	1.0378E-10	6.3167E-15
H2O	10108.00	9.512	9.3179E+01	2.6725E-03	5.7830E-07	8.5268E-11	5.1311E-15
SH2	10116.00	7.508	9.2064E+01	2.7883E-03	5.3505E-07	7.2159E-11	4.1344E-15
HLiO	10308.00	8.894	9.2675E+01	3.5194E-03	7.8181E-07	1.0862E-10	6.2491E-15
C2H	10606.00	12.069	9.5977E+01	3.5151E-03	7.1109E-07	9.7013E-11	5.5098E-15
NCH	10607.00	13.085	9.6092E+01	3.4150E-03	6.7686E-07	8.9342E-11	4.9893E-15
OCH	10608.00	11.721	9.4226E+01	3.0760E-03	5.9489E-07	7.6261E-11	4.1452E-15
ONH	10708.00	8.614	9.4263E+01	3.2515E-03	6.7110E-07	8.9566E-11	5.0184E-15
OH-	10800.00	6.224	8.3222E+01	1.6725E-03	4.4245E-07	7.0038E-11	4.3248E-15
O2H	10808.00	7.108	9.4186E+01	3.0836E-03	6.1755E-07	8.0811E-11	4.4544E-15
NaOH	10811.00	8.286	9.2701E+01	4.3703E-03	1.0975E-06	1.6241E-10	9.6222E-15
MgOH	10812.00	6.823	9.1448E+01	3.9729E-03	9.4759E-07	1.3688E-10	8.0099E-15
Li2O	30308.00	7.366	9.4344E+01	4.5560E-03	1.0617E-06	1.4668E-10	8.3566E-15
BeF2	40909.00	13.202	9.7539E+01	3.8763E-03	7.4631E-07	9.0689E-11	4.6897E-15
BeFCl	40917.00	11.168	9.6687E+01	4.5979E-03	1.0294E-06	1.4006E-10	7.8330E-15
BeCl2	41717.00	9.449	9.7191E+01	5.3790E-03	1.3389E-06	1.9437E-10	1.1303E-14
BO2	50808.00	14.587	9.9071E+01	4.5233E-03	9.7552E-07	1.2807E-10	6.9373E-15

BOF	50809.00	15.397	9.9301E+01	4.0104E-03	8.2171E-07	1.0551E-10	5.6521E-15
BOCl	50817.00	13.461	9.9020E+01	4.6174E-03	1.0596E-06	1.4704E-10	8.2987E-15
BF2	50909.00	13.251	9.6613E+01	4.3092E-03	9.9043E-07	1.3679E-10	7.6726E-15
BFCl	50917.00	11.196	9.5496E+01	4.9555E-03	1.2437E-06	1.8095E-10	1.0483E-14
BCl2	51717.00	9.141	9.5721E+01	5.5387E-03	1.4807E-06	2.2304E-10	1.3192E-14
C2-	60600.00	10.145	8.5045E+01	1.6850E-03	3.7003E-07	5.4390E-11	3.2244E-15
C3	60606.00	13.957	1.0081E+02	3.9913E-03	8.1028E-07	1.0167E-10	5.3621E-15
CN-	60700.00	11.592	8.4748E+01	1.8177E-03	4.4297E-07	6.5994E-11	3.9650E-15
CNCl	60717.00	12.126	9.8836E+01	4.8687E-03	1.1673E-06	1.6627E-10	9.5674E-15
CO2	60808.00	16.561	1.0098E+02	3.3697E-03	5.7958E-07	6.5121E-11	3.1625E-15
COS	60816.00	14.210	1.0000E+02	3.9763E-03	7.8058E-07	9.5929E-11	4.9686E-15
CF2	60909.00	10.268	9.7787E+01	3.7637E-03	7.7313E-07	9.9261E-11	5.3065E-15
CS2	61616.00	11.881	1.0044E+02	4.5422E-03	9.8359E-07	1.2836E-10	6.9210E-15
N2-	70700.00	8.155	8.3317E+01	2.0383E-03	5.1561E-07	7.7265E-11	4.6499E-15
N2O	70708.00	11.440	9.9172E+01	3.9917E-03	8.1117E-07	1.0518E-10	5.7309E-15
NO2	70808.00	9.621	9.7617E+01	3.6891E-03	7.5141E-07	9.6734E-11	5.2293E-15
NF2	70909.00	6.056	9.6316E+01	4.4386E-03	1.0275E-06	1.4206E-10	7.9873E-15
O2-	80800.00	5.556	8.4344E+01	1.9577E-03	4.3829E-07	5.9769E-11	3.3299E-15
SiO2	80814.00	13.447	1.0004E+02	3.7484E-03	6.5483E-07	6.8677E-11	3.0007E-15
SO2	80816.00	11.023	9.8405E+01	3.7855E-03	7.7032E-07	9.7481E-11	5.1594E-15
ClO2	80817.00	5.244	9.7361E+01	4.3717E-03	9.9792E-07	1.3788E-10	7.7489E-15
AlFO	80913.00	12.703	9.9135E+01	5.3486E-03	1.2832E-06	1.8036E-10	1.0208E-14
SFO	80916.00	7.482	9.6508E+01	4.0897E-03	8.9324E-07	1.1798E-10	6.4190E-15
Al2O	81313.00	10.615	9.7475E+01	4.5545E-03	1.0557E-06	1.4532E-10	8.1253E-15
AlClO	81317.00	11.108	9.8747E+01	5.9340E-03	1.5245E-06	2.2355E-10	1.3000E-14
SClO	81617.00	7.696	9.6006E+01	4.6730E-03	1.1339E-06	1.6109E-10	9.2064E-15
Cl2O	81717.00	4.226	9.7105E+01	4.9032E-03	1.2343E-06	1.8020E-10	1.0475E-14
MgF2	90912.00	10.812	9.8180E+01	5.3328E-03	1.2759E-06	1.7933E-10	1.0193E-14
SiF2	90914.00	11.835	9.7487E+01	4.3744E-03	9.9177E-07	1.3304E-10	7.2634E-15
SF2	90916.00	6.674	9.7417E+01	4.4298E-03	1.0205E-06	1.3991E-10	7.8045E-15
MgCl2	121717.00	8.360	9.7591E+01	6.5730E-03	1.7908E-06	2.7180E-10	1.6183E-14
Si3	141414.00	7.588	9.9755E+01	5.5188E-03	1.3275E-06	1.8099E-10	9.9184E-15
SiCl2	141717.00	8.902	9.6471E+01	5.5820E-03	1.4873E-06	2.2154E-10	1.2977E-14
SCl2	161717.00	5.545	9.6606E+01	5.6007E-03	1.5018E-06	2.2568E-10	1.3326E-14
BH3	1010105.00	11.697	1.4035E+02	3.6309E-03	5.3929E-07	5.8765E-11	2.9271E-15
CH3	1010106.00	12.600	1.4032E+02	4.1238E-03	7.2477E-07	8.9409E-11	4.8096E-15
NH3	1010107.00	12.004	1.3972E+02	3.5646E-03	5.7053E-07	6.8977E-11	3.7564E-15
PH3	1010115.00	9.809	1.3915E+02	4.2856E-03	6.7730E-07	7.1115E-11	3.3400E-15
C2H2	1010606.00	16.864	1.4492E+02	5.1010E-03	9.2490E-07	1.1306E-10	5.9293E-15
BO2H	1050808.00	19.005	1.4558E+02	4.7586E-03	8.4752E-07	1.0015E-10	5.1064E-15
Be2O2	4040808.00	16.308	1.4586E+02	6.9613E-03	1.5378E-06	2.0635E-10	1.1460E-14
B2O2	5050808.00	21.561	1.5114E+02	7.3479E-03	1.6545E-06	2.2582E-10	1.2593E-14
C2N2	6060707.00	21.323	1.5074E+02	7.5974E-03	1.7755E-06	2.4835E-10	1.4136E-14
COF2	6080909.00	18.010	1.4925E+02	5.6538E-03	1.0650E-06	1.2623E-10	6.3361E-15
COFCl	6080917.00	16.353	1.4834E+02	6.4946E-03	1.3929E-06	1.8326E-10	9.9610E-15
COCl2	6081717.00	14.698	1.4881E+02	7.3795E-03	1.7419E-06	2.4434E-10	1.3858E-14
CF3	6090909.00	14.907	1.4924E+02	5.7370E-03	1.0835E-06	1.2821E-10	6.4057E-15
N2F2	7070909.00	10.459	1.4820E+02	7.0988E-03	1.6054E-06	2.1898E-10	1.2222E-14
NF3	7090909.00	8.498	1.4891E+02	6.9578E-03	1.5265E-06	2.0284E-10	1.1073E-14
SO3	8080816.00	14.568	1.5135E+02	6.0103E-03	1.1784E-06	1.4333E-10	7.3393E-15
Al2O2	8081313.00	15.827	1.5047E+02	6.7434E-03	1.4313E-06	1.8513E-10	9.9056E-15
SF2O	8090916.00	11.166	1.4879E+02	7.0308E-03	1.5561E-06	2.0725E-10	1.1314E-14
SCl2O	8161717.00	10.044	1.4792E+02	8.6715E-03	2.2207E-06	3.2508E-10	1.8894E-14
PF3	9090915.00	15.220	1.4917E+02	7.8109E-03	1.8403E-06	2.5421E-10	1.4249E-14
Na2F2	9091111.00	12.416	1.4619E+02	1.1031E-02	3.0793E-06	4.7040E-10	2.8095E-14
S2F2	9091616.00	9.634	1.4894E+02	8.1079E-03	1.9604E-06	2.7548E-10	1.5572E-14
Cl2Na2	11111717.00	10.590	1.4537E+02	1.1630E-02	3.3523E-06	5.2149E-10	3.1482E-14
P4	15151515.00	12.320	1.5101E+02	9.8958E-03	2.5896E-06	3.7449E-10	2.1697E-14
PCl3	15171717.00	10.038	1.4827E+02	1.0007E-02	2.7339E-06	4.1313E-10	2.4484E-14
S2Cl2	16161717.00	8.382	1.4800E+02	9.6837E-03	2.6048E-06	3.9044E-10	2.2991E-14
CH4	101010106.00	17.019	1.8859E+02	3.7864E-03	2.3978E-07	4.9693E-12	1.3678E-15
SiH3	101010114.00	13.329	1.8810E+02	5.4222E-03	6.7853E-07	4.8867E-11	1.2069E-15
BeH2O	101040808.00	19.626	1.9304E+02	5.1031E-03	5.8373E-07	3.8644E-11	8.8439E-16
B2O3	505080808.00	28.019	2.0056E+02	9.3202E-03	2.0406E-06	2.7315E-10	1.5035E-14
CF4	609090909.00	19.911	2.0282E+02	8.5497E-03	1.6244E-06	1.9675E-10	1.0002E-14
CCl4	617171717.00	13.406	2.0244E+02	1.2234E-02	3.1728E-06	4.6716E-10	2.7232E-14
N2O3	707080808.00	19.793	2.5222E+02	1.2135E-02	2.6460E-06	3.5206E-10	1.9324E-14
SF2O2	808090916.00	18.367	2.0205E+02	8.9550E-03	1.8432E-06	2.3302E-10	1.2254E-14
SiF4	909090914.00	24.676	2.0238E+02	1.0223E-02	2.3178E-06	3.1296E-10	1.7196E-14
SF4	909090916.00	13.344	2.0111E+02	1.0262E-02	2.3219E-06	3.1349E-10	1.7243E-14
	1417171717.00	16.323	2.0167E+02	1.3270E-02	3.5481E-06	5.3087E-10	3.1197E-14
	10101010606.00	23.067	2.3815E+02	6.0074E-03	6.4283E-07	3.6092E-11	3.6357E-16
	10103030808.00	20.465	2.4088E+02	1.1084E-02	2.3946E-06	3.2062E-10	1.7815E-14
	10108081111.00	18.921	2.4136E+02	1.3325E-02	3.2511E-06	4.6891E-10	2.7211E-14

Table 20.The printout of the input data (first page). (IFPRNT=1,2,3,4)

```
TEFF  7500.   LOG G  4.00   LTE

TITLE

XSCALE   1.000   H  0.900   HE 0.100
LI-11.45 BE-10.99 B  -9.25 C  -3.48 N  -3.99 O  -3.22 F  -7.49 NE -4.60 NA -5.81 MG -4.51
AL -5.65 SI -4.50 P  -6.62 S  -4.84 CL -6.40 AR -5.40 K  -7.00 CA -5.72 SC -8.98 TI -7.31
V  -7.95 CR -6.35 MN -6.85 FE -4.50 CO -7.55 NI -5.77 CU -7.60 ZN -7.63 GA -9.21 GE -8.73
AS -9.70 SE -8.80 BR -9.40 KR -8.80 RB -9.42 SR -9.23 Y -10.43 ZR -9.63 NB -9.75 MO-10.15
TC-20.00 RU-10.48 RH-10.50 PD-10.48 AG-11.38 CD-10.08 IN-10.34 SN-10.34 SB-10.40 TE-10.00
I -10.60 XE-10.00 CS-10.90 BA-10.15 LA-10.24 CE-10.41 PR-10.42 ND-10.23 PM-20.00 SM-10.39
EU-11.56 GD-10.93 TB-11.60 DY-10.94 HO-11.50 ER-11.29 TM-11.62 YB-11.24 LU-11.20 HF-11.40
TA-11.70 W  -9.48 RE-11.40 OS-11.30 IR -9.84 PT-10.40 AU-11.73 HG -9.05 TL-11.85 PB-10.18
BI-11.25 PO-20.00 AT-20.00 RN-20.00 FR-20.00 RA-20.00 AC-20.00 TH-11.23 PA-20.00 U -11.45
NP-20.00 PU-20.00 AM-20.00 CM-20.00 BK-20.00 CF-20.00 ES-20.00

H1 1 H2PLUS 1 HMINUS 1 HRAY 1 HE1 1 HE2 1 HEMINUS 1 HERAY 1 COOL 1 LUKE 1
HOT 1 ELECTRON 1 H2RAY 1 HLINES 0 LINES 1 LINESCAT 0 XLINES 0 XLSCAT 0 XCONT 0 XSCAT 0

IFCORR 1  IFPRES 1  IFSURF 0  IFSCAT 1  IFCONV 0  MIXLTH  1.00  IFMOL 0
IFTURB 0  TRBFDG  0.00  TRBPOW  0.00  TRBSND  0.00  TRBCON  0.00
NUMITS  2  IFPRNT 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2  IFPNCH 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0

FREQID BIG      NUMNU 122   NULO  26   NUHI 122
```

1	1.309138E+16	2.267578E+14	32	4.684258E+15	2.153619E+14	63	1.249135E+15	4.754609E+13	94	4.508158E+14	2.037903E+13
2	1.281165E+16	3.771180E+14	33	4.467846E+15	2.159410E+14	64	1.208353E+15	4.379961E+13	95	4.313561E+14	2.007057E+13
3	1.233714E+16	4.575595E+14	34	4.252376E+15	1.972893E+14	65	1.161536E+15	4.900544E+13	96	4.106746E+14	2.100761E+13
4	1.189653E+16	3.132481E+14	35	4.073268E+15	1.794833E+14	66	1.110343E+15	4.542435E+13	97	3.893409E+14	1.917705E+13
5	1.171064E+16	1.830231E+14	36	3.893409E+15	1.860629E+14	67	1.070687E+15	3.828769E+13	98	3.723205E+14	1.519697E+13
6	1.153048E+16	2.201246E+14	37	3.701142E+15	1.832193E+14	68	1.033767E+15	3.568960E+13	99	3.589470E+14	1.485027E+13
7	1.127039E+16	3.144678E+14	38	3.526971E+15	1.663434E+14	69	9.993083E+14	3.334733E+13	100	3.426200E+14	1.742347E+13
8	1.090155E+16	3.385100E+14	39	3.368455E+15	1.516976E+14	70	9.670726E+14	3.122837E+13	101	3.241000E+14	1.757026E+13
9	1.059337E+16	3.348593E+14	40	3.223575E+15	1.468302E+14	71	9.368516E+14	2.930523E+13	102	3.074795E+14	1.580976E+13
10	1.023183E+16	3.167458E+14	41	3.074795E+15	1.493853E+14	72	9.084621E+14	2.755446E+13	103	2.924805E+14	1.430138E+13
11	9.959883E+15	2.649018E+14	42	2.924805E+15	1.430137E+14	73	8.817426E+14	2.595606E+13	104	2.788767E+14	1.299914E+13
12	9.702023E+15	3.677491E+14	43	2.788767E+15	1.299913E+14	74	8.565500E+14	2.426136E+13	105	2.664822E+14	1.186710E+13
13	9.224385E+15	4.680803E+14	44	2.664822E+15	1.186709E+14	75	8.332199E+14	1.883427E+13	106	2.551425E+14	1.087683E+13
14	8.765862E+15	3.416440E+14	45	2.551426E+15	1.027454E+14	76	8.188814E+14	1.005653E+13	107	2.447286E+14	1.000559E+13
15	8.541097E+15	1.723621E+14	46	2.459331E+15	9.449733E+13	77	8.131068E+14	5.625401E+12	108	2.351314E+14	9.235035E+12
16	8.421138E+15	1.638020E+14	47	2.362431E+15	9.837314E+13	78	8.076306E+14	5.439576E+12	109	2.262585E+14	8.550231E+12
17	8.213493E+15	2.133359E+14	48	2.262585E+15	9.106096E+13	79	8.022277E+14	9.351486E+12	110	2.180309E+14	8.262695E+12
18	7.994466E+15	2.031987E+14	49	2.180309E+15	7.716976E+13	80	7.889276E+14	1.676450E+13	111	2.097331E+14	7.693134E+12
19	7.807096E+15	2.498270E+14	50	2.108245E+15	7.870883E+13	81	7.686987E+14	2.205080E+13	112	2.026446E+14	8.159297E+12
20	7.494812E+15	2.915902E+14	51	2.022891E+15	8.392051E+13	82	7.448260E+14	2.745350E+13	113	1.934145E+14	1.047611E+13
21	7.223915E+15	2.204357E+14	52	1.940404E+15	7.165730E+13	83	7.137917E+14	3.173974E+13	114	1.816924E+14	7.216954E+12
22	7.053941E+15	2.435026E+14	53	1.879577E+15	6.118919E+13	84	6.813466E+14	3.103443E+13	115	1.789806E+14	7.570517E+12
23	6.736910E+15	3.512027E+14	54	1.818026E+15	6.473730E+13	85	6.517228E+14	2.838943E+13	116	1.665514E+14	3.397317E+13
24	6.351536E+15	3.341181E+14	55	1.750102E+15	7.160382E+13	86	6.245677E+14	2.606891E+13	117	1.110343E+14	4.580163E+13
25	6.068674E+15	2.133912E+14	56	1.674818E+15	7.346682E+13	87	5.995850E+14	2.402182E+13	118	7.494813E+13	2.553788E+13
26	5.924753E+15	1.293709E+14	57	1.603168E+15	6.633798E+13	88	5.765241E+14	2.220686E+13	119	5.995850E+13	1.441310E+13
27	5.809932E+15	1.865202E+14	58	1.542143E+15	6.245090E+13	89	5.551713E+14	2.059016E+13	120	4.612192E+13	1.498962E+13
28	5.551713E+15	2.472312E+14	59	1.478267E+15	6.167110E+13	90	5.353437E+14	1.914384E+13	121	2.997925E+13	1.556615E+13
29	5.315470E+15	2.222576E+14	60	1.418800E+15	5.778677E+13	91	5.168836E+14	1.990949E+13	122	1.498962E+13	1.498962E+13
30	5.107198E+15	2.084498E+14	61	1.362693E+15	5.767732E+13	92	4.955248E+14	2.238472E+13			
31	4.898570E+15	2.114700E+14	62	1.303446E+15	5.677886E+13	93	4.721142E+14	2.235450E+13			

Table 21: The starting model (second page). (IFPRNT=1,2,3,4)

	RHOX	T	P	XNE	ABROSS	PRAD	VTURB			BHYD				BMIN
1	1.764178E-03	6082.9	1.764E+01	0.000E+00	1.792E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.584763E-03	6083.0	2.585E+01	0.000E+00	1.813E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	3.761674E-03	6083.0	3.762E+01	0.000E+00	1.877E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
4	5.413880E-03	6083.2	5.414E+01	0.000E+00	1.981E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
5	7.690462E-03	6083.3	7.690E+01	0.000E+00	2.129E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
6	1.077818E-02	6083.6	1.078E+02	0.000E+00	2.315E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
7	1.492864E-02	6084.0	1.493E+02	0.000E+00	2.538E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
8	2.046480E-02	6084.6	2.046E+02	0.000E+00	2.802E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	2.780187E-02	6085.4	2.780E+02	0.000E+00	3.110E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
10	3.747717E-02	6086.6	3.748E+02	0.000E+00	3.472E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
11	5.016736E-02	6088.4	5.017E+02	0.000E+00	3.891E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12	6.675834E-02	6091.0	6.676E+02	0.000E+00	4.378E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
13	8.835786E-02	6094.9	8.836E+02	0.000E+00	4.943E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
14	1.163837E-01	6100.5	1.164E+03	0.000E+00	5.606E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
15	1.525547E-01	6108.7	1.526E+03	0.000E+00	6.388E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
16	1.990245E-01	6120.7	1.990E+03	0.000E+00	7.320E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
17	2.582943E-01	6138.0	2.583E+03	0.000E+00	8.462E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
18	3.331037E-01	6163.1	3.331E+03	0.000E+00	9.901E-02	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
19	4.261892E-01	6199.0	4.262E+03	0.000E+00	1.177E-01	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
20	5.398980E-01	6250.0	5.399E+03	0.000E+00	1.431E-01	0.000E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
21	6.751958E-01	6321.4	6.752E+03	0.000E+00	1.793E-01	3.729E-02	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
22	8.304472E-01	6419.7	8.304E+03	0.000E+00	2.343E-01	2.935E-01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
23	1.000926E+00	6551.9	1.001E+04	0.000E+00	3.195E-01	6.574E-01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24	1.180266E+00	6725.4	1.180E+04	0.000E+00	4.574E-01	1.169E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
25	1.359471E+00	6947.0	1.359E+04	0.000E+00	6.884E-01	1.884E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
26	1.529487E+00	7223.5	1.529E+04	0.000E+00	1.100E+00	2.875E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
27	1.679956E+00	7562.9	1.680E+04	0.000E+00	1.903E+00	4.259E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
28	1.802359E+00	7976.4	1.802E+04	0.000E+00	3.583E+00	6.216E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
29	1.894224E+00	8477.9	1.893E+04	0.000E+00	7.302E+00	9.035E+00	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
30	1.958037E+00	9079.9	1.957E+04	0.000E+00	1.613E+01	1.315E+01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
31	1.999473E+00	9790.8	1.998E+04	0.000E+00	3.644E+01	1.918E+01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
32	2.027385E+00	10615.7	2.025E+04	0.000E+00	7.527E+01	2.803E+01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
33	2.049385E+00	11559.1	2.045E+04	0.000E+00	1.219E+02	4.102E+01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
34	2.073123E+00	12626.2	2.067E+04	0.000E+00	1.383E+02	6.008E+01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
35	2.110928E+00	13823.6	2.102E+04	0.000E+00	1.077E+02	8.807E+01	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
36	2.191240E+00	15159.3	2.178E+04	0.000E+00	6.998E+01	1.291E+02	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
37	2.371712E+00	16643.2	2.353E+04	0.000E+00	4.677E+01	1.894E+02	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
38	2.748654E+00	18287.0	2.721E+04	0.000E+00	3.433E+01	2.779E+02	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
39	3.454614E+00	20104.1	3.414E+04	0.000E+00	2.867E+01	4.078E+02	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
40	4.631840E+00	22110.3	4.572E+04	0.000E+00	2.603E+01	5.985E+02	0.000E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 22: The temperature correction table. (IFPRNT=1,2,3,4)

	RHOX	T	DTLAMB	DTSURF	DTFLUX	T1	CONV/TOTAL	ERROR	DERIV
1	1.7642E-03	6082.9	-300.0	0.0	0.0	-300.0	0.000E+00	-3.626	-23668.826
2	2.5848E-03	6083.0	-142.0	0.0	0.0	-142.0	0.000E+00	-3.725	-1107.160
3	3.7617E-03	6083.0	-108.0	0.0	0.0	-108.0	0.000E+00	-3.747	-906.937
4	5.4139E-03	6083.2	-105.8	0.0	0.0	-105.8	0.000E+00	-3.773	-729.067
5	7.6905E-03	6083.3	-102.8	0.0	0.0	-102.8	0.000E+00	-3.803	-576.916
6	1.0778E-02	6083.6	-99.2	0.0	0.0	-99.2	0.000E+00	-3.838	-450.802
7	1.4929E-02	6084.0	-95.6	0.0	0.0	-95.6	0.000E+00	-3.878	-350.060
8	2.0465E-02	6084.6	-92.5	0.0	0.0	-92.5	0.000E+00	-3.924	-275.798
9	2.7802E-02	6085.4	-89.2	0.0	0.0	-89.2	0.000E+00	-3.976	-215.603
10	3.7477E-02	6086.6	-85.3	0.0	0.0	-85.3	0.000E+00	-4.037	-166.881
11	5.0167E-02	6088.4	-80.6	0.0	0.0	-80.6	0.000E+00	-4.105	-127.473
12	6.6758E-02	6091.0	-74.8	0.0	0.0	-74.8	0.000E+00	-4.181	-95.805
13	8.8358E-02	6094.9	-68.0	0.0	0.0	-68.0	0.000E+00	-4.264	-70.626
14	1.1638E-01	6100.5	-60.2	0.0	0.0	-60.2	0.000E+00	-4.352	-50.823
15	1.5255E-01	6108.7	-51.4	0.0	0.1	-51.3	0.000E+00	-4.444	-35.430
16	1.9902E-01	6120.7	-41.6	0.0	0.2	-41.4	0.000E+00	-4.536	-23.551
17	2.5829E-01	6138.0	-31.0	0.0	0.6	-30.3	0.000E+00	-4.623	-14.481
18	3.3310E-01	6163.1	-19.7	0.0	1.9	-17.9	0.000E+00	-4.697	-7.697
19	4.2619E-01	6199.0	-8.7	0.0	5.5	-3.3	0.000E+00	-4.747	-2.875
20	5.3990E-01	6250.0	0.3	0.0	7.9	8.1	0.000E+00	-4.765	0.081
21	6.7520E-01	6321.4	8.1	0.0	11.1	19.2	0.000E+00	-4.739	2.008
22	8.3045E-01	6419.7	16.3	0.0	15.1	31.4	0.000E+00	-4.645	3.691
23	1.0009E+00	6551.9	10.7	0.0	20.0	30.7	0.000E+00	-4.446	4.485
24	1.1803E+00	6725.4	4.9	0.0	25.5	30.3	0.000E+00	-4.148	3.827
25	1.3595E+00	6947.0	0.7	0.0	31.3	32.0	0.000E+00	-3.889	1.062
26	1.5295E+00	7223.5	-0.6	0.0	37.4	36.7	0.000E+00	-3.943	-1.799
27	1.6800E+00	7562.9	-0.5	0.0	45.8	45.3	0.000E+00	-4.463	-3.014
28	1.8024E+00	7976.4	0.0	0.0	57.9	57.9	0.000E+00	-5.187	-2.272
29	1.8942E+00	8477.9	0.0	0.0	75.0	75.0	0.000E+00	-5.989	-1.622
30	1.9580E+00	9079.9	0.0	0.0	95.7	95.7	0.000E+00	-6.210	0.180
31	1.9995E+00	9790.8	0.0	0.0	111.9	111.9	0.000E+00	-5.048	1.066
32	2.0274E+00	10615.7	0.0	0.0	115.2	115.2	0.000E+00	-3.057	0.571
33	2.0494E+00	11559.1	0.0	0.0	92.8	92.8	0.000E+00	0.196	1.101
34	2.0731E+00	12626.2	0.0	0.0	45.9	45.9	0.000E+00	5.134	0.641
35	2.1109E+00	13823.6	0.0	0.0	-30.2	-30.2	0.000E+00	9.561	0.126
36	2.1912E+00	15159.3	0.0	0.0	-145.1	-145.1	0.000E+00	15.218	0.840
37	2.3717E+00	16643.2	0.0	0.0	-330.0	-330.0	0.000E+00	24.195	0.859
38	2.7487E+00	18287.0	0.0	0.0	-572.1	-572.1	0.000E+00	32.956	0.594
39	3.4546E+00	20104.1	0.0	0.0	-855.0	-855.0	0.000E+00	41.137	0.244
40	4.6318E+00	22110.3	0.0	0.0	-1366.4	-1366.4	0.000E+00	46.194	0.221

Table 23: A summary table. (IFPRNT=1,2,3,4)

TEFF 7500. LOG G 4.000 XSCALE 1.0000 ITER 1

				ELECTRON		ROSSELAND	HEIGHT	ROSSELAND	FRACTION	RADIATIVE	PER CENT FLUX	
	RHOX	TEMP	PRESSURE	NUMBER	DENSITY	MEAN	(KM)	DEPTH	CONV FLUX	ACCELERATION	ERROR	DERIV
1	2.483E-03	5782.9	1.764E+01	3.410E+11	4.554E-11	1.812E-02	0.000E+00	0.000E+00	0.000E+00	1.302E+01	-3.626	-23668.826
2	3.622E 03	5941.0	2.585E+01	4.146E+11	6.691E-11	1.812E-02	2.102E+02	4.684E-05	0.000E+00	9.098E-01	-3.725	-1107.160
3	5.153E-03	5975.0	3.762E+01	5.024E+11	9.760E-11	1.877E-02	4.030E+02	6.855E-05	0.000E+00	8.066E-01	-3.747	-906.937
4	7.166E-03	5977.3	5.414E+01	6.051E+11	1.407E-10	1.983E-02	5.776E+02	1.004E-04	0.000E+00	7.226E-01	-3.773	-729.067
5	9.922E-03	5980.5	7.690E+01	7.240E+11	2.002E-10	2.129E-02	7.414E+02	1.473E-04	0.000E+00	6.541E-01	-3.803	-576.916
6	1.354E-02	5984.4	1.078E+02	8.604E+11	2.809E-10	2.314E-02	8.935E+02	2.159E-04	0.000E+00	5.983E-01	-3.838	-450.802
7	1.837E-02	5988.4	1.493E+02	1.017E+12	3.894E-10	2.539E-02	1.039E+03	3.167E-04	0.000E+00	5.552E-01	-3.878	-350.060
8	2.472E-02	5992.0	2.046E+02	1.196E+12	5.342E-10	2.807E-02	1.178E+03	4.648E-04	0.000E+00	5.311E-01	-3.924	-275.798
9	3.308E-02	5996.2	2.780E+02	1.400E+12	7.261E-10	3.121E-02	1.312E+03	6.826E-04	0.000E+00	5.150E-01	-3.976	-215.603
10	4.399E-02	6001.3	3.748E+02	1.635E+12	9.792E-10	3.486E-02	1.441E+03	1.003E-03	0.000E+00	5.057E-01	-4.037	-166.881
11	5.816E-02	6007.9	5.017E+02	1.905E+12	1.311E-09	3.907E-02	1.566E+03	1.472E-03	0.000E+00	5.026E-01	-4.105	-127.473
12	7.649E-02	6016.2	6.676E+02	2.218E+12	1.744E-09	4.394E-02	1.687E+03	2.161E-03	0.000E+00	5.056E-01	-4.181	-95.805
13	1.001E-01	6026.9	8.836E+02	2.581E+12	2.308E-09	4.959E-02	1.804E+03	3.173E-03	0.000E+00	5.156E-01	-4.264	-70.626
14	1.303E-01	6040.3	1.164E+03	3.009E+12	3.038E-09	5.621E-02	1.918E+03	4.657E-03	0.000E+00	5.337E-01	-4.352	-50.823
15	1.687E-01	6057.4	1.526E+03	3.518E+12	3.978E-09	6.403E-02	2.028E+03	6.833E-03	0.000E+00	5.614E-01	-4.444	-35.430
16	2.174E-01	6079.2	1.990E+03	4.137E+12	5.181E-09	7.347E-02	2.135E+03	1.003E-02	0.000E+00	6.008E-01	-4.536	-23.551
17	2.785E-01	6107.7	2.583E+03	4.906E+12	6.706E-09	8.493E-02	2.239E+03	1.472E-02	0.000E+00	6.548E-01	-4.623	-14.481
18	3.543E-01	6145.2	3.331E+03	5.890E+12	8.614E-09	9.939E-02	2.338E+03	2.162E-02	0.000E+00	7.277E-01	-4.697	-7.697
19	4.469E-01	6195.7	4.262E+03	7.195E+12	1.096E-08	1.181E-01	2.433E+03	3.173E-02	0.000E+00	8.268E-01	-4.747	-2.875
20	5.581E-01	6258.1	5.399E+03	9.000E+12	1.377E-08	1.433E-01	2.524E+03	4.656E-02	0.000E+00	9.632E-01	-4.765	0.081
21	6.886E-01	6340.6	6.752E+03	1.161E+13	1.702E-08	1.796E-01	2.609E+03	6.831E-02	0.000E+00	1.175E+00	-4.739	2.008
22	8.363E-01	6451.0	8.304E+03	1.558E+13	2.061E-08	2.351E-01	2.688E+03	1.003E-01	0.000E+00	1.520E+00	-4.645	3.691
23	9.977E-01	6582.6	1.001E+04	2.189E+13	2.433E-08	3.208E-01	2.760E+03	1.472E-01	0.000E+00	2.046E+00	-4.446	4.485
24	1.169E+00	6755.8	1.180E+04	3.239E+13	2.794E-08	4.579E-01	2.825E+03	2.161E-01	0.000E+00	2.874E+00	-4.148	3.827
25	1.340E+00	6979.0	1.359E+04	5.054E+13	3.112E-08	6.860E-01	2.883E+03	3.167E-01	0.000E+00	4.214E+00	-3.889	1.062
26	1.502E+00	7260.2	1.529E+04	8.291E+13	3.361E-08	1.103E+00	2.933E+03	4.648E-01	8.393E-10	6.712E+00	-3.943	-1.799
27	1.645E+00	7608.2	1.680E+04	1.423E+14	3.513E-08	1.906E+00	2.974E+03	6.832E-01	7.627E-08	1.147E+01	-4.463	-3.014
28	1.759E+00	8034.3	1.802E+04	2.538E+14	3.549E-08	3.594E+00	3.007E+03	1.005E+00	8.483E-06	2.146E+01	-5.187	-2.272
29	1.844E+00	8552.9	1.893E+04	4.663E+14	3.462E-08	7.322E+00	3.031E+03	1.479E+00	1.373E-03	4.280E+01	-5.989	-1.622
30	1.901E+00	9175.6	1.957E+04	8.657E+14	3.249E-08	1.615E+01	3.048E+03	2.182E+00	1.373E-01	9.307E+01	-6.210	0.180
31	1.938E+00	9902.7	1.998E+04	1.569E+15	2.911E-08	3.642E+01	3.060E+03	3.209E+00	7.345E-01	2.108E+02	-5.048	1.066
32	1.964E+00	10730.9	2.025E+04	2.642E+15	2.462E-08	7.442E+01	3.069E+03	4.708E+00	9.269E-01	4.347E+02	-3.057	0.571
33	1.985E+00	11651.8	2.045E+04	3.869E+15	1.972E-08	1.196E+02	3.079E+03	6.842E+00	9.564E-01	7.196E+02	0.196	1.101
34	2.009E+00	12672.1	2.067E+04	4.702E+15	1.577E-08	1.300E+02	3.092E+03	9.864E+00	9.057E-01	7.866E+02	5.134	0.641
35	2.047E+00	13793.5	2.102E+04	4.908E+15	1.346E-08	9.619E+01	3.119E+03	1.414E+01	4.014E-01	5.805E+02	9.561	0.126
36	2.127E+00	15014.3	2.178E+04	4.828E+15	1.230E-08	5.924E+01	3.182E+03	2.022E+01	2.451E-03	3.562E+02	15.218	0.840
37	2.299E+00	16313.2	2.353E+04	4.840E+15	1.190E-08	3.659E+01	3.325E+03	2.857E+01	3.947E-05	2.192E+02	24.195	0.859
38	2.646E+00	17714.8	2.721E+04	5.202E+15	1.228E-08	2.542E+01	3.612E+03	3.993E+01	4.608E-06	1.513E+02	32.956	0.594
39	3.280E+00	19249.2	3.414E+04	6.050E+15	1.377E-08	1.999E+01	4.101E+03	5.567E+01	9.555E-08	1.183E+02	41.137	0.244
40	4.308E+00	20743.9	4.572E+04	7.431E+15	1.663E-08	1.721E+01	4.783E+03	7.757E+01	2.264E-09	1.034E+02	46.194	0.221

Table 24: The convection parameters. (IFPRNT=2,3,4)

	RHOX	PTOTAL	PTURB	GRDADB	DLTDLP	VELSND	DLRDLT	HEATCP	HSCALE	VCONV	FLXCNV
1	2.411E-03	2.172E+01	0.000E+00	1.965E-01	7.236E-02	7.346E+05	-1.117E+00	4.424E+08	4.504E+07	0.000E+00	0.000E+00
2	3.517E-03	2.993E+01	0.000E+00	1.818E-01	5.573E-02	7.197E+05	-1.139E+00	4.597E+08	4.358E+07	0.000E+00	0.000E+00
3	5.037E-03	4.170E+01	0.000E+00	1.892E-01	1.057E-02	7.156E+05	-1.125E+00	4.170E+08	4.191E+07	0.000E+00	0.000E+00
4	7.066E-03	5.822E+01	0.000E+00	2.028E-01	1.374E-03	7.151E+05	-1.105E+00	3.700E+08	4.060E+07	0.000E+00	0.000E+00
5	9.782E-03	8.099E+01	0.000E+00	2.167E-01	1.803E-03	7.163E+05	-1.089E+00	3.337E+08	3.973E+07	0.000E+00	0.000E+00
6	1.338E-02	1.119E+02	0.000E+00	2.304E-01	2.070E-03	7.187E+05	-1.076E+00	3.053E+08	3.914E+07	0.000E+00	0.000E+00
7	1.815E-02	1.534E+02	0.000E+00	2.437E-01	2.073E-03	7.219E+05	-1.065E+00	2.826E+08	3.874E+07	0.000E+00	0.000E+00
8	2.442E-02	2.087E+02	0.000E+00	2.566E-01	2.124E-03	7.256E+05	-1.056E+00	2.641E+08	3.846E+07	0.000E+00	0.000E+00
9	3.263E-02	2.821E+02	0.000E+00	2.687E-01	2.568E-03	7.296E+05	-1.049E+00	2.490E+08	3.827E+07	0.000E+00	0.000E+00
10	4.336E-02	3.789E+02	0.000E+00	2.800E-01	3.305E-03	7.338E+05	-1.042E+00	2.366E+08	3.814E+07	0.000E+00	0.000E+00
11	5.731E-02	5.058E+02	0.000E+00	2.903E-01	4.301E-03	7.379E+05	-1.037E+00	2.263E+08	3.806E+07	0.000E+00	0.000E+00
12	7.536E-02	6.717E+02	0.000E+00	2.996E-01	5.565E-03	7.421E+05	-1.033E+00	2.178E+08	3.803E+07	0.000E+00	0.000E+00
13	9.860E-02	8.877E+02	0.000E+00	3.080E-01	7.158E-03	7.462E+05	-1.029E+00	2.108E+08	3.803E+07	0.000E+00	0.000E+00
14	1.284E-01	1.168E+03	0.000E+00	3.153E-01	9.197E-03	7.501E+05	-1.026E+00	2.050E+08	3.806E+07	0.000E+00	0.000E+00
15	1.665E-01	1.530E+03	0.000E+00	3.217E-01	1.189E-02	7.540E+05	-1.024E+00	2.003E+08	3.813E+07	0.000E+00	0.000E+00
16	2.148E-01	1.994E+03	0.000E+00	3.270E-01	1.559E-02	7.577E+05	-1.022E+00	1.966E+08	3.824E+07	0.000E+00	0.000E+00
17	2.757E-01	2.587E+03	0.000E+00	3.312E-01	2.079E-02	7.614E+05	-1.021E+00	1.937E+08	3.840E+07	0.000E+00	0.000E+00
18	3.518E-01	3.335E+03	0.000E+00	3.341E-01	2.834E-02	7.651E+05	-1.020E+00	1.918E+08	3.862E+07	0.000E+00	0.000E+00
19	4.457E-01	4.266E+03	0.000E+00	3.354E-01	3.757E-02	7.688E+05	-1.019E+00	1.909E+08	3.892E+07	0.000E+00	0.000E+00
20	5.592E-01	5.403E+03	0.000E+00	3.354E-01	4.999E-02	7.726E+05	-1.020E+00	1.909E+08	3.931E+07	0.000E+00	0.000E+00
21	6.929E-01	6.756E+03	0.000E+00	3.330E-01	7.035E-02	7.764E+05	-1.021E+00	1.925E+08	3.982E+07	0.000E+00	0.000E+00
22	8.452E-01	8.309E+03	0.000E+00	3.276E-01	9.548E-02	7.803E+05	-1.023E+00	1.962E+08	4.052E+07	0.000E+00	0.000E+00
23	1.010E+00	1.001E+04	0.000E+00	3.194E-01	1.321E-01	7.839E+05	-1.027E+00	2.021E+08	4.136E+07	0.000E+00	0.000E+00
24	1.179E+00	1.181E+04	0.000E+00	3.058E-01	1.931E-01	7.873E+05	-1.035E+00	2.126E+08	4.247E+07	0.000E+00	0.000E+00
25	1.347E+00	1.360E+04	0.000E+00	2.851E-01	3.011E-01	7.902E+05	-1.047E+00	2.311E+08	4.392E+07	6.405E+01	9.083E-03
26	1.502E+00	1.530E+04	0.000E+00	2.524E-01	4.592E-01	7.926E+05	-1.073E+00	2.682E+08	4.601E+07	9.519E+02	3.618E+01
27	1.637E+00	1.680E+04	0.000E+00	2.126E-01	6.560E-01	7.962E+05	-1.121E+00	3.341E+08	4.864E+07	3.680E+03	2.578E+03
28	1.743E+00	1.803E+04	0.000E+00	1.735E-01	9.883E-01	8.040E+05	-1.203E+00	4.429E+08	5.177E+07	1.622E+04	2.728E+05
29	1.816E+00	1.895E+04	0.000E+00	1.374E-01	1.548E+00	8.205E+05	-1.356E+00	6.406E+08	5.598E+07	8.064E+04	4.111E+07
30	1.863E+00	1.958E+04	0.000E+00	1.115E-01	1.998E+00	8.494E+05	-1.611E+00	9.662E+08	6.151E+07	2.624E+05	1.642E+09
31	1.896E+00	2.000E+04	0.000E+00	1.001E-01	2.122E+00	8.770E+05	-1.846E+00	1.271E+09	6.622E+07	4.077E+05	6.504E+09
32	1.920E+00	2.028E+04	0.000E+00	9.454E-02	2.452E+00	9.008E+05	-2.041E+00	1.531E+09	7.021E+07	5.407E+05	1.537E+10
33	1.940E+00	2.050E+04	0.000E+00	9.065E-02	2.710E+00	9.287E+05	-2.251E+00	1.822E+09	7.484E+07	6.608E+05	2.775E+10
34	1.965E+00	2.074E+04	0.000E+00	8.817E-02	2.418E+00	9.618E+05	-2.469E+00	2.141E+09	8.041E+07	6.974E+05	3.157E+10
35	2.008E+00	2.111E+04	0.000E+00	8.693E-02	2.028E+00	1.012E+06	-2.716E+00	2.544E+09	8.912E+07	7.182E+05	3.214E+10
36	2.101E+00	2.192E+04	0.000E+00	9.005E-02	1.501E+00	1.117E+06	-2.850E+00	2.913E+09	1.080E+08	6.951E+05	2.410E+10
37	2.292E+00	2.372E+04	0.000E+00	1.104E-01	8.937E-01	1.278E+06	-2.229E+00	2.153E+09	1.379E+08	4.767E+05	5.370E+09
38	2.738E+00	2.749E+04	0.000E+00	1.635E-01	5.558E-01	1.434E+06	-1.595E+00	1.119E+09	1.634E+08	2.003E+05	2.634E+08
39	3.873E+00	3.455E+04	0.000E+00	2.223E-01	4.613E-01	1.606E+06	-1.252E+00	6.665E+08	1.880E+08	6.253E+04	6.434E+06
40	5.929E+00	4.632E+04	0.000E+00	1.913E-01	4.903E-01	1.706E+06	-1.280E+00	8.110E+08	2.199E+08	7.846E+04	1.694E+07

Table 25. Some physical quantities. (IFPRNT=2,3,4)

	XNATOM	RADEN	PRADK	XNFPH1	XNFPH2	XNFPHE1	XNFPHE2	XNFPHE3	VTURB
1	2.189E+13	9.880E+00	3.982E+00	9.765E+12	1.691E+11	2.189E+12	1.015E+01	0.000E+00	0.000E+00
2	3.117E+13	9.899E+00	3.986E+00	1.388E+13	2.965E+11	3.117E+12	3.205E+01	0.000E+00	0.000E+00
3	4.516E+13	9.904E+00	3.987E+00	2.013E+13	3.864E+11	4.516E+12	4.714E+01	0.000E+00	0.000E+00
4	6.507E+13	9.910E+00	3.988E+00	2.905E+13	4.658E+11	6.507E+12	5.721E+01	0.000E+00	0.000E+00
5	9.250E+13	9.917E+00	3.989E+00	4.135E+13	5.587E+11	9.250E+12	6.932E+01	0.000E+00	0.000E+00
6	1.297E+14	9.926E+00	3.991E+00	5.803E+13	6.664E+11	1.297E+13	8.375E+01	0.000E+00	0.000E+00
7	1.797E+14	9.937E+00	3.993E+00	8.045E+13	7.902E+11	1.797E+13	1.006E+02	0.000E+00	0.000E+00
8	2.463E+14	9.951E+00	3.996E+00	1.104E+14	9.311E+11	2.463E+13	1.201E+02	0.000E+00	0.000E+00
9	3.346E+14	9.969E+00	3.999E+00	1.500E+14	1.093E+12	3.346E+13	1.430E+02	0.000E+00	0.000E+00
10	4.508E+14	9.991E+00	4.004E+00	2.022E+14	1.281E+12	4.508E+13	1.705E+02	0.000E+00	0.000E+00
11	6.030E+14	1.002E+01	4.009E+00	2.706E+14	1.500E+12	6.030E+13	2.043E+02	0.000E+00	0.000E+00
12	8.016E+14	1.006E+01	4.017E+00	3.598E+14	1.759E+12	8.016E+13	2.466E+02	0.000E+00	0.000E+00
13	1.059E+15	1.011E+01	4.027E+00	4.757E+14	2.067E+12	1.059E+14	3.007E+02	0.000E+00	0.000E+00
14	1.393E+15	1.018E+01	4.041E+00	6.254E+14	2.437E+12	1.393E+14	3.716E+02	0.000E+00	0.000E+00
15	1.821E+15	1.027E+01	4.059E+00	8.178E+14	2.889E+12	1.821E+14	4.675E+02	0.000E+00	0.000E+00
16	2.367E+15	1.039E+01	4.085E+00	1.063E+15	3.454E+12	2.367E+14	6.026E+02	0.000E+00	0.000E+00
17	3.058E+15	1.056E+01	4.121E+00	1.374E+15	4.177E+12	3.058E+14	8.035E+02	0.000E+00	0.000E+00
18	3.920E+15	1.078E+01	4.171E+00	1.761E+15	5.136E+12	3.920E+14	1.122E+03	0.000E+00	0.000E+00
19	4.974E+15	1.109E+01	4.243E+00	2.235E+15	6.465E+12	4.974E+14	1.673E+03	0.000E+00	0.000E+00
20	6.238E+15	1.152E+01	4.345E+00	2.803E+15	8.295E+12	6.238E+14	2.635E+03	0.000E+00	0.000E+00
21	7.699E+15	1.211E+01	4.491E+00	3.459E+15	1.100E+13	7.699E+14	4.553E+03	0.000E+00	0.000E+00
22	9.305E+15	1.292E+01	4.706E+00	4.180E+15	1.523E+13	9.305E+14	8.899E+03	0.000E+00	0.000E+00
23	1.099E+16	1.405E+01	5.016E+00	4.934E+15	2.158E+13	1.099E+15	1.872E+04	0.000E+00	0.000E+00
24	1.262E+16	1.560E+01	5.460E+00	5.661E+15	3.227E+13	1.262E+15	4.601E+04	0.000E+00	0.000E+00
25	1.405E+16	1.776E+01	6.096E+00	6.298E+15	5.104E+13	1.405E+15	1.332E+05	0.000E+00	0.000E+00
26	1.509E+16	2.093E+01	7.049E+00	6.746E+15	8.965E+13	1.509E+15	5.164E+05	0.000E+00	0.000E+00
27	1.568E+16	2.560E+01	8.509E+00	6.973E+15	1.633E+14	1.568E+15	2.258E+06	8.709E-23	0.000E+00
28	1.580E+16	3.212E+01	1.062E+01	6.965E+15	2.935E+14	1.580E+15	9.836E+06	1.771E-20	0.000E+00
29	1.536E+16	4.120E+01	1.357E+01	6.642E+15	5.399E+14	1.536E+15	4.735E+07	5.472E-18	0.000E+00
30	1.445E+16	5.305E+01	1.740E+01	6.020E+15	9.570E+14	1.445E+15	2.191E+08	1.527E-15	0.000E+00
31	1.371E+16	6.366E+01	2.099E+01	5.483E+15	1.358E+15	1.371E+15	5.818E+08	5.577E-14	0.000E+00
32	1.311E+16	7.244E+01	2.400E+01	5.039E+15	1.704E+15	1.311E+15	1.130E+09	6.472E-13	0.000E+00
33	1.243E+16	8.133E+01	2.692E+01	4.537E+15	2.092E+15	1.243E+15	2.136E+09	6.842E-12	0.000E+00
34	1.170E+16	9.197E+01	3.043E+01	3.987E+15	2.534E+15	1.170E+15	4.035E+09	7.190E-11	0.000E+00
35	1.075E+16	1.083E+02	3.593E+01	3.242E+15	3.161E+15	1.075E+15	9.146E+09	1.462E-09	0.000E+00
36	9.213E+15	1.431E+02	4.729E+01	2.003E+15	4.242E+15	9.212E+14	3.711E+10	2.332E-07	0.000E+00
37	7.804E+15	2.118E+02	7.075E+01	7.949E+14	5.380E+15	7.798E+14	2.764E+11	2.388E-04	0.000E+00
38	7.635E+15	3.116E+02	1.069E+02	2.990E+14	6.213E+15	7.594E+14	2.047E+12	1.577E-01	0.000E+00
39	8.341E+15	4.823E+02	1.669E+02	1.097E+14	7.221E+15	7.995E+14	1.723E+13	1.307E+02	0.000E+00
40	9.562E+15	8.212E+02	2.639E+02	3.681E+13	8.458E+15	6.784E+14	1.387E+14	1.504E+05	0.000E+00

PRADK0 3.9681E+00

Table 26: The radiation field at the surface . (IFPRNT=2,3,4)

	WAVE	HLAMBDA	LOG H	MAG	FREQUENCY	HNU	LOG H	MAG		TAUONE	TAUNU	
					0.01666667	3.4306E-22	-21.46463	53.662	0.99870	2	7.61	
					0.03333334	3.4321E-22	-21.46444	53.661	0.99914	2	7.01	
					0.05000000	3.4350E-22	-21.46407	53.660	0.99998	2	6.33	
					0.89999998	3.4351E-22	-21.46407	53.660	1.00000	2	6.07	
26	50.600	4.0219E-08	-7.39557	18.489	5.924753E+15	3.4349E-22	-21.46409	53.660	0.99995	0	0.00	26
					0.01666667	8.3885E-22	-21.07632	52.691	0.99896	2	7.57	
					0.03333334	8.3970E-22	-21.07587	52.690	0.99999	2	6.21	
					0.94999999	8.3972E-22	-21.07587	52.690	1.00000	2	6.10	
27	51.600	9.4547E-08	-7.02435	17.561	5.809932E+15	8.3970E-22	-21.07588	52.690	0.99998	0	0.00	27
					0.01666667	6.2409E-21	-20.20475	50.512	0.99997	2	6.31	
					0.98333335	6.2411E-21	-20.20474	50.512	1.00000	2	6.15	
28	54.000	6.4165E-07	-6.19270	15.482	5.551713E+15	6.2411E-21	-20.20474	50.512	1.00000	0	0.00	28
					0.01666667	3.8887E-20	-19.41019	48.525	1.00000	2	6.24	
					0.98333335	3.8887E-20	-19.41019	48.525	1.00000	2	6.21	
29	56.400	3.6650E-06	-5.43593	13.590	5.315470E+15	3.8887E-20	-19.41019	48.525	1.00000	0	0.00	29
					0.01666667	1.9414E-19	-18.71188	46.780	0.99992	2	6.41	
					0.98333335	1.9416E-19	-18.71184	46.780	1.00000	2	6.26	
30	58.700	1.6893E-05	-4.77230	11.931	5.107198E+15	1.9416E-19	-18.71185	46.780	1.00000	0	0.00	30
					0.01666667	9.6724E-19	-18.01447	45.036	1.00000	2	6.31	
					0.98333335	9.6724E-19	-18.01447	45.036	1.00000	2	6.31	
31	61.200	7.7420E-05	-4.11115	10.278	4.898570E+15	9.6724E-19	-18.01447	45.036	1.00000	0	0.00	31
					0.01666667	5.0056E-18	-17.30055	43.251	1.00000	2	6.38	
					0.98333335	5.0056E-18	-17.30055	43.251	1.00000	2	6.36	
32	64.000	3.6637E-04	-3.43608	8.590	4.684258E+15	5.0056E-18	-17.30055	43.251	1.00000	0	0.00	32
					0.01666667	2.6158E-17	-16.58240	41.456	0.99999	2	6.45	
					0.98333335	2.6158E-17	-16.58240	41.456	1.00000	2	6.42	
33	67.100	1.7417E-03	-2.75902	6.898	4.467846E+15	2.6158E-17	-16.58240	41.456	1.00000	0	0.00	33

Table 27: Other physical quantities printed. (IFPRNT=3)

WAVELENGTH 220.000 FREQUENCY 1.362693E+15

	RHOX	TAUNU	ABTOT	ALPHA	BNU	SNU	JNU	JMINS	HNU
1	1.764E-03	0.000E+00	1.080E+03	2.220E-05	7.838E-07	7.838E-07	4.220E-07	-3.618E-07	2.159E-07
2	2.585E-03	2.791E+00	1.080E+03	2.175E-05	1.125E-06	1.123E-06	1.099E-06	-2.397E-08	3.015E-08
3	3.762E-03	4.070E+00	1.094E+03	2.082E-05	1.179E-06	1.176E-06	1.165E-06	-1.089E-08	1.104E-08
4	5.414E-03	5.882E+00	1.099E+03	1.995E-05	1.187E-06	1.187E-06	1.186E-06	-1.388E-09	2.127E-09
5	7.690E-03	8.397E+00	1.111E+03	1.912E-05	1.194E-06	1.194E-06	1.194E-06	-1.638E-10	8.496E-10
6	1.078E-02	1.185E+01	1.123E+03	1.841E-05	1.201E-06	1.201E-06	1.201E-06	-2.146E-11	6.210E-10
7	1.493E-02	1.654E+01	1.136E+03	1.780E-05	1.209E-06	1.209E-06	1.209E-06	-2.131E-11	5.177E-10
8	2.046E-02	2.286E+01	1.148E+03	1.728E-05	1.218E-06	1.218E-06	1.218E-06	1.477E-11	4.544E-10
9	2.780E-02	3.133E+01	1.161E+03	1.682E-05	1.229E-06	1.229E-06	1.229E-06	2.382E-11	9.346E-10
10	3.748E-02	4.266E+01	1.181E+03	1.636E-05	1.278E-06	1.278E-06	1.278E-06	-8.870E-12	1.015E-09
11	5.017E-02	5.775E+01	1.196E+03	1.598E-05	1.305E-06	1.305E-06	1.305E-06	-1.849E-11	4.509E-10
12	6.676E-02	7.771E+01	1.209E+03	1.565E-05	1.323E-06	1.323E-06	1.323E-06	-4.606E-12	2.636E-10
13	8.836E-02	1.040E+02	1.221E+03	1.536E-05	1.340E-06	1.340E-06	1.340E-06	-8.889E-13	2.123E-10
14	1.164E-01	1.384E+02	1.234E+03	1.509E-05	1.361E-06	1.361E-06	1.361E-06	2.036E-13	2.107E-10
15	1.526E-01	1.832E+02	1.247E+03	1.483E-05	1.391E-06	1.391E-06	1.391E-06	5.278E-13	2.314E-10
16	1.990E-01	2.415E+02	1.262E+03	1.458E-05	1.434E-06	1.434E-06	1.434E-06	5.926E-13	2.662E-10
17	2.583E-01	3.168E+02	1.279E+03	1.433E-05	1.498E-06	1.498E-06	1.498E-06	5.621E-13	3.105E-10
18	3.331E-01	4.147E+02	1.341E+03	1.364E-05	1.597E-06	1.597E-06	1.597E-06	5.333E-13	3.630E-10
19	4.262E-01	5.440E+02	1.437E+03	1.273E-05	1.749E-06	1.749E-06	1.749E-06	5.365E-13	4.316E-10
20	5.399E-01	7.131E+02	1.531E+03	1.197E-05	1.988E-06	1.988E-06	1.988E-06	5.916E-13	5.233E-10
21	6.752E-01	9.256E+02	1.602E+03	1.151E-05	2.355E-06	2.355E-06	2.355E-06	8.127E-13	6.600E-10
22	8.304E-01	1.175E+03	1.613E+03	1.156E-05	2.917E-06	2.917E-06	2.917E-06	1.294E-12	9.138E-10
23	1.001E+00	1.460E+03	1.725E+03	1.104E-05	3.861E-06	3.861E-06	3.861E-06	2.074E-12	1.385E-09
24	1.180E+00	1.777E+03	1.810E+03	1.095E-05	5.518E-06	5.518E-06	5.518E-06	2.622E-12	2.222E-09
25	1.359E+00	2.124E+03	2.070E+03	1.035E-05	8.533E-06	8.533E-06	8.533E-06	2.923E-12	3.127E-09
26	1.529E+00	2.491E+03	2.238E+03	1.053E-05	1.226E-05	1.226E-05	1.226E-05	4.877E-12	4.335E-09
27	1.680E+00	2.839E+03	2.390E+03	1.151E-05	1.826E-05	1.826E-05	1.826E-05	9.389E-12	7.093E-09
28	1.802E+00	3.139E+03	2.529E+03	1.327E-05	2.644E-05	2.644E-05	2.644E-05	1.317E-11	1.052E-08
29	1.894E+00	3.381E+03	2.751E+03	1.488E-05	3.547E-05	3.547E-05	3.547E-05	2.170E-11	1.427E-08
30	1.958E+00	3.564E+03	2.979E+03	1.647E-05	4.459E-05	4.459E-05	4.459E-05	5.231E-11	2.063E-08
31	1.999E+00	3.690E+03	3.138E+03	1.875E-05	5.481E-05	5.481E-05	5.481E-05	1.370E-10	3.353E-08
32	2.027E+00	3.779E+03	3.238E+03	2.190E-05	6.664E-05	6.664E-05	6.664E-05	1.937E-10	5.208E-08
33	2.049E+00	3.852E+03	3.345E+03	2.554E-05	8.034E-05	8.034E-05	8.034E-05	1.569E-12	6.518E-08
34	2.073E+00	3.933E+03	3.462E+03	2.974E-05	9.669E-05	9.669E-05	9.669E-05	-7.989E-11	6.039E-08
35	2.111E+00	4.065E+03	3.546E+03	3.542E-05	1.184E-04	1.184E-04	1.184E-04	-6.409E-11	4.435E-08
36	2.191E+00	4.351E+03	3.569E+03	4.349E-05	1.503E-04	1.503E-04	1.503E-04	-1.473E-11	3.209E-08
37	2.372E+00	5.005E+03	3.673E+03	5.270E-05	2.053E-04	2.053E-04	2.053E-04	-1.151E-12	2.760E-08
38	2.749E+00	6.285E+03	3.112E+03	7.473E-05	3.096E-04	3.096E-04	3.096E-04	6.334E-12	3.172E-08
39	3.455E+00	8.081E+03	1.975E+03	1.303E-04	5.100E-04	5.100E-04	5.100E-04	1.276E-11	5.191E-08
40	4.632E+00	9.714E+03	7.997E+02	3.382E-04	8.807E-04	8.807E-04	8.807E-04	1.456E-11	7.567E-08

0.03333334 2.7750E-07 -6.55674 16.392 0.1

Table 28: The opacities. (IFPRNT=4)

	AHYD	AH2P	AHMIN	SIGH	AHE1	AHE2	AHEMIN	SIGHE	ACOOL	ALUKE	AHOT	SIGEL	SIGH2	AHLINE	ALINES	SIGLIN	AXLINE	SIGXL	AXCONT	SIGX	
1	-1.73	-3.37	-2.90	-1.77	-10.93	0.00	-5.68	-3.93	-2.89	-7.22	0.00	-2.31	-9.01	0.00	3.00	0.00	0.00	0.00	0.00	0.00	1
2	-1.45	-3.16	-2.67	-1.77	-10.35	0.00	-5.41	-3.93	-2.78	-7.02	0.00	-2.19	-9.00	0.00	3.03	0.00	0.00	0.00	0.00	0.00	2
3	-1.41	-3.06	-2.56	-1.77	-10.28	0.00	-5.30	-3.93	-2.70	-6.99	0.00	-2.24	-8.85	0.00	3.04	0.00	0.00	0.00	0.00	0.00	3
4	-1.41	-2.97	-2.48	-1.77	-10.26	0.00	-5.22	-3.93	-2.61	-6.99	0.00	-2.32	-8.69	0.00	3.04	0.00	0.00	0.00	0.00	0.00	4
5	-1.40	-2.89	-2.40	-1.77	-10.26	0.00	-5.14	-3.93	-2.54	-6.98	0.00	-2.39	-8.54	0.00	3.05	0.00	0.00	0.00	0.00	0.00	5
6	-1.39	-2.81	-2.32	-1.77	-10.25	0.00	-5.06	-3.93	-2.46	-6.98	0.00	-2.46	-8.39	0.00	3.05	0.00	0.00	0.00	0.00	0.00	6
7	-1.39	-2.74	-2.24	-1.77	-10.24	0.00	-4.99	-3.93	-2.39	-6.98	0.00	-2.53	-8.25	0.00	3.06	0.00	0.00	0.00	0.00	0.00	7
8	-1.38	-2.67	-2.17	-1.77	-10.22	0.00	-4.91	-3.93	-2.32	-6.97	0.00	-2.59	-8.11	0.00	3.06	0.00	0.00	0.00	0.00	0.00	8
9	-1.37	-2.60	-2.10	-1.77	-10.21	0.00	-4.84	-3.93	-2.25	-6.97	0.00	-2.65	-7.98	0.00	3.06	0.00	0.00	0.00	0.00	0.00	9
10	-1.34	-2.52	-2.02	-1.76	-10.15	0.00	-4.75	-3.93	-2.18	-6.95	0.00	-2.69	-7.87	0.00	3.07	0.00	0.00	0.00	0.00	0.00	10
11	-1.33	-2.45	-1.94	-1.76	-10.11	0.00	-4.68	-3.93	-2.11	-6.93	0.00	-2.74	-7.75	0.00	3.08	0.00	0.00	0.00	0.00	0.00	11
12	-1.32	-2.38	-1.87	-1.76	-10.09	0.00	-4.61	-3.93	-2.05	-6.93	0.00	-2.80	-7.63	0.00	3.08	0.00	0.00	0.00	0.00	0.00	12
13	-1.30	-2.31	-1.80	-1.76	-10.07	0.00	-4.54	-3.93	-1.99	-6.92	0.00	-2.85	-7.51	0.00	3.09	0.00	0.00	0.00	0.00	0.00	13
14	-1.29	-2.25	-1.74	-1.76	-10.04	0.00	-4.47	-3.93	-1.93	-6.91	0.00	-2.90	-7.40	0.00	3.09	0.00	0.00	0.00	0.00	0.00	14
15	-1.28	-2.18	-1.67	-1.76	-10.01	0.00	-4.40	-3.93	-1.86	-6.90	0.00	-2.94	-7.29	0.00	3.10	0.00	0.00	0.00	0.00	0.00	15
16	-1.25	-2.11	-1.60	-1.76	-9.96	0.00	-4.33	-3.93	-1.80	-6.88	0.00	-2.98	-7.19	0.00	3.10	0.00	0.00	0.00	0.00	0.00	16
17	-1.22	-2.04	-1.52	-1.76	-9.89	0.00	-4.24	-3.93	-1.74	-6.86	0.00	-3.01	-7.09	0.00	3.11	0.00	0.00	0.00	0.00	0.00	17
18	-1.17	-1.96	-1.44	-1.76	-9.79	0.00	-4.16	-3.93	-1.68	-6.82	0.00	-3.03	-7.01	0.00	3.13	0.00	0.00	0.00	0.00	0.00	18
19	-1.09	-1.87	-1.35	-1.76	-9.64	0.00	-4.06	-3.93	-1.62	-6.77	0.00	-3.03	-6.94	0.00	3.16	0.00	0.00	0.00	0.00	0.00	19
20	-0.99	-1.77	-1.24	-1.76	-9.44	0.00	-3.94	-3.93	-1.56	-6.69	0.00	-3.01	-6.90	0.00	3.19	0.00	0.00	0.00	0.00	0.00	20
21	-0.86	-1.66	-1.13	-1.76	-9.16	0.00	-3.80	-3.93	-1.49	-6.59	0.00	-2.96	-6.88	0.00	3.20	0.00	0.00	0.00	0.00	0.00	21
22	-0.69	-1.54	-0.99	-1.76	-8.82	0.00	-3.65	-3.93	-1.43	-6.45	0.00	-2.89	-6.90	0.00	3.21	0.00	0.00	0.00	0.00	0.00	22
23	-0.47	-1.39	-0.84	-1.76	-8.37	0.00	-3.46	-3.93	-1.36	-6.27	0.00	-2.76	-6.97	0.00	3.24	0.00	0.00	0.00	0.00	0.00	23
24	-0.19	-1.22	-0.66	-1.77	-7.79	-37.47	-3.24	-3.93	-1.30	-6.04	0.00	-2.59	-7.11	0.00	3.26	0.00	0.00	0.00	0.00	0.00	24
25	0.15	-1.03	-0.46	-1.77	-7.09	-35.11	-2.98	-3.93	-1.24	-5.73	0.00	-2.37	-7.36	0.00	3.32	0.00	0.00	0.00	0.00	0.00	25
26	0.43	-0.87	-0.29	-1.77	-6.50	-33.18	-2.77	-3.93	-1.19	-5.47	0.00	-2.18	-7.64	0.00	3.35	0.00	0.00	0.00	0.00	0.00	26
27	0.74	-0.72	-0.12	-1.78	-5.86	-31.05	-2.55	-3.93	-1.15	-5.17	0.00	-1.97	-8.06	0.00	3.38	0.00	0.00	0.00	0.00	0.00	27
28	1.02	-0.58	0.02	-1.79	-5.26	-29.06	-2.35	-3.93	-1.11	-4.87	0.00	-1.76	-8.60	0.00	3.40	0.00	0.00	0.00	0.00	0.00	28
29	1.24	-0.49	0.12	-1.80	-4.79	-27.48	-2.19	-3.93	-1.10	-4.62	0.00	-1.60	-9.18	0.00	3.44	0.00	0.00	0.00	0.00	0.00	29
30	1.41	-0.42	0.19	-1.82	-4.42	-26.23	-2.07	-3.93	-1.09	-4.43	0.00	-1.47	-9.75	0.00	3.47	0.00	0.00	0.00	0.00	0.00	30
31	1.55	-0.37	0.24	-1.84	-4.09	-25.11	-1.98	-3.93	-1.09	-4.24	0.00	-1.35	-10.40	0.00	3.49	0.00	0.00	0.00	0.00	0.00	31
32	1.68	-0.34	0.28	-1.87	-3.77	-24.03	-1.89	-3.93	-1.10	-4.06	0.00	-1.24	-11.15	0.00	3.50	0.00	0.00	0.00	0.00	0.00	32
33	1.80	-0.33	0.30	-1.90	-3.47	-23.00	-1.81	-3.93	-1.12	-3.88	0.00	-1.14	-12.04	0.00	3.52	0.00	0.00	0.00	0.00	0.00	33
34	1.90	-0.33	0.30	-1.94	-3.17	-21.97	-1.74	-3.93	-1.14	-3.70	0.00	-1.04	-13.10	0.00	3.53	0.00	0.00	0.00	0.00	0.00	34
35	2.00	-0.36	0.27	-2.01	-2.84	-20.83	-1.67	-3.93	-1.19	-3.50	0.00	-0.94	-14.55	0.00	3.54	0.00	0.00	0.00	0.00	0.00	35
36	2.09	-0.43	0.21	-2.11	-2.46	-19.49	-1.60	-3.93	-1.26	-3.26	0.00	-0.83	-16.70	0.00	3.54	0.00	0.00	0.00	0.00	0.00	36
37	2.16	-0.58	0.06	-2.28	-1.95	-17.71	-1.52	-3.93	-1.40	-2.97	0.00	-0.73	-20.55	0.00	3.55	0.00	0.00	0.00	0.00	0.00	37
38	2.17	-0.88	-0.24	-2.60	-1.29	-15.34	-1.43	-3.93	-1.69	-2.61	0.00	-0.64	0.00	0.00	3.47	0.00	0.00	0.00	0.00	0.00	38
39	2.11	-1.35	-0.70	-3.06	-0.49	-12.46	-1.35	-3.94	-2.15	-2.29	0.00	-0.59	0.00	0.00	3.27	0.00	0.00	0.00	0.00	0.00	39
40	1.99	-1.91	-1.25	-3.61	0.32	-9.37	-1.32	-4.00	-2.75	-2.19	0.00	-0.57	0.00	0.00	2.84	0.00	0.00	0.00	0.00	0.00	40

0.03333334 2.7750E-07 -6.55674 16.392 0.13955 7 3.26

Table 29: The electrons. (IFPRNT=1,2,3,4 + IFMOL=0)

ELECTRON CONTRIBUTIONS

	H	HE	C	NA	MG	AL	SI	K	CA	FE	H	HE	C	NA	MG	AL	SI	K	CA	FE
1	0.965	0.000	0.023	0.000	0.004	0.000	0.004	0.000	0.000	0.004	0.009	0.000	0.546	1.000	1.000	1.000	0.998	1.000	1.190	1.000
2	0.970	0.000	0.019	0.000	0.003	0.000	0.003	0.000	0.000	0.003	0.011	0.000	0.566	1.000	1.000	1.000	0.998	1.000	1.206	1.000
3	0.969	0.000	0.020	0.000	0.003	0.000	0.004	0.000	0.000	0.004	0.010	0.000	0.533	1.000	1.000	1.000	0.998	1.000	1.185	1.000
4	0.964	0.000	0.022	0.000	0.004	0.000	0.004	0.000	0.000	0.004	0.008	0.000	0.488	1.000	1.000	1.000	0.997	1.000	1.160	0.999
5	0.960	0.000	0.023	0.000	0.005	0.000	0.005	0.000	0.000	0.005	0.007	0.000	0.444	1.000	1.000	1.000	0.997	1.000	1.138	0.999
6	0.956	0.000	0.025	0.000	0.006	0.000	0.006	0.000	0.000	0.006	0.006	0.000	0.404	1.000	1.000	1.000	0.996	1.000	1.119	0.999
7	0.952	0.000	0.026	0.000	0.007	0.000	0.007	0.000	0.000	0.007	0.005	0.000	0.366	1.000	1.000	1.000	0.995	1.000	1.103	0.999
8	0.947	0.000	0.027	0.000	0.008	0.001	0.008	0.000	0.001	0.008	0.004	0.000	0.331	1.000	1.000	1.000	0.995	1.000	1.090	0.999
9	0.942	0.000	0.029	0.000	0.009	0.001	0.009	0.000	0.001	0.009	0.004	0.000	0.299	1.000	1.000	1.000	0.994	1.000	1.079	0.999
10	0.937	0.000	0.029	0.001	0.010	0.001	0.010	0.000	0.001	0.010	0.003	0.000	0.270	1.000	0.999	1.000	0.993	1.000	1.069	0.998
11	0.932	0.000	0.030	0.001	0.012	0.001	0.012	0.000	0.001	0.012	0.003	0.000	0.243	1.000	0.999	1.000	0.992	1.000	1.060	0.998
12	0.927	0.000	0.031	0.001	0.013	0.001	0.013	0.000	0.001	0.013	0.002	0.000	0.220	1.000	0.999	0.999	0.990	1.000	1.053	0.998
13	0.922	0.000	0.031	0.001	0.015	0.001	0.015	0.000	0.001	0.015	0.002	0.000	0.199	1.000	0.999	0.999	0.989	1.000	1.047	0.998
14	0.916	0.000	0.031	0.001	0.016	0.001	0.016	0.000	0.001	0.017	0.002	0.000	0.181	1.000	0.999	0.999	0.988	1.000	1.042	0.997
15	0.911	0.000	0.031	0.001	0.018	0.001	0.018	0.000	0.001	0.018	0.002	0.000	0.165	1.000	0.998	0.999	0.986	1.000	1.038	0.997
16	0.907	0.000	0.031	0.001	0.019	0.001	0.019	0.000	0.001	0.020	0.002	0.000	0.151	1.000	0.998	0.999	0.984	1.000	1.035	0.996
17	0.903	0.000	0.031	0.001	0.020	0.001	0.021	0.000	0.001	0.021	0.002	0.000	0.141	1.000	0.998	0.999	0.982	1.000	1.032	0.996
18	0.902	0.000	0.030	0.001	0.021	0.002	0.021	0.000	0.001	0.022	0.001	0.000	0.132	1.000	0.998	0.999	0.980	1.000	1.030	0.995
19	0.902	0.000	0.029	0.001	0.021	0.002	0.021	0.000	0.001	0.022	0.001	0.000	0.127	1.000	0.997	0.999	0.978	1.000	1.029	0.995
20	0.905	0.000	0.028	0.001	0.021	0.002	0.021	0.000	0.001	0.021	0.001	0.000	0.125	1.000	0.997	0.999	0.976	1.000	1.028	0.995
21	0.911	0.000	0.027	0.001	0.020	0.001	0.020	0.000	0.001	0.020	0.002	0.000	0.126	1.000	0.997	0.998	0.975	1.000	1.029	0.994
22	0.920	0.000	0.025	0.001	0.017	0.001	0.017	0.000	0.001	0.018	0.002	0.000	0.133	1.000	0.997	0.998	0.974	1.000	1.031	0.994
23	0.930	0.000	0.023	0.001	0.015	0.001	0.015	0.000	0.001	0.015	0.002	0.000	0.145	1.000	0.997	0.998	0.974	1.000	1.034	0.994
24	0.943	0.000	0.020	0.001	0.011	0.001	0.011	0.000	0.001	0.012	0.003	0.000	0.165	1.000	0.997	0.998	0.974	1.000	1.041	0.994
25	0.957	0.000	0.017	0.000	0.008	0.001	0.008	0.000	0.001	0.008	0.004	0.000	0.198	1.000	0.997	0.998	0.975	1.000	1.051	0.994
26	0.970	0.000	0.014	0.000	0.005	0.000	0.005	0.000	0.000	0.005	0.007	0.000	0.254	1.000	0.997	0.998	0.977	1.000	1.071	0.994
27	0.980	0.000	0.010	0.000	0.003	0.000	0.003	0.000	0.000	0.003	0.012	0.000	0.331	1.000	0.998	0.997	0.980	1.000	1.101	0.995
28	0.987	0.000	0.007	0.000	0.002	0.000	0.002	0.000	0.000	0.002	0.021	0.000	0.423	1.000	1.000	0.997	0.983	1.000	1.145	0.996
29	0.992	0.000	0.005	0.000	0.001	0.000	0.001	0.000	0.000	0.001	0.039	0.000	0.533	0.999	1.003	0.997	0.985	1.000	1.209	0.997
30	0.995	0.000	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.074	0.000	0.645	0.999	1.010	0.998	0.988	1.000	1.299	0.999
31	0.997	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.110	0.000	0.713	0.999	1.019	0.998	0.991	1.000	1.360	1.001
32	0.997	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.144	0.000	0.756	0.999	1.028	0.999	0.992	0.999	1.419	1.004
33	0.998	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.187	0.000	0.794	0.999	1.040	0.999	0.994	0.999	1.474	1.008
34	0.998	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.241	0.000	0.830	0.999	1.058	1.001	0.997	0.999	1.533	1.013
35	0.998	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.327	0.000	0.870	0.999	1.093	1.007	1.002	0.999	1.609	1.024
36	0.999	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.511	0.000	0.924	0.999	1.197	1.026	1.019	0.999	1.784	1.063
37	0.999	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.766	0.001	0.968	0.999	1.470	1.113	1.090	0.999	1.888	1.215
38	0.999	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.904	0.005	0.987	0.999	1.746	1.329	1.280	0.999	1.940	1.500
39	0.995	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.962	0.041	0.999	0.999	1.906	1.674	1.610	1.000	1.970	1.794
40	0.968	0.032	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.983	0.290	1.040	1.000	1.970	1.912	1.877	1.010	1.986	1.943

Table 30: The molecular input data. (IFPRNT=1,2,3,4, IFMOL=1, IFPRES=1)

MOLECULES INPUT

1	1.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
2	1.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
3	2.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
4	2.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
5	2.02	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
6	6.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
7	6.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
8	7.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
9	7.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
10	8.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
11	8.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
12	9.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
13	11.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
14	11.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
15	12.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
16	12.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
17	13.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
18	13.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
19	14.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
20	14.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
21	15.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
22	16.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
23	17.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
24	19.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
25	19.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
26	20.00	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
27	20.01	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
28	20.02	0.000	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00	0.0000E+00
29	101.00	4.478	4.6641E+01	1.8212E-03	5.1150E-07	8.3297E-11	5.1844E-15
30	106.00	3.465	4.5508E+01	1.6980E-03	3.8478E-07	5.8550E-11	3.6153E-15
31	107.00	3.470	4.5255E+01	1.8611E-03	4.9980E-07	7.9515E-11	4.9182E-15
32	108.00	4.392	4.5892E+01	1.8453E-03	5.0935E-07	8.1825E-11	5.0831E-15
33	109.00	5.869	4.6645E+01	1.5717E-03	4.1562E-07	6.6450E-11	4.1190E-15
34	111.00	2.050	4.4709E+01	2.4163E-03	6.1037E-07	9.0492E-11	5.3705E-15
35	112.00	1.340	4.3452E+01	2.2352E-03	5.5901E-07	8.3104E-11	4.9314E-15
36	113.00	3.050	4.5851E+01	2.1457E-03	5.4325E-07	7.8096E-11	4.3341E-15
37	114.00	3.060	4.4814E+01	1.7271E-03	3.9057E-07	5.3819E-11	3.0029E-15
38	115.00	3.300	4.4680E+01	1.8595E-03	4.6737E-07	6.8061E-11	4.0256E-15
39	116.00	3.550	4.5350E+01	1.9723E-03	5.2543E-07	8.3191E-11	5.1476E-15
40	117.00	4.434	4.5898E+01	1.5825E-03	4.0531E-07	6.3983E-11	3.9606E-15
41	606.00	6.210	4.9635E+01	3.4889E-03	1.0588E-06	1.7292E-10	1.0735E-14
42	607.00	7.760	4.7854E+01	1.8650E-03	4.6317E-07	7.2948E-11	4.5174E-15
43	608.00	11.091	4.8914E+01	1.2133E-03	1.6990E-07	1.3763E-11	4.5299E-16
44	609.00	4.966	4.7368E+01	2.0173E-03	4.7759E-07	6.7404E-11	3.8474E-15
45	615.00	6.895	4.7509E+01	2.1172E-03	4.9533E-07	7.2805E-11	4.4007E-15
46	616.00	7.355	4.8536E+01	1.7529E-03	3.7872E-07	5.1956E-11	2.9409E-15
47	617.00	3.340	4.7009E+01	2.4592E-03	6.5348E-07	9.8261E-11	5.8172E-15
48	707.00	9.759	4.8708E+01	1.9370E-03	4.9854E-07	7.6174E-11	4.6475E-15
49	708.00	6.497	4.7373E+01	1.9956E-03	4.9814E-07	7.3915E-11	4.4017E-15
50	709.00	2.819	4.6770E+01	2.2411E-03	5.5102E-07	7.9899E-11	4.6459E-15
51	714.00	5.658	4.7117E+01	1.7960E-03	3.6727E-07	5.0042E-11	2.8886E-15
52	715.00	7.111	4.7683E+01	2.2458E-03	5.5753E-07	7.9113E-11	4.5753E-15
53	716.00	4.800	4.6990E+01	2.2957E-03	5.9392E-07	8.9837E-11	5.4041E-15
54	808.00	5.116	4.8632E+01	1.6412E-03	3.4362E-07	4.6858E-11	2.6408E-15
55	811.00	3.079	4.6421E+01	2.6221E-03	6.8505E-07	1.0200E-10	6.0540E-15
56	812.00	3.530	4.7490E+01	4.4046E-03	1.5814E-06	3.4953E-10	2.6721E-14
57	813.00	5.270	4.7491E+01	1.8257E-03	3.3193E-07	4.4069E-11	2.5856E-15
58	814.00	8.260	4.8482E+01	1.5553E-03	2.9270E-07	3.3106E-11	1.5597E-15
59	815.00	6.071	4.7307E+01	2.4172E-03	6.2096E-07	8.9966E-11	5.2500E-15
60	816.00	5.359	4.7493E+01	1.7257E-03	3.6371E-07	5.0705E-11	2.9300E-15
61	817.00	2.745	4.6832E+01	2.1078E-03	5.1344E-07	7.4414E-11	4.3173E-15
62	909.00	1.592	4.8632E+01	2.0165E-03	4.6054E-07	6.4288E-11	3.6296E-15
63	911.00	4.953	4.6717E+01	2.7566E-03	7.4062E-07	1.1213E-10	6.7066E-15
64	912.00	3.200	4.5468E+01	2.5089E-03	6.5244E-07	9.7170E-11	5.7561E-15
65	913.00	6.790	4.7788E+01	2.1362E-03	5.0666E-07	7.1400E-11	4.0530E-15
66	914.00	5.420	4.6897E+01	2.1060E-03	4.9864E-07	6.8598E-11	3.7971E-15
67	916.00	3.338	4.6706E+01	1.9206E-03	4.3001E-07	5.8063E-11	3.2077E-15
68	917.00	2.616	4.7680E+01	2.1411E-03	5.3239E-07	7.8152E-11	4.5625E-15
69	1111.00	0.730	4.5152E+01	3.6917E-03	1.0752E-06	1.7017E-10	1.0459E-14
70	1117.00	4.222	4.6147E+01	3.0037E-03	8.5128E-07	1.3301E-10	8.0960E-15
71	1216.00	2.400	4.6796E+01	3.9803E-03	9.4542E-07	1.2089E-10	6.2056E-15
72	1217.00	2.701	4.4998E+01	2.8447E-03	7.9686E-07	1.2369E-10	7.4944E-15
73	1313.00	1.604	4.7559E+01	2.9097E-03	7.7812E-07	1.1753E-10	6.9499E-15
74	1317.00	5.074	4.7276E+01	2.5438E-03	6.7568E-07	1.0182E-10	6.0055E-15
75	1414.00	3.252	4.7179E+01	2.0256E-03	4.5186E-07	5.7418E-11	2.9577E-15
76	1416.00	6.418	4.7989E+01	1.7935E-03	3.7532E-07	4.5974E-11	2.3242E-15
77	1417.00	4.002	4.6541E+01	2.5534E-03	6.8459E-07	1.0209E-10	5.9733E-15
78	1515.00	5.033	4.8223E+01	2.6898E-03	7.0362E-07	1.0075E-10	5.8493E-15
79	1516.00	5.637	4.6919E+01	2.7644E-03	7.4350E-07	1.0948E-10	6.4205E-15
80	1616.00	4.369	4.7747E+01	1.9271E-03	4.1963E-07	5.6886E-11	3.1854E-15
81	1617.00	2.749	4.7565E+01	3.5631E-03	1.0897E-06	1.7573E-10	1.0805E-14
82	1717.00	2.476	4.8021E+01	2.4184E-03	6.5374E-07	1.0061E-10	6.0420E-15
83	10106.00	7.849	9.2455E+01	3.1402E-03	6.6306E-07	9.2666E-11	5.3624E-15
84	10108.00	9.512	9.3179E+01	2.6725E-03	5.7830E-07	8.5268E-11	5.1311E-15
85	10116.00	7.508	9.2064E+01	2.7883E-03	5.3505E-07	7.2159E-11	4.1344E-15
86	10607.00	13.085	9.6092E+01	3.4150E-03	6.7686E-07	8.9342E-11	4.9893E-15
87	10608.00	11.721	9.4226E+01	3.0760E-03	5.9489E-07	7.6261E-11	4.1452E-15
88	10811.00	8.286	9.2701E+01	4.3703E-03	1.0975E-06	1.6241E-10	9.6222E-15
89	10812.00	6.823	9.1448E+01	3.9729E-03	9.4759E-07	1.3688E-10	8.0099E-15
90	60606.00	13.957	1.0081E+02	3.9913E-03	8.1028E-07	1.0167E-10	5.3621E-15
91	60717.00	12.126	9.8836E+01	4.8687E-03	1.1673E-06	1.6627E-10	9.5674E-15
92	60808.00	16.561	1.0098E+02	3.3697E-03	5.7958E-07	6.5121E-11	3.1625E-15
93	60816.00	14.210	1.0000E+02	3.9763E-03	7.8058E-07	9.5929E-11	4.9686E-15
94	60909.00	10.268	9.7787E+01	3.7637E-03	7.7313E-07	9.9261E-11	5.3065E-15
95	61616.00	11.881	1.0044E+02	4.5422E-03	9.8359E-07	1.2836E-10	6.9210E-15
96	70708.00	11.440	9.9172E+01	3.9917E-03	8.1117E-07	1.0518E-10	5.7309E-15
97	70808.00	9.621	9.7617E+01	3.6891E-03	7.5141E-07	9.6734E-11	5.2293E-15
98	70909.00	6.056	9.6316E+01	4.4386E-03	1.0275E-06	1.4206E-10	7.9873E-15
99	80814.00	13.447	1.0004E+02	3.7484E-03	6.5483E-07	6.8677E-11	3.0007E-15
100	80816.00	11.023	9.8405E+01	3.7855E-03	7.7032E-07	9.7481E-11	5.1594E-15

MOLECULES USED 100 MAX 160
COMPONENTS USED 205 MAX 450
EQUATIONS USED 17 MAX 25

Table 31: Some physical quantities. (IFPRNT=1,2,3,4, IFMOL=1, IFPRES=1)

	RHOX	T	P	XNE	XNATOM	RHO
1	6.586E-02	3.057E+03	2.083E+03	2.462E+10	5.143E+15	1.133E-08
2	8.830E-02	4.158E+03	2.792E+03	2.105E+11	4.862E+15	1.071E-08
3	1.073E-01	4.182E+03	3.393E+03	2.516E+11	5.875E+15	1.295E-08
4	1.241E-01	4.213E+03	3.924E+03	2.910E+11	6.744E+15	1.486E-08
5	1.387E-01	4.230E+03	4.387E+03	3.231E+11	7.510E+15	1.655E-08
6	1.544E-01	4.248E+03	4.883E+03	3.579E+11	8.324E+15	1.834E-08
7	1.739E-01	4.268E+03	5.498E+03	4.009E+11	9.329E+15	2.056E-08
8	1.965E-01	4.289E+03	6.214E+03	4.503E+11	1.049E+16	2.312E-08
9	2.237E-01	4.311E+03	7.075E+03	5.097E+11	1.189E+16	2.619E-08
10	2.561E-01	4.335E+03	8.098E+03	5.800E+11	1.353E+16	2.981E-08
11	2.948E-01	4.360E+03	9.323E+03	6.635E+11	1.549E+16	3.413E-08
12	3.409E-01	4.387E+03	1.078E+04	7.626E+11	1.780E+16	3.922E-08
13	3.959E-01	4.415E+03	1.252E+04	8.806E+11	2.054E+16	4.526E-08
14	4.616E-01	4.446E+03	1.460E+04	1.021E+12	2.379E+16	5.242E-08
15	5.401E-01	4.478E+03	1.708E+04	1.190E+12	2.763E+16	6.089E-08
16	6.346E-01	4.514E+03	2.007E+04	1.394E+12	3.221E+16	7.098E-08
17	7.484E-01	4.552E+03	2.367E+04	1.641E+12	3.768E+16	8.302E-08
18	8.855E-01	4.593E+03	2.800E+04	1.940E+12	4.418E+16	9.736E-08
19	1.051E+00	4.634E+03	3.324E+04	2.298E+12	5.199E+16	1.146E-07
20	1.252E+00	4.690E+03	3.959E+04	2.761E+12	6.119E+16	1.348E-07
21	1.494E+00	4.755E+03	4.724E+04	3.343E+12	7.200E+16	1.587E-07
22	1.786E+00	4.832E+03	5.648E+04	4.086E+12	8.471E+16	1.867E-07
23	2.139E+00	4.924E+03	6.763E+04	5.052E+12	9.953E+16	2.193E-07
24	2.561E+00	5.031E+03	8.099E+04	6.316E+12	1.167E+17	2.571E-07
25	3.063E+00	5.171E+03	9.685E+04	8.115E+12	1.357E+17	2.990E-07
26	3.657E+00	5.350E+03	1.156E+05	1.093E+13	1.566E+17	3.450E-07
27	4.346E+00	5.563E+03	1.374E+05	1.586E+13	1.789E+17	3.942E-07
28	5.112E+00	5.856E+03	1.617E+05	2.728E+13	1.998E+17	4.404E-07
29	5.803E+00	6.254E+03	1.835E+05	5.840E+13	2.123E+17	4.678E-07
30	6.372E+00	6.671E+03	2.015E+05	1.267E+14	2.185E+17	4.814E-07
31	6.844E+00	7.107E+03	2.164E+05	2.664E+14	2.201E+17	4.850E-07
32	7.216E+00	7.549E+03	2.282E+05	5.236E+14	2.182E+17	4.808E-07
33	7.537E+00	7.930E+03	2.383E+05	8.883E+14	2.166E+17	4.772E-07
34	7.864E+00	8.186E+03	2.487E+05	1.244E+15	2.185E+17	4.816E-07
35	8.227E+00	8.433E+03	2.602E+05	1.693E+15	2.215E+17	4.881E-07
36	8.634E+00	8.675E+03	2.730E+05	2.262E+15	2.254E+17	4.968E-07
37	9.091E+00	8.910E+03	2.875E+05	2.961E+15	2.305E+17	5.079E-07
38	9.621E+00	9.145E+03	3.042E+05	3.834E+15	2.369E+17	5.220E-07
39	1.023E+01	9.385E+03	3.235E+05	4.942E+15	2.445E+17	5.387E-07
40	1.094E+01	9.614E+03	3.459E+05	6.258E+15	2.541E+17	5.599E-07

Table 32: Molecular number densities. (IFPRNT=1,2,3,4, IFMOL=1, IFPRES=1)

MOLECULAR NUMBER DENSITIES

	606.00	607.00	608.00	609.00	615.00	616.00	617.00	707.00	708.00	709.00
1	1.213E+00	3.823E+05	1.703E+12	2.407E-02	2.550E+03	1.945E+05	1.078E-02	2.552E+11	3.480E+08	1.373E-02
2	2.132E+06	1.459E+08	1.090E+12	3.839E+01	7.656E+04	3.403E+06	1.130E+01	1.324E+10	2.566E+07	2.178E-01
3	2.790E+06	1.872E+08	1.322E+12	5.138E+01	9.976E+04	4.396E+06	1.555E+01	1.651E+10	3.371E+07	3.037E-01
4	3.602E+06	2.228E+08	1.481E+12	6.441E+01	1.205E+05	5.252E+06	2.017E+01	1.794E+10	3.963E+07	3.799E-01
5	4.247E+06	2.563E+08	1.644E+12	7.622E+01	1.400E+05	6.065E+06	2.432E+01	2.003E+10	4.594E+07	4.574E-01
6	5.016E+06	2.926E+08	1.808E+12	8.971E+01	1.614E+05	6.948E+06	2.921E+01	2.199E+10	5.260E+07	5.444E-01
7	6.031E+06	3.389E+08	2.008E+12	1.074E+02	1.890E+05	8.077E+06	3.577E+01	2.437E+10	6.111E+07	6.603E-01
8	7.272E+06	3.944E+08	2.242E+12	1.293E+02	2.224E+05	9.437E+06	4.403E+01	2.720E+10	7.147E+07	8.065E-01
9	8.885E+06	4.630E+08	2.515E+12	1.574E+02	2.641E+05	1.112E+07	5.492E+01	3.047E+10	8.424E+07	9.961E-01
10	1.095E+07	5.469E+08	2.832E+12	1.931E+02	3.158E+05	1.319E+07	6.914E+01	3.423E+10	9.987E+07	1.240E+00
11	1.361E+07	6.504E+08	3.207E+12	2.389E+02	3.804E+05	1.576E+07	8.785E+01	3.869E+10	1.193E+08	1.559E+00
12	1.704E+07	7.770E+08	3.638E+12	2.975E+02	4.605E+05	1.891E+07	1.125E+02	4.372E+10	1.431E+08	1.971E+00
13	2.151E+07	9.328E+08	4.140E+12	3.728E+02	5.605E+05	2.280E+07	1.452E+02	4.952E+10	1.724E+08	2.510E+00
14	2.735E+07	1.124E+09	4.714E+12	4.698E+02	6.848E+05	2.759E+07	1.887E+02	5.600E+10	2.082E+08	3.210E+00
15	3.509E+07	1.356E+09	5.360E+12	5.952E+02	8.389E+05	3.344E+07	2.470E+02	6.296E+10	2.515E+08	4.119E+00
16	4.541E+07	1.640E+09	6.091E+12	7.580E+02	1.031E+06	4.064E+07	3.258E+02	7.048E+10	3.041E+08	5.307E+00
17	5.917E+07	1.988E+09	6.915E+12	9.699E+02	1.270E+06	4.948E+07	4.324E+02	7.860E+10	3.681E+08	6.867E+00
18	7.756E+07	2.410E+09	7.827E+12	1.245E+03	1.566E+06	6.026E+07	5.770E+02	8.711E+10	4.454E+08	8.906E+00
19	1.016E+08	2.935E+09	8.908E+12	1.605E+03	1.940E+06	7.377E+07	7.724E+02	9.759E+10	5.431E+08	1.164E+01
20	1.362E+08	3.505E+09	9.780E+12	2.066E+03	2.366E+06	8.851E+07	1.044E+03	1.023E+11	6.417E+08	1.498E+01
21	1.827E+08	4.109E+09	1.044E+13	2.641E+03	2.841E+06	1.043E+08	1.410E+03	1.029E+11	7.428E+08	1.910E+01
22	2.435E+08	4.695E+09	1.073E+13	3.337E+03	3.335E+06	1.199E+08	1.896E+03	9.880E+10	8.386E+08	2.407E+01
23	3.175E+08	5.160E+09	1.044E+13	4.121E+03	3.784E+06	1.328E+08	2.513E+03	8.935E+10	9.146E+08	2.982E+01
24	3.971E+08	5.408E+09	9.521E+12	4.926E+03	4.113E+06	1.406E+08	3.251E+03	7.637E+10	9.607E+08	3.629E+01
25	4.571E+08	5.103E+09	7.501E+12	5.484E+03	4.063E+06	1.344E+08	3.990E+03	5.698E+10	9.213E+08	4.216E+01
26	4.636E+08	4.238E+09	4.947E+12	5.557E+03	3.567E+06	1.137E+08	4.545E+03	3.699E+10	7.964E+08	4.662E+01
27	4.096E+08	3.130E+09	2.783E+12	5.124E+03	2.804E+06	8.588E+07	4.774E+03	2.154E+10	6.273E+08	4.923E+01
28	2.861E+08	1.832E+09	1.147E+12	3.961E+03	1.771E+06	5.195E+07	4.332E+03	9.668E+09	4.047E+08	4.665E+01
29	1.423E+08	7.846E+08	3.250E+11	2.386E+03	8.292E+05	2.342E+07	3.137E+03	3.069E+09	1.978E+08	3.680E+01
30	6.138E+07	3.204E+08	9.474E+10	1.347E+03	3.658E+05	1.024E+07	2.053E+03	9.590E+08	9.213E+07	2.680E+01
31	2.200E+07	1.234E+08	2.892E+10	7.128E+02	1.508E+05	4.356E+06	1.202E+03	2.902E+08	4.063E+07	1.789E+01
32	6.249E+06	4.458E+07	9.533E+09	3.528E+02	5.773E+04	1.811E+06	6.173E+02	8.491E+07	1.690E+07	1.083E+01
33	1.701E+06	1.761E+07	3.983E+09	1.836E+02	2.386E+04	8.430E+05	3.122E+02	2.867E+07	7.590E+06	6.519E+00
34	6.334E+05	9.306E+06	2.368E+09	1.176E+02	1.298E+04	5.116E+05	1.892E+02	1.379E+07	4.392E+06	4.525E+00
35	2.168E+05	4.867E+06	1.484E+09	7.458E+01	6.978E+03	3.133E+05	1.105E+02	6.627E+06	2.518E+06	3.061E+00
36	6.619E+04	2.469E+06	9.659E+08	4.620E+01	3.639E+03	1.907E+05	6.108E+01	3.113E+06	1.404E+06	1.992E+00
37	1.824E+04	1.223E+06	6.555E+08	2.811E+01	1.854E+03	1.159E+05	3.222E+01	1.438E+06	7.658E+05	1.252E+00
38	4.332E+03	5.774E+05	4.575E+08	1.649E+01	9.014E+02	6.917E+04	1.584E+01	6.354E+05	3.995E+05	7.471E-01
39	8.308E+02	2.509E+05	3.238E+08	9.097E+00	4.045E+02	3.956E+04	7.007E+00	2.587E+05	1.932E+05	4.118E-01
40	1.441E+02	1.068E+05	2.400E+08	4.944E+00	1.780E+02	2.268E+04	2.964E+00	1.036E+05	9.141E+04	2.193E-01

Table 33: The atomic and molecular number densities/partition functions
(IFPRNT=1,2,3,3, IFPNCH=5 IFMOL=1, IFPRES=1)

```
                      NUMBER DENSITIES / PARTITION FUNCTIONS
 100 MOLECULES
                  1.00
2.103E+15 2.185E+15 2.640E+15 3.031E+15 3.375E+15 3.740E+15 4.191E+15 4.714E+15
5.339E+15 6.077E+15 6.955E+15 7.992E+15 9.222E+15 1.068E+16 1.240E+16 1.445E+16
1.690E+16 1.982E+16 2.331E+16 2.744E+16 3.228E+16 3.798E+16 4.463E+16 5.232E+16
6.088E+16 7.029E+16 8.034E+16 8.980E+16 9.544E+16 9.822E+16 9.890E+16 9.792E+16
9.702E+16 9.773E+16 9.885E+16 1.003E+17 1.023E+17 1.047E+17 1.075E+17 1.112E+17
                  1.01
2.807E+03 4.473E+08 5.658E+08 7.507E+08 8.772E+08 1.036E+09 1.247E+09 1.500E+09
1.833E+09 2.265E+09 2.817E+09 3.547E+09 4.505E+09 5.792E+09 7.576E+09 1.007E+10
1.358E+10 1.861E+10 2.536E+10 3.791E+10 5.971E+10 9.999E+10 1.800E+11 3.444E+11
7.602E+11 1.897E+12 4.920E+12 1.425E+13 4.339E+13 1.097E+14 2.470E+14 5.015E+14
8.632E+14 1.216E+15 1.663E+15 2.228E+15 2.924E+15 3.792E+15 4.896E+15 6.206E+15
                  2.00
5.143E+14 4.862E+14 5.875E+14 6.744E+14 7.510E+14 8.324E+14 9.329E+14 1.049E+15
1.189E+15 1.353E+15 1.549E+15 1.780E+15 2.054E+15 2.379E+15 2.763E+15 3.221E+15
3.768E+15 4.418E+15 5.199E+15 6.119E+15 7.200E+15 8.471E+15 9.953E+15 1.167E+16
1.357E+16 1.566E+16 1.789E+16 1.998E+16 2.123E+16 2.185E+16 2.201E+16 2.182E+16
2.166E+16 2.185E+16 2.215E+16 2.254E+16 2.305E+16 2.369E+16 2.445E+16 2.541E+16
                  2.01
5.293E-16 4.809E-06 7.241E-06 1.204E-05 1.584E-05 2.129E-05 2.957E-05 4.103E-05
5.859E-05 8.528E-05 1.256E-04 1.891E-04 2.893E-04 4.527E-04 7.311E-04 1.216E-03
2.079E-03 3.660E-03 6.374E-03 1.321E-02 3.023E-02 7.765E-02 2.289E-01 7.591E-01
3.327E+00 1.888E+01 1.222E+02 1.112E+03 1.353E+04 1.223E+05 8.896E+05 5.174E+06
2.009E+07 4.685E+07 1.012E+08 2.076E+08 4.026E+08 7.566E+08 1.402E+09 2.471E+09
                  2.02
6.528E-49 1.101E-39 1.398E-39 2.033E-39 2.423E-39 2.959E-39 3.695E-39 4.598E-39
5.846E-39 7.540E-39 9.794E-39 1.295E-38 1.732E-38 2.361E-38 3.308E-38 4.754E-38
6.990E-38 1.055E-37 1.572E-37 2.761E-37 5.327E-37 1.147E-36 2.812E-36 7.706E-36
2.739E-35 1.214E-34 5.746E-34 3.282E-33 2.059E-32 2.025E-29 2.568E-26 1.524E-23
2.102E-21 4.441E-20 7.059E-19 9.205E-18 9.721E-17 9.058E-16 7.956E-15 5.744E-14
                  6.00
2.125E+06 5.715E+10 6.849E+10 8.262E+10 9.259E+10 1.041E+11 1.186E+11 1.353E+11
1.558E+11 1.807E+11 2.105E+11 2.470E+11 2.915E+11 3.461E+11 4.144E+11 5.000E+11
6.073E+11 7.425E+11 9.060E+11 1.142E+12 1.459E+12 1.882E+12 2.444E+12 3.153E+12
4.042E+12 5.041E+12 6.028E+12 6.869E+12 7.251E+12 7.291E+12 7.087E+12 6.685E+12
6.289E+12 6.093E+12 5.918E+12 5.756E+12 5.618E+12 5.502E+12 5.393E+12 5.332E+12
                  6.01
2.046E-02 8.023E+06 9.699E+06 1.289E+07 1.478E+07 1.724E+07 2.045E+07 2.420E+07
2.910E+07 3.537E+07 4.322E+07 5.348E+07 6.675E+07 8.442E+07 1.088E+08 1.428E+08
1.902E+08 2.576E+08 3.457E+08 5.163E+08 8.151E+08 1.367E+09 2.447E+09 4.583E+09
9.630E+09 2.178E+10 4.864E+10 1.125E+11 2.534E+11 4.774E+11 8.082E+11 1.249E+12
1.718E+12 2.091E+12 2.492E+12 2.925E+12 3.384E+12 3.883E+12 4.433E+12 5.015E+12
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..............................................................................
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XNATOM,RHO
5.143E+15 1.133E-08 4.862E+15 1.071E-08 5.875E+15 1.295E-08 6.744E+15 1.486E-08
7.510E+15 1.655E-08 8.324E+15 1.834E-08 9.329E+15 2.056E-08 1.049E+16 2.312E-08
1.189E+16 2.619E-08 1.353E+16 2.981E-08 1.549E+16 3.413E-08 1.780E+16 3.922E-08
2.054E+16 4.526E-08 2.379E+16 5.242E-08 2.763E+16 6.089E-08 3.221E+16 7.098E-08
3.768E+16 8.302E-08 4.418E+16 9.736E-08 5.199E+16 1.146E-07 6.119E+16 1.348E-07
7.200E+16 1.587E-07 8.471E+16 1.867E-07 9.953E+16 2.193E-07 1.167E+17 2.571E-07
1.357E+17 2.990E-07 1.566E+17 3.450E-07 1.789E+17 3.942E-07 1.998E+17 4.404E-07
2.123E+17 4.678E-07 2.185E+17 4.814E-07 2.201E+17 4.850E-07 2.182E+17 4.808E-07
2.166E+17 4.772E-07 2.185E+17 4.816E-07 2.215E+17 4.881E-07 2.254E+17 4.968E-07
2.305E+17 5.079E-07 2.369E+17 5.220E-07 2.445E+17 5.387E-07 2.541E+17 5.599E-07
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Table 34: Statistical equilibrium rates and departure coefficients for H-
(IFPRNT=1,2,3,4, NLTEON=1)

HMINUS STATISTICAL EQUILIBRIUM

	RHOX	GELECT	GASSOC	GCHARG	GRDKHM	GRDHMK	BMIN
1	1.401E-02	1.656E+02	1.073E+06	5.280E+02	1.227E+02	1.789E+02	0.9999
2	1.980E-02	2.191E+02	1.516E+06	5.581E+02	1.325E+02	1.894E+02	1.0000
3	2.642E-02	2.803E+02	2.022E+06	5.820E+02	1.333E+02	1.907E+02	1.0000
4	3.422E-02	3.510E+02	2.619E+06	6.021E+02	1.337E+02	1.921E+02	1.0000
5	4.350E-02	4.337E+02	3.330E+06	6.202E+02	1.338E+02	1.936E+02	1.0000
6	5.476E-02	5.319E+02	4.191E+06	6.373E+02	1.339E+02	1.952E+02	1.0000
7	6.843E-02	6.488E+02	5.237E+06	6.542E+02	1.341E+02	1.970E+02	1.0000
8	8.512E-02	7.885E+02	6.514E+06	6.717E+02	1.344E+02	1.990E+02	1.0000
9	1.055E-01	9.548E+02	8.075E+06	6.907E+02	1.348E+02	2.012E+02	1.0000
10	1.305E-01	1.153E+03	9.986E+06	7.119E+02	1.354E+02	2.038E+02	1.0000
11	1.612E-01	1.389E+03	1.233E+07	7.367E+02	1.362E+02	2.067E+02	1.0000
12	1.989E-01	1.669E+03	1.520E+07	7.666E+02	1.374E+02	2.102E+02	1.0000
13	2.452E-01	2.002E+03	1.873E+07	8.038E+02	1.393E+02	2.143E+02	1.0000
14	3.021E-01	2.396E+03	2.306E+07	8.518E+02	1.420E+02	2.194E+02	1.0000
15	3.720E-01	2.862E+03	2.836E+07	9.160E+02	1.459E+02	2.258E+02	1.0000
16	4.579E-01	3.412E+03	3.484E+07	1.005E+03	1.518E+02	2.344E+02	1.0000
17	5.637E-01	4.065E+03	4.276E+07	1.134E+03	1.607E+02	2.458E+02	1.0000
18	6.937E-01	4.839E+03	5.241E+07	1.330E+03	1.743E+02	2.613E+02	1.0000
19	8.541E-01	5.765E+03	6.416E+07	1.644E+03	1.958E+02	2.830E+02	1.0000
20	1.051E+00	6.873E+03	7.834E+07	2.179E+03	2.303E+02	3.143E+02	1.0000
21	1.294E+00	8.197E+03	9.528E+07	3.162E+03	2.883E+02	3.604E+02	1.0000
22	1.589E+00	9.764E+03	1.152E+08	5.135E+03	3.902E+02	4.304E+02	1.0000
23	1.946E+00	1.159E+04	1.383E+08	9.504E+03	5.801E+02	5.393E+02	1.0000
24	2.379E+00	1.370E+04	1.647E+08	2.023E+04	9.567E+02	7.125E+02	1.0000
25	2.902E+00	1.620E+04	1.945E+08	4.889E+04	1.762E+03	9.936E+02	1.0000
26	3.516E+00	1.967E+04	2.266E+08	1.286E+05	3.516E+03	1.460E+03	1.0000
27	4.186E+00	2.576E+04	2.577E+08	3.436E+05	7.367E+03	2.268E+03	1.0000
28	4.839E+00	4.246E+04	2.824E+08	9.082E+05	1.251E+04	3.753E+03	1.0000
29	5.406E+00	7.936E+04	2.966E+08	2.303E+06	2.157E+04	6.525E+03	1.0001
30	5.860E+00	1.637E+05	2.998E+08	5.686E+06	3.638E+04	1.164E+04	1.0001
31	6.189E+00	3.543E+05	2.927E+08	1.371E+07	5.921E+04	2.131E+04	1.0001
32	6.412E+00	7.722E+05	2.774E+08	3.207E+07	9.174E+04	3.932E+04	1.0002
33	6.560E+00	1.642E+06	2.556E+08	7.193E+07	1.342E+05	7.225E+04	1.0002
34	6.651E+00	3.328E+06	2.267E+08	1.524E+08	1.826E+05	1.300E+05	1.0001
35	6.708E+00	6.276E+06	1.890E+08	2.991E+08	2.301E+05	2.267E+05	1.0000
36	6.746E+00	1.068E+07	1.413E+08	5.289E+08	2.650E+05	3.807E+05	0.9998
37	6.776E+00	1.576E+07	8.759E+07	8.097E+08	2.733E+05	6.156E+05	0.9996
38	6.807E+00	1.941E+07	4.180E+07	1.034E+09	2.405E+05	9.586E+05	0.9993
39	6.850E+00	2.014E+07	1.563E+07	1.112E+09	1.629E+05	1.441E+06	0.9989
40	6.934E+00	1.870E+07	5.234E+06	1.079E+09	8.398E+04	2.097E+06	0.9982

Table 35: Departure coefficients for H. (IFPRNT=1,2,3,4, NLTEON=1)

STATISTICAL EQUILIBRIUM FOR HYDROGEN

	RHOX	B1	B2	B3	B4	B5	B6
1	1.4014E-02	0.9460	0.9459	0.9835	0.9955	0.9987	0.9996
2	1.9801E-02	0.9584	0.9583	0.9874	0.9966	0.9990	0.9997
3	2.6423E-02	0.9662	0.9662	0.9898	0.9972	0.9992	0.9998
4	3.4217E-02	0.9719	0.9719	0.9915	0.9977	0.9993	0.9998
5	4.3505E-02	0.9763	0.9762	0.9928	0.9981	0.9994	0.9998
6	5.4756E-02	0.9798	0.9798	0.9939	0.9983	0.9995	0.9999
7	6.8430E-02	0.9828	0.9828	0.9948	0.9986	0.9996	0.9999
8	8.5123E-02	0.9853	0.9853	0.9956	0.9988	0.9996	0.9999
9	1.0553E-01	0.9874	0.9874	0.9962	0.9990	0.9997	0.9999
10	1.3053E-01	0.9892	0.9892	0.9967	0.9991	0.9997	0.9999
11	1.6120E-01	0.9907	0.9907	0.9972	0.9992	0.9998	0.9999
12	1.9888E-01	0.9920	0.9920	0.9976	0.9993	0.9998	0.9999
13	2.4520E-01	0.9932	0.9932	0.9979	0.9994	0.9998	1.0000
14	3.0211E-01	0.9941	0.9941	0.9982	0.9995	0.9999	1.0000
15	3.7201E-01	0.9950	0.9950	0.9985	0.9996	0.9999	1.0000
16	4.5794E-01	0.9957	0.9957	0.9987	0.9997	0.9999	1.0000
17	5.6365E-01	0.9964	0.9964	0.9989	0.9997	0.9999	1.0000
18	6.9373E-01	0.9970	0.9970	0.9991	0.9998	0.9999	1.0000
19	8.5414E-01	0.9977	0.9977	0.9993	0.9998	0.9999	1.0000
20	1.0515E+00	0.9983	0.9983	0.9995	0.9999	1.0000	1.0000
21	1.2935E+00	0.9989	0.9989	0.9997	0.9999	1.0000	1.0000
22	1.5889E+00	0.9996	0.9996	0.9999	1.0000	1.0000	1.0000
23	1.9465E+00	1.0004	1.0004	1.0001	1.0000	1.0000	1.0000
24	2.3789E+00	1.0012	1.0012	1.0003	1.0001	1.0000	1.0000
25	2.9017E+00	1.0020	1.0020	1.0004	1.0001	1.0000	1.0000
26	3.5161E+00	1.0025	1.0026	1.0005	1.0001	1.0000	1.0000
27	4.1857E+00	1.0026	1.0027	1.0005	1.0001	1.0000	1.0000
28	4.8389E+00	1.0021	1.0021	1.0003	1.0001	1.0000	1.0000
29	5.4058E+00	1.0015	1.0015	1.0002	1.0000	1.0000	1.0000
30	5.8599E+00	1.0009	1.0010	1.0001	1.0000	1.0000	1.0000
31	6.1892E+00	1.0006	1.0006	1.0001	1.0000	1.0000	1.0000
32	6.4124E+00	1.0003	1.0003	1.0000	1.0000	1.0000	1.0000
33	6.5602E+00	1.0001	1.0001	1.0000	1.0000	1.0000	1.0000
34	6.6509E+00	1.0001	1.0001	1.0000	1.0000	1.0000	1.0000
35	6.7081E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
36	6.7464E+00	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
37	6.7764E+00	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
38	6.8068E+00	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
39	6.8502E+00	0.9999	0.9999	1.0000	1.0000	1.0000	1.0000
40	6.9339E+00	0.9998	0.9998	1.0000	1.0000	1.0000	1.0000

Table 36:Radiative and collisional rates for H (IFPRNT=2,3,4, NLTEON=1)

STATISTICAL EQUILIBRIUM RATES RATE=SIGN(ALOG10(MAX (ABS(RATE*1.E20),1.)),RATE)

RAD	1-K	K-1	2-K	K-2	3-K	K-3	4-K	K-4	5-K	K-5	6-K	K-6	COLL	1-K	2-K	3-K	4-K	5-K	6-K	5-8	6-8
COLL	1-2	1-3	1-4	1-5	1-6	1-7	2-3	2-4	2-5	2-6	2-7	3-4	3-5	3-6	3-7	4-5	4-6	4-7	5-6	5-7	6-7
1	0.00	0.00	21.80	21.65	20.96	20.81	20.35	20.19	19.87	19.71	19.47	19.32		7.71	19.66	22.24	23.33	23.95	24.37	24.54	25.69
	12.48	9.63	8.45	7.79	7.35	7.03	22.59	20.96	20.14	19.62	19.25	24.75	23.41	22.69	22.22	25.77	24.52	23.84	26.41	25.21	26.88
2	0.00	0.00	21.83	21.68	20.98	20.84	20.37	20.23	19.89	19.75	19.50	19.35		7.92	19.81	22.37	23.46	24.08	24.50	24.67	25.82
	12.66	9.83	8.65	7.99	7.56	7.23	22.73	21.10	20.28	19.76	19.39	24.88	23.54	22.82	22.35	25.90	24.65	23.97	26.54	25.33	27.00
3	0.00	0.00	21.83	21.68	20.99	20.84	20.37	20.23	19.90	19.75	19.50	19.36		8.03	19.92	22.48	23.57	24.19	24.61	24.78	25.93
	12.77	9.94	8.77	8.11	7.67	7.35	22.84	21.21	20.39	19.87	19.50	24.99	23.65	22.93	22.46	26.00	24.76	24.08	26.64	25.44	27.11
4	0.00	0.00	21.83	21.69	20.99	20.84	20.38	20.23	19.90	19.75	19.50	19.36		8.14	20.02	22.58	23.67	24.29	24.70	24.88	26.03
	12.87	10.04	8.87	8.21	7.77	7.45	22.94	21.31	20.49	19.97	19.60	25.09	23.75	23.03	22.56	26.10	24.86	24.18	26.74	25.54	27.21
5	0.00	0.00	21.84	21.69	20.99	20.84	20.38	20.23	19.90	19.75	19.51	19.36		8.23	20.11	22.67	23.76	24.38	24.80	24.97	26.12
	12.97	10.13	8.96	8.30	7.86	7.54	23.03	21.40	20.58	20.06	19.69	25.18	23.84	23.12	22.65	26.19	24.95	24.27	26.83	25.63	27.30
6	0.00	0.00	21.84	21.69	21.00	20.84	20.38	20.23	19.91	19.75	19.51	19.36		8.32	20.20	22.76	23.85	24.47	24.88	25.06	26.21
	13.06	10.22	9.05	8.39	7.95	7.63	23.12	21.49	20.67	20.15	19.78	25.27	23.93	23.21	22.74	26.28	25.04	24.36	26.92	25.72	27.39
7	0.00	0.00	21.84	21.69	21.00	20.84	20.39	20.23	19.91	19.75	19.52	19.36		8.41	20.29	22.85	23.93	24.55	24.97	25.14	26.29
	13.14	10.31	9.14	8.48	8.04	7.72	23.21	21.58	20.75	20.23	19.87	25.36	24.02	23.30	22.83	26.37	25.13	24.44	27.01	25.81	27.48
8	0.00	0.00	21.85	21.69	21.01	20.84	20.39	20.23	19.91	19.75	19.52	19.36		8.49	20.37	22.93	24.02	24.64	25.06	25.23	26.38
	13.23	10.40	9.22	8.56	8.13	7.81	23.29	21.66	20.84	20.32	19.95	25.44	24.10	23.38	22.91	26.45	25.21	24.53	27.09	25.89	27.56
9	0.00	0.00	21.85	21.69	21.01	20.85	20.40	20.23	19.92	19.75	19.53	19.36		8.58	20.46	23.02	24.10	24.72	25.14	25.31	26.46
	13.32	10.48	9.31	8.65	8.21	7.89	23.37	21.75	20.92	20.40	20.04	25.53	24.18	23.47	23.00	26.54	25.29	24.61	27.18	25.98	27.64
10	0.00	0.00	21.86	21.69	21.02	20.85	20.40	20.24	19.92	19.76	19.53	19.36		8.67	20.54	23.10	24.18	24.80	25.22	25.39	26.54
	13.40	10.57	9.40	8.74	8.30	7.98	23.46	21.83	21.01	20.49	20.12	25.61	24.27	23.55	23.08	26.62	25.38	24.70	27.26	26.06	27.73
11	0.00	0.00	21.87	21.69	21.02	20.85	20.41	20.24	19.93	19.76	19.54	19.37		8.75	20.62	23.18	24.27	24.89	25.30	25.47	26.62
	13.49	10.65	9.48	8.83	8.39	8.07	23.54	21.91	21.09	20.57	20.20	25.69	24.35	23.63	23.16	26.70	25.46	24.78	27.34	26.14	27.81
12	0.00	0.00	21.87	21.70	21.03	20.85	20.42	20.24	19.94	19.76	19.54	19.37		8.85	20.71	23.26	24.35	24.97	25.38	25.56	26.71
	13.58	10.74	9.57	8.92	8.48	8.16	23.62	21.99	21.17	20.65	20.29	25.77	24.43	23.71	23.24	26.78	25.54	24.86	27.42	26.22	27.89
13	0.00	0.00	21.88	21.70	21.04	20.86	20.43	20.25	19.95	19.77	19.55	19.37		8.94	20.79	23.34	24.43	25.05	25.46	25.63	26.79
	13.67	10.84	9.67	9.01	8.57	8.25	23.70	22.08	21.25	20.74	20.37	25.85	24.51	23.79	23.32	26.86	25.62	24.94	27.50	26.30	27.97
14	0.00	0.00	21.89	21.71	21.05	20.87	20.44	20.26	19.96	19.78	19.56	19.38		9.04	20.87	23.43	24.51	25.13	25.54	25.71	26.86
	13.76	10.93	9.76	9.11	8.67	8.35	23.78	22.16	21.34	20.82	20.45	25.93	24.59	23.87	23.40	26.94	25.70	25.02	27.58	26.38	28.05
15	0.00	0.00	21.90	21.72	21.06	20.88	20.45	20.27	19.97	19.79	19.58	19.39		9.15	20.96	23.51	24.59	25.21	25.62	25.79	26.94
	13.86	11.04	9.87	9.21	8.78	8.46	23.87	22.24	21.42	20.90	20.54	26.01	24.67	23.95	23.48	27.02	25.78	25.10	27.66	26.46	28.13
16	0.00	0.00	21.92	21.74	21.08	20.90	20.46	20.28	19.99	19.81	19.59	19.41		9.27	21.05	23.59	24.67	25.29	25.70	25.87	27.02
	13.97	11.16	9.99	9.34	8.90	8.58	23.95	22.33	21.51	20.99	20.63	26.09	24.75	24.04	23.57	27.10	25.86	25.18	27.74	26.54	28.20
17	0.00	0.00	21.94	21.77	21.10	20.92	20.49	20.31	20.01	19.83	19.61	19.44		9.42	21.15	23.68	24.76	25.37	25.79	25.95	27.10
	14.10	11.29	10.13	9.47	9.04	8.72	24.04	22.42	21.60	21.08	20.72	26.17	24.84	24.12	23.65	27.18	25.94	25.26	27.82	26.62	28.28
18	0.00	0.00	21.97	21.80	21.13	20.96	20.51	20.34	20.03	19.87	19.64	19.47		9.59	21.25	23.77	24.84	25.46	25.87	26.04	27.18
	14.25	11.45	10.29	9.64	9.21	8.89	24.13	22.52	21.70	21.18	20.82	26.26	24.92	24.21	23.74	27.26	26.02	25.34	27.90	26.70	28.36

Table 37: Surface intensity at specified MU=cosθ (IFPRNT=2,3,4, IFSURF=2, IFCORR=0)

	WAVE	FREQUENCY	TAUONE	TAUNU	MU	INTENSITY	MU	INTENSITY	MU	INTENSITY	MU	INTENSITY	MU	INTENSITY
27	51.600	5.809932E+15	0	0.00	1.000	4.502E-36	0.900	4.051E-36	0.800	3.603E-36	0.700	3.154E-36	0.600	2.706E-36
					0.550	2.481E-36	0.500	2.257E-36	0.400	1.808E-36	0.300	1.360E-36	0.200	9.112E-37
					0.100	4.626E-37								
28	54.000	5.551713E+15	0	0.00	1.000	9.785E-35	0.900	8.803E-35	0.800	7.832E-35	0.700	6.861E-35	0.600	5.890E-35
					0.550	5.405E-35	0.500	4.919E-35	0.400	3.948E-35	0.300	2.977E-35	0.200	2.006E-35
					0.100	1.035E-35								
29	56.400	5.315470E+15	0	0.00	1.000	1.610E-33	0.900	1.451E-33	0.800	1.292E-33	0.700	1.133E-33	0.600	9.737E-34
					0.550	8.942E-34	0.500	8.147E-34	0.400	6.558E-34	0.300	4.968E-34	0.200	3.379E-34
					0.100	1.789E-34								
30	58.700	5.107198E+15	0	0.00	1.000	1.889E-32	0.900	1.702E-32	0.800	1.517E-32	0.700	1.333E-32	0.600	1.148E-32
					0.550	1.056E-32	0.500	9.639E-33	0.400	7.794E-33	0.300	5.950E-33	0.200	4.105E-33
					0.100	2.260E-33								
31	61.200	4.898570E+15	0	0.00	1.000	2.229E-31	0.900	2.015E-31	0.800	1.801E-31	0.700	1.587E-31	0.600	1.372E-31
					0.550	1.265E-31	0.500	1.158E-31	0.400	9.438E-32	0.300	7.295E-32	0.200	5.152E-32
					0.100	3.009E-32								
32	64.000	4.684258E+15	0	0.00	1.000	2.823E-30	0.900	2.561E-30	0.800	2.298E-30	0.700	2.036E-30	0.600	1.773E-30
					0.550	1.642E-30	0.500	1.510E-30	0.400	1.248E-30	0.300	9.851E-31	0.200	7.225E-31
					0.100	4.598E-31								
33	67.100	4.467846E+15	0	0.00	1.000	3.718E-29	0.900	3.390E-29	0.800	3.065E-29	0.700	2.739E-29	0.600	2.413E-29
					0.550	2.250E-29	0.500	2.087E-29	0.400	1.761E-29	0.300	1.435E-29	0.200	1.109E-29
					0.100	7.832E-30								
34	70.500	4.252376E+15	0	0.00	1.000	4.995E-28	0.900	4.599E-28	0.800	4.204E-28	0.700	3.808E-28	0.600	3.412E-28
					0.550	3.214E-28	0.500	3.016E-28	0.400	2.621E-28	0.300	2.225E-28	0.200	1.829E-28
					0.100	1.433E-28								
35	73.600	4.073268E+15	0	0.00	1.000	4.506E-27	0.900	4.188E-27	0.800	3.876E-27	0.700	3.565E-27	0.600	3.253E-27
					0.550	3.097E-27	0.500	2.942E-27	0.400	2.630E-27	0.300	2.318E-27	0.200	2.007E-27
					0.100	1.695E-27								
36	77.000	3.893409E+15	0	0.00	1.000	4.314E-26	0.900	4.067E-26	0.800	3.821E-26	0.700	3.575E-26	0.600	3.330E-26
					0.550	3.207E-26	0.500	3.084E-26	0.400	2.838E-26	0.300	2.592E-26	0.200	2.346E-26
					0.100	2.100E-26								
37	81.000	3.701142E+15	0	0.00	1.000	5.154E-25	0.900	4.927E-25	0.800	4.708E-25	0.700	4.488E-25	0.600	4.268E-25
					0.550	4.158E-25	0.500	4.048E-25	0.400	3.829E-25	0.300	3.609E-25	0.200	3.389E-25
					0.100	3.169E-25								

Table 38: The structure of the final model in the format of an ATLAS input file. (IFPNCH=1,2,5)

```
TEFF   7500.  GRAVITY 4.000 LTE
TITLE
OPACITY IFOP 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 0 0 0 0
CONVECTION OFF  1.00 TURBULENCE OFF  0.00  0.00  0.00  0.00
ABUNDANCE SCALE   1.000 ABUNDANCE CHANGE 1 0.900 2 0.100
READ DECK6 40 RHOX,T,P,XNE,ABROSS,ACCRAD,VTURB
3.45633342E-03    5416.7 2.481E+01 2.080E+11 1.331E-02 7.997E+00 0.000E+00
5.02116000E-03    5788.5 3.620E+01 3.618E+11 1.331E-02 8.356E-01 0.000E+00
7.01894471E-03    5850.1 5.150E+01 4.669E+11 1.527E-02 7.209E-01 0.000E+00
9.49678570E-03    5863.4 7.163E+01 5.553E+11 1.644E-02 6.143E-01 0.000E+00
1.28030013E-02    5874.7 9.918E+01 6.602E+11 1.796E-02 5.580E-01 0.000E+00
1.70226730E-02    5885.3 1.354E+02 7.803E+11 1.980E-02 5.162E-01 0.000E+00
2.25745235E-02    5895.3 1.837E+02 9.199E+11 2.199E-02 4.840E-01 0.000E+00
2.97636949E-02    5904.8 2.472E+02 1.079E+12 2.453E-02 4.659E-01 0.000E+00
3.91202867E-02    5914.9 3.308E+02 1.264E+12 2.752E-02 4.600E-01 0.000E+00
5.11725955E-02    5926.7 4.398E+02 1.479E+12 3.102E-02 4.601E-01 0.000E+00
6.66354373E-02    5941.1 5.816E+02 1.731E+12 3.513E-02 4.659E-01 0.000E+00
8.63335878E-02    5958.4 7.648E+02 2.029E+12 3.996E-02 4.778E-01 0.000E+00
1.11291967E-01    5979.0 1.001E+03 2.383E+12 4.567E-02 4.965E-01 0.000E+00
1.42715544E-01    6003.6 1.303E+03 2.810E+12 5.246E-02 5.232E-01 0.000E+00
1.82045117E-01    6032.6 1.687E+03 3.330E+12 6.064E-02 5.598E-01 0.000E+00
2.30956182E-01    6067.1 2.174E+03 3.975E+12 7.061E-02 6.088E-01 0.000E+00
2.91305244E-01    6108.0 2.785E+03 4.794E+12 8.304E-02 6.739E-01 0.000E+00
3.65351260E-01    6150.4 3.543E+03 5.865E+12 9.892E-02 7.609E-01 0.000E+00
4.55897570E-01    6204.9 4.469E+03 7.326E+12 1.200E-01 8.773E-01 0.000E+00
5.63011587E-01    6288.4 5.581E+03 9.303E+12 1.475E-01 1.030E+00 0.000E+00
6.85016274E-01    6377.2 6.886E+03 1.217E+13 1.876E-01 1.278E+00 0.000E+00
8.24197114E-01    6491.5 8.362E+03 1.658E+13 2.492E-01 1.668E+00 0.000E+00
9.76179898E-01    6617.6 9.976E+03 2.310E+13 3.373E-01 2.217E+00 0.000E+00
1.14051628E+00    6784.7 1.169E+04 3.396E+13 4.786E-01 3.096E+00 0.000E+00
1.30642772E+00    7003.1 1.340E+04 5.285E+13 7.176E-01 4.559E+00 0.000E+00
1.46479130E+00    7282.4 1.502E+04 8.685E+13 1.159E+00 7.325E+00 0.000E+00
1.60374629E+00    7630.6 1.645E+04 1.498E+14 2.025E+00 1.275E+01 0.000E+00
1.71531951E+00    8058.6 1.759E+04 2.692E+14 3.875E+00 2.431E+01 0.000E+00
1.79733276E+00    8581.0 1.843E+04 4.984E+14 8.032E+00 4.966E+01 0.000E+00
1.85286987E+00    9210.1 1.900E+04 9.289E+14 1.804E+01 1.097E+02 0.000E+00
1.88849044E+00    9942.0 1.936E+04 1.670E+15 4.059E+01 2.458E+02 0.000E+00
1.91327047E+00   10770.6 1.961E+04 2.742E+15 8.045E+01 4.805E+02 0.000E+00
1.93416464E+00   11696.6 1.981E+04 3.874E+15 1.239E+02 7.285E+02 0.000E+00
1.95845294E+00   12735.8 2.003E+04 4.592E+15 1.335E+02 7.751E+02 0.000E+00
1.99811888E+00   13837.3 2.039E+04 4.770E+15 1.037E+02 5.798E+02 0.000E+00
2.08127141E+00   15099.2 2.115E+04 4.723E+15 6.971E+01 3.666E+02 0.000E+00
2.26319289E+00   16471.2 2.282E+04 4.771E+15 4.760E+01 2.378E+02 0.000E+00
2.63303900E+00   17965.3 2.622E+04 5.134E+15 3.589E+01 1.712E+02 0.000E+00
3.31168580E+00   19624.3 3.247E+04 5.960E+15 3.052E+01 1.313E+02 0.000E+00
4.42289972E+00   21373.5 4.262E+04 7.339E+15 2.893E+01 1.130E+02 0.000E+00
PRADK 4.1816E+00
BEGIN                    ITERATION   2 COMPLETED
```

Table 39: The surface flux as saved on unit 7.
(IFPNCH=2, IFSURF=0,1)

```
TEFF    7500. GRAVITY 4.000
FLUX         5.924753E+15   3.3936E-22    3.3937E-22    0.99996
FLUX         5.809932E+15   8.2982E-22    8.2983E-22    0.99999
FLUX         5.551713E+15   6.1712E-21    6.1712E-21    1.00000
FLUX         5.315470E+15   3.8472E-20    3.8472E-20    1.00000
FLUX         5.107198E+15   1.9217E-19    1.9217E-19    1.00000
FLUX         4.898570E+15   9.5776E-19    9.5776E-19    1.00000
FLUX         4.684258E+15   4.9588E-18    4.9588E-18    1.00000
FLUX         4.467846E+15   2.5925E-17    2.5925E-17    1.00000
FLUX         4.252376E+15   1.3363E-16    1.3363E-16    1.00000
FLUX         4.073268E+15   5.1925E-16    5.1925E-16    1.00000
FLUX         3.893409E+15   2.0173E-15    2.0173E-15    1.00000
FLUX         3.701142E+15   8.5460E-15    8.5460E-15    1.00000
FLUX         3.526971E+15   3.1384E-14    3.1384E-14    1.00000
FLUX         3.368455E+15   1.0189E-13    1.0189E-13    1.00000
FLUX         3.223575E+15   3.3666E-13    3.6304E-13    0.92734
FLUX         3.074795E+15   1.0516E-12    1.0666E-12    0.98586
FLUX         2.924805E+15   3.1209E-12    3.1481E-12    0.99135
FLUX         2.788767E+15   8.3074E-12    8.3553E-12    0.99427
FLUX         2.664822E+15   3.1355E-11    3.3726E-11    0.92969
FLUX         2.551426E+15   6.9848E-11    7.3689E-11    0.94787
FLUX         2.459331E+15   1.3256E-10    1.3891E-10    0.95431
FLUX         2.362431E+15   3.1072E-10    3.3728E-10    0.92125
FLUX         2.262585E+15   6.2166E-10    6.5269E-10    0.95246
FLUX         2.180309E+15   1.0730E-09    1.1189E-09    0.95895
FLUX         2.108245E+15   1.7434E-09    1.7952E-09    0.97114
FLUX         2.022891E+15   3.1135E-09    3.1903E-09    0.97593
FLUX         1.940404E+15   2.7777E-08    7.2313E-08    0.38412
FLUX         1.879577E+15   3.6482E-08    7.0400E-08    0.51821
FLUX         1.818026E+15   3.2067E-08    7.5741E-08    0.42338
FLUX         1.750102E+15   7.2883E-07    1.5244E-06    0.47812
FLUX         1.674818E+15   8.1955E-07    1.6143E-06    0.50768
FLUX         1.603168E+15   9.9318E-07    1.7005E-06    0.58406
FLUX         1.542143E+15   1.1687E-06    1.7751E-06    0.65838
FLUX         1.478267E+15   1.1674E-06    2.0160E-06    0.57906
FLUX         1.418800E+15   1.5997E-06    2.7226E-06    0.58758
FLUX         1.362693E+15   1.6157E-06    2.9261E-06    0.55217
FLUX         1.303446E+15   1.4715E-06    3.1688E-06    0.46437
FLUX         1.249135E+15   1.2312E-06    3.4218E-06    0.35980
FLUX         1.208353E+15   1.6970E-06    3.6328E-06    0.46713
FLUX         1.161536E+15   1.8280E-06    4.2562E-06    0.42949
FLUX         1.110343E+15   2.7078E-06    4.6289E-06    0.58497
FLUX         1.070687E+15   2.4735E-06    4.9476E-06    0.49995
FLUX         1.033767E+15   3.6322E-06    5.2692E-06    0.68932
FLUX         9.993083E+14   4.2658E-06    5.5922E-06    0.76282
FLUX         9.670726E+14   4.7593E-06    5.9142E-06    0.80471
FLUX         9.368516E+14   5.0055E-06    6.2340E-06    0.80293
FLUX         9.084621E+14   5.5770E-06    6.5502E-06    0.85143
FLUX         8.817426E+14   5.8980E-06    6.8614E-06    0.85959
FLUX         8.565500E+14   6.2204E-06    7.1667E-06    0.86796
FLUX         8.332199E+14   6.5377E-06    7.4588E-06    0.87651
FLUX         8.188814E+14   6.8692E-06    2.3459E-05    0.29282
FLUX         8.131068E+14   6.7042E-06    2.3422E-05    0.28623
FLUX         8.076306E+14   7.1805E-06    2.3389E-05    0.30700
FLUX         8.022277E+14   8.4077E-06    2.3357E-05    0.35997
FLUX         7.889276E+14   1.0732E-05    2.3303E-05    0.46054
FLUX         7.686987E+14   1.4625E-05    2.3178E-05    0.63098
```

Table 40: The surface intensity as saved on unit 7 (IFPNCH=2, IFSURF=2)

```
TEFF   5500. GRAVITY 4.500
INTENSITY    5.809932E+15 1.00 4.5020E-36 0.90 4.0514E-36 0.80 3.6028E-36
 0.70 3.1542E-36 0.60 2.7056E-36 0.55 2.4813E-36 0.50 2.2570E-36 0.40 1.8084E-36
 0.30 1.3598E-36 0.20 9.1118E-37 0.10 4.6258E-37
INTENSITY    5.551713E+15 1.00 9.7850E-35 0.90 8.8035E-35 0.80 7.8324E-35
 0.70 6.8613E-35 0.60 5.8901E-35 0.55 5.4046E-35 0.50 4.9190E-35 0.40 3.9479E-35
 0.30 2.9768E-35 0.20 2.0057E-35 0.10 1.0346E-35
INTENSITY    5.315470E+15 1.00 1.6095E-33 0.90 1.4506E-33 0.80 1.2916E-33
 0.70 1.1327E-33 0.60 9.7370E-34 0.55 8.9422E-34 0.50 8.1474E-34 0.40 6.5578E-34
 0.30 4.9682E-34 0.20 3.3786E-34 0.10 1.7890E-34
INTENSITY    5.107198E+15 1.00 1.8888E-32 0.90 1.7018E-32 0.80 1.5174E-32
 0.70 1.3329E-32 0.60 1.1484E-32 0.55 1.0562E-32 0.50 9.6392E-33 0.40 7.7944E-33
 0.30 5.9497E-33 0.20 4.1049E-33 0.10 2.2601E-33
INTENSITY    4.898570E+15 1.00 2.2294E-31 0.90 2.0151E-31 0.80 1.8009E-31
 0.70 1.5866E-31 0.60 1.3723E-31 0.55 1.2652E-31 0.50 1.1580E-31 0.40 9.4377E-32
 0.30 7.2949E-32 0.20 5.1522E-32 0.10 3.0094E-32
INTENSITY    4.684258E+15 1.00 2.8235E-30 0.90 2.5609E-30 0.80 2.2982E-30
 0.70 2.0356E-30 0.60 1.7730E-30 0.55 1.6417E-30 0.50 1.5104E-30 0.40 1.2477E-30
 0.30 9.8510E-31 0.20 7.2247E-31 0.10 4.5984E-31
INTENSITY    4.467846E+15 1.00 3.7179E-29 0.90 3.3905E-29 0.80 3.0646E-29
 0.70 2.7387E-29 0.60 2.4127E-29 0.55 2.2498E-29 0.50 2.0868E-29 0.40 1.7609E-29
 0.30 1.4350E-29 0.20 1.1091E-29 0.10 7.8320E-30
INTENSITY    4.252376E+15 1.00 4.9953E-28 0.90 4.5995E-28 0.80 4.2037E-28
 0.70 3.8079E-28 0.60 3.4121E-28 0.55 3.2142E-28 0.50 3.0163E-28 0.40 2.6205E-28
 0.30 2.2247E-28 0.20 1.8289E-28 0.10 1.4331E-28
INTENSITY    4.073268E+15 1.00 4.5063E-27 0.90 4.1880E-27 0.80 3.8764E-27
 0.70 3.5648E-27 0.60 3.2532E-27 0.55 3.0974E-27 0.50 2.9416E-27 0.40 2.6301E-27
 0.30 2.3185E-27 0.20 2.0069E-27 0.10 1.6953E-27
INTENSITY    3.893409E+15 1.00 4.3138E-26 0.90 4.0672E-26 0.80 3.8213E-26
 0.70 3.5754E-26 0.60 3.3295E-26 0.55 3.2066E-26 0.50 3.0836E-26 0.40 2.8377E-26
 0.30 2.5918E-26 0.20 2.3459E-26 0.10 2.1000E-26
INTENSITY    3.701142E+15 1.00 5.1538E-25 0.90 4.9274E-25 0.80 4.7076E-25
 0.70 4.4879E-25 0.60 4.2681E-25 0.55 4.1582E-25 0.50 4.0483E-25 0.40 3.8286E-25
 0.30 3.6088E-25 0.20 3.3890E-25 0.10 3.1692E-25
INTENSITY    3.526971E+15 1.00 5.1887E-24 0.90 5.0290E-24 0.80 4.8694E-24
 0.70 4.7097E-24 0.60 4.5501E-24 0.55 4.4703E-24 0.50 4.3905E-24 0.40 4.2308E-24
 0.30 4.0712E-24 0.20 3.9115E-24 0.10 3.7519E-24
INTENSITY    3.368455E+15 1.00 4.4293E-23 0.90 4.3274E-23 0.80 4.2325E-23
 0.70 4.1375E-23 0.60 4.0426E-23 0.55 3.9951E-23 0.50 3.9476E-23 0.40 3.8527E-23
 0.30 3.7577E-23 0.20 3.6628E-23 0.10 3.5678E-23
INTENSITY    3.258614E+15 1.00 3.0579E-20 0.90 2.7526E-20 0.80 2.4480E-20
 0.70 2.1439E-20 0.60 1.8400E-20 0.55 1.6880E-20 0.50 1.5361E-20 0.40 1.2323E-20
 0.30 9.2840E-21 0.20 6.2455E-21 0.10 3.2070E-21
INTENSITY    3.189282E+15 1.00 9.5464E-20 0.90 8.5841E-20 0.80 7.6335E-20
 0.70 6.6842E-20 0.60 5.7356E-20 0.55 5.2614E-20 0.50 4.7872E-20 0.40 3.8388E-20
 0.30 2.8904E-20 0.20 1.9421E-20 0.10 9.9370E-21
INTENSITY    3.116346E+15 1.00 2.3125E-19 0.90 2.0805E-19 0.80 1.8504E-19
 0.70 1.6205E-19 0.60 1.3908E-19 0.55 1.2759E-19 0.50 1.1611E-19 0.40 9.3144E-20
 0.30 7.0178E-20 0.20 4.7211E-20 0.10 2.4244E-20
INTENSITY    3.037411E+15 1.00 6.1025E-19 0.90 5.4870E-19 0.80 4.8809E-19
 0.70 4.2753E-19 0.60 3.6700E-19 0.55 3.3674E-19 0.50 3.0649E-19 0.40 2.4597E-19
 0.30 1.8546E-19 0.20 1.2494E-19 0.10 6.4429E-20
INTENSITY    2.962377E+15 1.00 1.4824E-18 0.90 1.3338E-18 0.80 1.1867E-18
 0.70 1.0397E-18 0.60 8.9277E-19 0.55 8.1932E-19 0.50 7.4586E-19 0.40 5.9895E-19
 0.30 4.5205E-19 0.20 3.0514E-19 0.10 1.5823E-19
```

Table 41: The files at OAT with the 1200 models.

ASCII files	Disk blocks	Binary files	Disk blocks	Model numbers
MODEL1.DAT	2051	MODBIN1.DAT	946	1 - 284
MODEL2.DAT	1300	MODBIN2.DAT	600	285 - 464
MODEL3.DAT	1047	MODBIN3.DAT	483	465 - 609
MODEL4.DAT	1361	MODBIN4.DAT	594	610 - 732
MODEL5.DAT	664	MODBIN5.DAT	290	733 - 792
MODEL6.DAT	2025	MODBIN6.DAT	884	793 - 975
MODEL7.DAT	2490	MODBIN7.DAT	1087	976 -1200

Table 42. Models with ODF's with microturbulence velocities 0,4,10 Km/s. Solar Composition.

ξ=0 Km/s

log g / T	3	3.5	4	4.5
25000	*	*	*	*
30000		*	*	*
35000		*	*	*
40000			*	*

ξ=4 Km/s

log g / T	3	3.5	4	4.5
25000	*	*	*	*
30000		*	*	*
35000			*	*
40000			*	*

ξ=10 Km/s

log g / T	3.5	4	4.5	5.
20000	*			
25000	*	*	*	
30000		*	*	
35000			*	
40000				*

Models	File names	Models	File names	Models	File names
25000,3.0	M0KM2530.DAT	25000,3.0	M4KM2530.DAT	20000,4.0	M10K2040.DAT
25000,3.5	M0KM2535.DAT	25000,3.5	M4KM2535.DAT	25000,3.5	M10K2535.DAT
25000,4.0	M0KM2540.DAT	25000,4.0	M4KM2540.DAT	25000,4.0	M10K2540.DAT
25000,4.5	M0KM2545.DAT	25000,4.5	M4KM2545.DAT	25000,4.5	M10K2545.DAT
30000,3.5	M0KM3035.DAT	30000,3.5	M4KM3035.DAT	30000,4.0	M10K3040.DAT
30000,4.0	M0KM3040.DAT	30000,4.0	M4KM3040.DAT	30000,4.5	M10K3045.DAT
30000,4.5	M0KM3045.DAT	30000,4.5	M4KM3045.DAT	35000,4.5	M10K3545.DAT
35000,3.5	M0KM3535.DAT	35000,4.0	M4KM3540.DAT	40000,5.0	M10K4050.DAT
35000,4.0	M0KM3540.DAT	35000,4.5	M4KM3545.DAT		
35000,4.5	M0KM3545.DAT	40000,4.0	M4KM4040.DAT		
40000,4.0	M0KM4040.DAT	40000,4.5	M4KM4045.DAT		
40000,4.5	M0KM4045.DAT				

All the models are computed with 40 optical depths, except (40000,5.0) which has 64 optical depths.

Table 43: The files at OAT with the 1200 fluxes.

ASCII files	Disk blocks	Binary files	Disk blocks	Model numbers
FLUX1.DAT	4358	FLUXBIN1.DAT	2295	1 - 284
FLUX2.DAT	2765			285 - 464
FLUX3.DAT	2229			465 - 609
FLUX4.DAT	1892			610 - 732
FLUX5.DAT	927	FLUXBIN5.DAT	485	733 - 792
FLUX6.DAT	2811			793 - 975
FLUX7.DAT	3454			976 -1200

Table 44: ODF's and the corresponding KAPPA tables available at OAT for computing blanketed models with ATLAS8 code.

	ABUNDANCES				ξ (Km/s)	ODF's binary filenames	KAP** names	remarks
	H	He	[M/H]	log[M/H]				
1)	0.90	0.1	1	0.	2	BDFBP00.DAT	KAPP00.DAT	
						BDFLP00.DAT	"	
2)	0.90	0.1	1/3	-0.5	2	BDFBM05.DAT	KAPM05.DAT	
						BDFLM05.DAT	"	
3)	0.90	0.1	1/10	-1.0	2	BDFBM10.DAT	KAPM10.DAT	
						BDFLM10.DAT	"	
4)	0.90	0.1	1/30	-1.5	2	BDFBM15.DAT	KAPM15.DAT	
						BDFLM15.DAT	"	
5)	0.90	0.1	1/100	-2.0	2	BDFBM20.DAT	KAPM20.DAT	
						BDFLM20.DAT	"	
6)	0.90	0.1	1/300	-2.5	2	BDFBM25.DAT	KAPM25.DAT	
						BDFLM25.DAT	"	
7)	0.90	0.1	1/1000	-3.0	2	BDFBM30.DAT	KAPM30.DAT	
						BDFLM30.DAT	"	
8)	0.90	0.1	0	-9.99	2	BDFBM99.DAT	KAPM99.DAT	
						BDFLM99.DAT	"	
9)	0.90	0.1	3	0.5	2	BDFBP05.DAT	KAPP05.DAT	
						BDFLP05.DAT	"	
10)	0.90	0.1	10	1.0	2	BDFBP10.DAT	KAPP10.DAT	
						BDFLP10.DAT	"	
11)	0.90	0.1	1	0.0	2	BDFBNOH.DAT	KAPP00.DAT	no H lines
						BDFLNOH.DAT	"	
12)	0.01	0.99	1	0.0	2	BDFB01H.DAT	KAP01H.DAT	
						BDFL01H.DAT		
13)	0.05	0.95	1	0.0	2	BDFB05H.DAT	KAP05H.DAT	
						BDFL05H.DAT		
14)	0.10	0.9	1	0.0	2	BDFB10H.DAT	KAP10H.DAT	
						BDFL10H.DAT		
15)	0.20	0.8	1	0.0	2	BDFB20H.DAT	KAP20H.DAT	
						BDFL20H.DAT		
16)	0.30	0.7	1	0.0	2	BDFB30H.DAT	KAP30H.DAT	
						BDFL30H.DAT		
17)	0.40	0.6	1	0.0	2	BDFB40H.DAT	KAP40H.DAT	
						BDFL40H.DAT		
18)	0.50	0.5	1	0.0	2	BDFB50H.DAT	KAP50H.DAT	
						BDFL50H.DAT		
19)	0.53	0.47	1	0.0	2	BDFB53H.DAT	KAP53H.DAT	
						BDFL53H.DAT	"	
20)	0.60	0.4	1	0.0	2	BDFB60H.DAT	KAP60H.DAT	
						BDFL60H.DAT		
21)	0.70	0.3	1	0.0	2	BDFB70H.DAT	KAP70H.DAT	
						BDFL70H.DAT		
22)	0.80	0.2	1	0.0	2	BDFB80H.DAT	KAP80H.DAT	
						BDFL80H.DAT		
23)	0.90	0.1	1	0.0	0	BDFB0KM.DAT	KAP0KM.DAT	
						BDFL0KM.DAT	"	
24)	0.90	0.1	1	0.0	4	BDFB4KM.DAT	KAP4KM.DAT	
						BDFL4KM.DAT	"	
25)	0.90	0.1	1	0.0	10	BDFB10K.DAT	KAP10K.DAT	
						BDFL10K.DAT	"	

Table 45: $\Sigma\varepsilon_i$ and $\Sigma\mu_i\varepsilon_i$ with ATLAS data, for different metallicities

	Abundances		Metallicity		$\Sigma\varepsilon_i$	$\Sigma\mu_i\varepsilon_i$
	H	He	[M/H]	log[M/H]		
1)	0.90	0.1	1	0.	1.112452	1.474916
2)	0.90	0.1	1/3	-0.5	1.111527	1.459779
3)	0.90	0.1	1/10	-1.0	1.111242	1.454991
4)	0.90	0.1	1/30	-1.5	1.111153	1.453478
5)	0.90	0.1	1/100	-2.0	1.111124	1.452999
6)	0.90	0.1	1/300	-2.5	1.111115	1.452848
7)	0.90	0.1	1/1000	-3.0	1.111112	1.452800
8)	0.90	0.1	0	-9.99	1.111111	1.452778
9)	0.90	0.1	3	0.5	1.115266	1.522785
10)	0.90	0.1	10	1.0	1.124251	1.674162
11)	0.01	0.99	1	0.0	100.118200	399.297300
12)	0.05	0.95	1	0.0	20.02365	77.46345
13)	0.10	0.9	1	0.0	10.01183	37.23422
14)	0.20	0.8	1	0.0	5.005913	17.11961
15)	0.30	0.7	1	0.0	3.337275	10.41474
16)	0.40	0.6	1	0.0	2.502956	7.062310
17)	0.50	0.5	1	0.0	2.002365	5.050848
18)	0.53	0.47	1	0.0	1.889024	4.595423
19)	0.60	0.4	1	0.0	1.668638	3.709873
20)	0.70	0.3	1	0.0	1.430261	2.752034
21)	0.80	0.2	1	0.0	1.251478	2.033655