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RADIATION (NEQAIR) PROGRAM: USER'S MANUAL
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Nonequilibrium Air Radiation (NEQAIR) Program: User's Manual

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National Aeronautics and
Space Administration

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SUMMARY

This supplement to the paper entitled "Calculation of Nonequilibrium Radiation in the Flight Regimes of Aerassisted Orbital Transfer Vehicles," AIAA Paper 84-0306, January 1984, contains the listings of the computer code NEQAIR (Nonequilibrium Air Radiation), its primary input data, and explanation of the user-supplied input variables. The user-supplied input variables are the thermodynamic variables of air at a given point, i.e., number densities of various chemical species, translational temperatures of heavy particles and electrons, and vibrational temperature. These thermodynamic variables do not necessarily have to be in thermodynamic equilibrium. The program calculates emission and absorption characteristics of air under these given conditions.

INTRODUCTION

Radiative properties of gases at high temperatures have been studied over the past several decades. Such studies culminated in the development of a computer code titled, "A Computer Program for a Line-by-line Calculation of Spectra From Diatomic Molecules and Atoms Assuming a Voigt Line Profile" (ref. 1). The computer code in reference 1 accepts thermodynamic properties of the gas under study, such as number densities of chemical species, translational temperatures of both heavy particles and electrons, and rotational and vibrational temperatures of the molecules, and calculates spectrally detailed radiative properties.

Reference 1 has a serious limitation, however. The thermodynamic properties must satisfy the equilibrium relationships. In a low-density environment, as encountered at high altitudes, equilibrium relationships may be violated; that is, a nonequilibrium condition may exist. Such would be the case for the flight regime of the proposed Aeroassisted Orbital Transfer Vehicles (ref. 2). For such low-density regimes, therefore, an additional technique must be developed that would replace the equilibrium relationship. Such a technique has been developed in reference 2. The technique is based on the concept of quasi-steady-state distribution (ref. 2) of thermodynamic properties, which replaces the equilibrium relationship. Reference 2 describes the technique in detail, and presents typical results of the calculations.

Since reference 1 presents the complete listing of the code for the equilibrium case, and since reference 2 is an extension of reference 1 for the low-density nonequilibrium regime, the entire code is published herein to serve as an update to

the code in reference 1. All technical details and nomenclature contained in this code are given in references 1 and 2.

SECTION 1. CALL STATEMENT

This subroutine is entered by the statement:

```
CALL NEQAIR(NMETH,NFIN1,NFIN2,NFOUT,NPRT1,NPRT2,NERR,NARRAY,NSAVE,WAVELS,WAVELL,  
STARK,WIDTF,D,UVX,UVC,SMF,ESCF,T,TV,TE,TARB,ANTOT,FN,FNP,FO,FOP,FNE,FN2P,FN2,FNO,  
FO2,FCN,FC,WAVEL,EMIS,ABSB,TOTPWR,AN)
```

The definition of the arguments is given as comments in the subroutine NEQAIR, and is reproduced below:

(InputParameters):

NMETH=Calculating method. 0=no radiation calculation. 1=emitted power only calculated. 2=emitted power and spectra calculated.

NFIN1=Unit number of excitation data input file.

NFIN2=Unit number of radiation data input file.

NFOUT=Unit number of output file.

NPRT1=Print control for input data. 0=no print. 1=small print. 2=large print.

NPRT2=Print control for output print. 0=no print. 1=small print. 2=large print.

NERR=Unit number of error message file.

NARRAY=Length of spectral array.

NSAVE=Unit number of spectral intensity output file. In this file, the index NARRAY and the arrays WAVEL, EMIS, and ABSB are saved in an unformatted form. See the subroutine NEQAIR.

WAVELS=Short wavelength limit, angstrom.

WAVELL=Long wavelength limit, angstrom.

STARK=Stark width for molecules at electron density of 1.0×10^{16} cm⁻³, angstrom.

WIDTF=Lorentz width multiplication factor. This factor is multiplied to the Lorentz width calculated by the impact approximation to obtain the true Lorentz width.

D=Physical thickness of the equivalent isothermal emitting cylinder for line absorption calculation, cm. If D is set equal to zero, absorption is calculated using the UVX values given. If D is finite, the UVX values are ignored, and absorption is calculated from D assuming a Doppler line profile.

UVX(3,2)=Ultraviolet line escape factors for the atomic lines of nitrogen and oxygen whose lower states are one of the three lowest states of the atoms. UVX(I,J)=1.0 means optically thin gas. UVX(I,J)=0.0 means completely self-absorbed. The first index refers to the electronic states, counting from the ground state. The second index refers to nitrogen and oxygen (1=nitrogen, 2=oxygen). If D value given is finite, UVX values are ignored, and absorption is calculated using D and assuming a Doppler profile.

UVC(3,2)=Ultraviolet free-bound continuum escape factors for nitrogen and oxygen. UVC(I,J)=1.0 means optically thin. UVC(I,J)=0.0 means completely self-absorbed. The indices are the same as for UVX(3,2).

SMF(20,2)=Emission strength multiplication factors. The first index refers to the radiating mechanism. The second index refers to atoms and molecules (1=atoms, 2=molecules). The SMF values are multiplied to the oscillator-strength (or equivalently to transition probability or transition moment) values assumed in the basic radiation data read in as unit NFIN2. The oscillator-strength values are taken: for atomic lines, from reference 3; for atomic continuum, from reference 4; for molecular bands of N2+, N2, NO, and O2, from reference 5; for the CN bands, from references 6 and 7. The indices refer to:

(1,1)=atomic nitrogen lines.

(2,1)=free-bound continuum of nitrogen atom.

(3,1)=free-free continuum of atomic nitrogen ion.

(4,1)=atomic oxygen lines.

(5,1)=free-bound continuum of oxygen atom.

(6,1)=free-free continuum of atomic oxygen ion.

(1,2)=N2+ First Negative band, low vibrational quantum number transitions.

(2,2)=N2+First Negative band, high vibrational quantum number transitions.

(3,2)=N2 First Positive band, low vibrational transitions.

(4,2)=N2 First Positive band, high vibrational quantum number transitions.

(5,2)=N2 Second Positive band.

(6,2)=N2 Birge-Hopfield 2 band, low vibrational quantum number transitions.

(7,2)=N2 Birge-Hopfield 2 band, intermediate vibrational quantum number transitions.

(8,2)=N2 Birge-Hopfield 2 band, high vibrational quantum number vibrations.

(9,2)=NO Beta band, low vibrational quantum number transitions.

(10,2)=NO Beta band, intermediate vibrational quantum number transitions.

(11,2)=NO Beta band, high vibrational quantum number transitions.

(12,2)=NO Gamma band, low vibrational quantum number transitions.

(13,2)=NO Gamma band, high vibrational quantum number transitions.

(14,2)=O2 Schumann-Runge band, low vibrational quantum number transitions.

(15,2)=O2 Schumann-Runge band, intermediate vibrational quantum number transitions.

(16,2)=O2 Schumann-Runge band, high vibrational quantum number transitions.

(17,2)=O2 Schumann-Runge band, high vibrational quantum number transitions.

(18,2)=CN Violet band.

(19,2)=CN Red band, low vibrational quantum number transitions.

(20,2)=CN Red band, high vibrational quantum number transitions.

T=Heavy particle temperature (assumed to be the same as rotational temperature), K.

TV=Vibrational temperature, K.
TE=Electron temperature, K.
TARB=Arbitrarily assumed equilibrium radiation temperature, K.
ANTOT=Total number density, cm^{-3} .
FN=Mole fraction of N.
FNP=Mole fraction of N+.
FO=Mole fraction of O.
FOP=Mole fraction of O+.
FNE=Mole fraction of free electrons.
FN2P=Mole fraction of N2+.
FN2=Mole fraction of N2.
FNO=Mole fraction of NO.
FO2=Mole fraction of O2.
FCN=Mole fraction of CN.
FC=Mole fraction of C.

(Output Parameters):

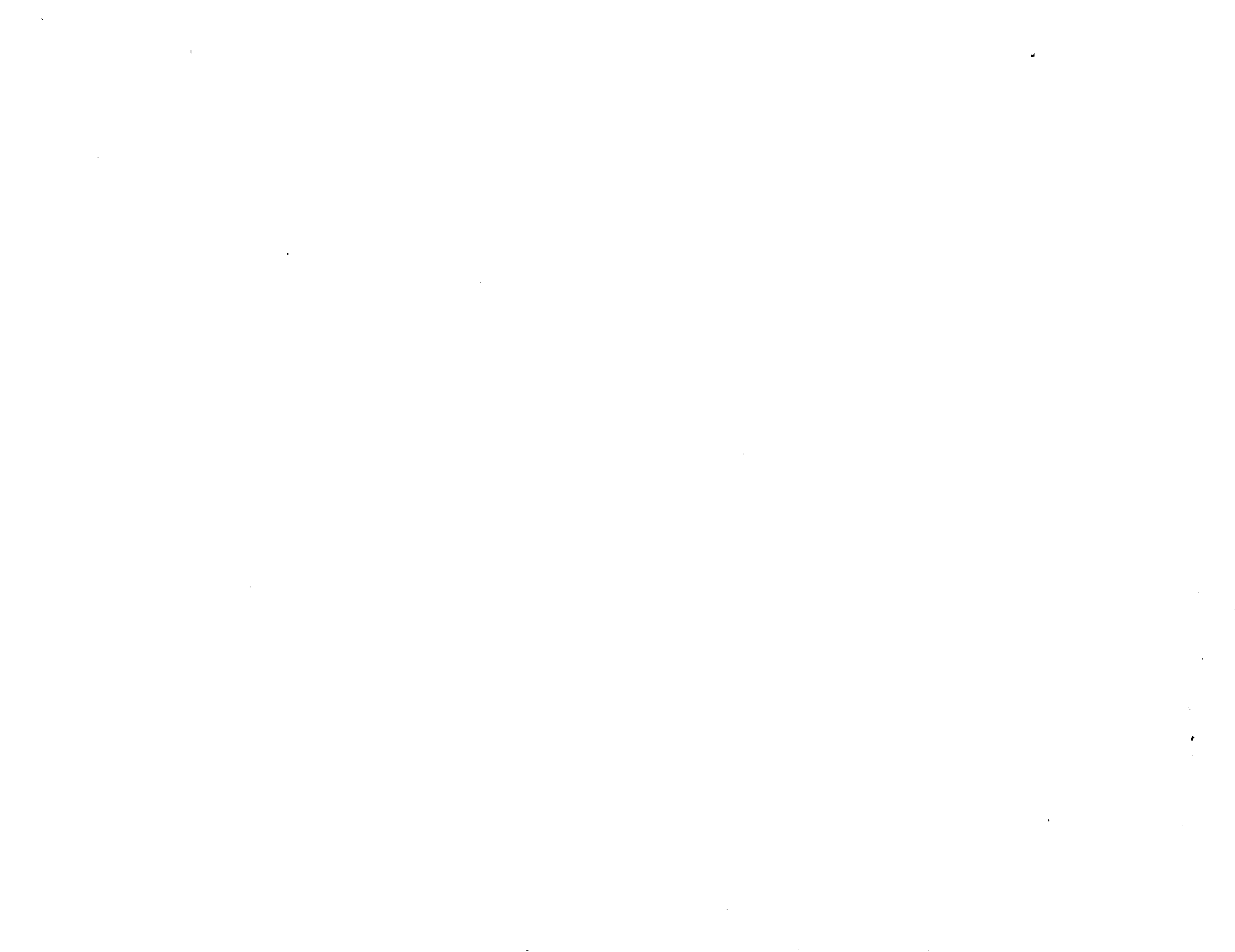
WAVEL(NARRAY)=Wavelength, angstrom. The wavelengths are at equal photon-energy intervals starting from WAVELS and ending at WAVELL.

EMIS(NARRAY)=Emission coefficient, Watts/(cm^3 -micron-ster radian).

ABSB(NARRAY)=Absorption + stimulated emission coefficient, cm^{-1} .

TOTPWR(3)=Total optically thin emitted power. (1)=all wavelengths. (2)=longer than 2500 angstrom. (3)=longer than 3500 angstrom, Watts/ cm^3 .

AN(20,2)=Equilibrium-equivalent number density for each radiating mechanism corresponding to the given hypothetical equilibrium radiation temperature TARB, cm^{-3} . The first index refers to the radiation mechanism. The second index refers to atoms and molecules (1=atoms, 2=molecules). The indices are identical to those for SMF.



SECTION 2. SOURCE CODE LISTING

```

*DECK TEST
PROGRAM TEST
C TESTS PROGRAM NEQAIR
DIMENSION TOTPNR(3)
NMETH=2
NPRT1=1
NPRT2=1
NARRAY=20000
NPLOT=0
FN=0.4813
FNP=3.425E-02
FO=0.1788
FOP=6.204E-03
FNE=0.04269
FN2P=6.188E-04
FN2=0.2143
FNO=0.03032
FO2=0.01160
FCN=1.0E-10
FC=1.0E-10
ANTOT=8.013E16
T=18000.
TV=14000.
TE=12000.
TARB=9650.
D=10.
CALL BUFFER(NMETH,NPRT1,NPRT2,NARRAY,NPLOT, FN,FNP,FO,FOP,FNE,
1 FN2P,FN2,FNO,FO2,FCN,FC,ANTOT,T,TV,TE,TARB,D,TOTPNR)
STOP
END
*DECK BUFFER
SUBROUTINE BUFFER(NMETH,NPRT1,NPRT2,NARRAY,NPLOT, FN,FNP,FO,
1 FOP,FNE,FN2P,FN2,FNO,FO2,FCN,FC,ANTOT,T,TV,TE,TARB,D,
2 TOTPNR)
C BUFFER SUBROUTINE
DIMENSION UUX(3,2),UVC(3,2),SMF(20,2),ESCF(5,5,5),AN(20,2),
1 TOTPNR(3)
DIMENSION WAVEL(20000)
DIMENSION EMIS(20000)
DIMENSION ABSB(20000)
DATA UUX/1.0E-3,1.0E-2,0.1,1.0E-3,1.0E-2,0.1/
DATA UVC/6*1./,WAVELS/2000./,WAVELL/20000./
DATA SMF/25*1.,3*0.,9*1.,3*0./
DATA ESCF/125*1./
DATA STARK/0.3/
DATA WIDTHF/10./
DATA NSAVE/3/,NFOUT/6/
DATA NFIN1/1/,NFIN2/2/,NERR/6/
CALL NEQAIR(NMETH,NFIN1,NFIN2,NFOUT,NPRT1,NPRT2,NERR,NARRAY,
1 NSAVE,WAVELS,WAVELL,STARK,WIDTHF,D,UUX,UVC,SMF,ESCF,T,TV,TE,
2 TARB,ANTOT, FN,FNP,FO,FOP,FNE,FN2P,FN2,FNO,FO2,FCN,FC,WAVEL,
3 EMIS,ABSB,TOTPNR,AN)

```

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OF POOR QUALITY

```
C
C PLOT SPECTRAL EMISSION
  IF(NPLOT.EQ.1) CALL PLOTT(WAVEL,EMIS,NARRAY)
  RETURN
  END
*DECK PLOTT
  SUBROUTINE PLOTT(WAVEL,EMIS,NARRAY)
C THIS IS THE PLOT SUBROUTINE FOR VAX
  DIMENSION WAVEL(1),EMIS(1)
  DIMENSION X(1000),Y(1000)
  DIMENSION XX(3),YY(3)
  DATA ITIME/0/
  READ(5,1) NAV,IX,XL,YL,XCYCLE,YCYCLE,WS,WL,WSTEP
1  FORMAT(2I5,7E10.3)
  WRITE(9,2)NAV,IX,XL,YL,XCYCLE,YCYCLE,WS,WL,WSTEP
2  FORMAT(/
  1 40H NAV(AVERAGING NUMBER)           =,I3/
  2 40H IX(1=LINEAR. 2=LOG FOR X COORDINATE) =,I2/
  3 40H XL(LENGTH OF X RANGE, INCHES)     =,F7.3/
  4 40H YL(LENGTH OF Y RANGE, INCHES)     =,F7.3/
  X 40H XCYCLE(LOG CYCLE FOR X)           =,F6.0/
  5 40H YCYCLE(LOG CYCLE FOR Y)           =,F6.0/
  6 40H WS(SHORTEST WAVELENGTH, A)        =,F8.0/
  7 40H WL(LONGEST WAVELENGTH, A)         =,F8.0/
  8 40H WSTEP(WAVELENGTH STEP, A)         =,F8.0)
```

```
C
C PRODUCE AVERAGE SPECTRUM
  N=FLOAT(NARRAY)/FLOAT(NAV)
  IF(N.GT.1000) N=1000
  IF(N.EQ.1000) NAV=FLOAT(NARRAY)/FLOAT(N)
  NSTEP=0.001*NARRAY
  IF(NSTEP.LT.1)NSTEP=1
  I=0
  NEND=NARRAY-0.55*NAV
  DO 3 M=NAV,NEND,NSTEP
  I=I+1
  IF(I.GT.1000) GO TO 3
  IMAX=I
  M1=M-0.5*NAV
  M2=M1+NAV-1
  IF(M2.GT.NARRAY) GO TO 3
  Y(I)=0.
  DO 4 IM=M1,M2
4  Y(I)=Y(I)+EMIS(IM)
  Y(I)=Y(I)/FLOAT(NAV)
  X(I)=WAVEL(M)
3  CONTINUE
  IMAX=IMAX-1
```

```
C
C PICK THE MAXIMUM OF Y(I)
  YMAX=0.
  DO 5 I=1,IMAX
  YMAX=AMAX1(YMAX,Y(I))
```

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```
5 CONTINUE
  INDMAX=INT(ALOG10(YMAX))+1
  YMAX1=10.**INDMAX
  YMIN1=YMAX1/10.**YCYCLE
  WRITE(9,7) YMIN1,YMAX1
7 FORMAT(1X6HYMIN= ,1PE10.3,2X,6HYMAX= ,E10.3)
C
C PUT THE MINIMUM VALUE
DO 28 I=1,IMAX
  IF(Y(I).LT.YMIN1)Y(I)=YMIN1
28 CONTINUE
C
C CONVERT TO LOG
DO 12 I=1,IMAX
  Y(I)=ALOG10(Y(I)/YMIN1)
12 CONTINUE
C
C REARRANGE X-COORDINATE FOR LOG-LOG PLOT
IF(IX.EQ.1) GO TO 10
DO 9 I=1,IMAX
  X(I)=ALOG10(X(I)/1500.)
9 CONTINUE
10 CONTINUE
C
C PLOT
IF(ITIME.NE.0) GO TO 6
CALL DIP(9,10HNEQAIR.PLT ,10)
CALL RESET('ALL')
ITIME=1
6 CONTINUE
CALL AREA2D(XL,YL)
IF(IX.EQ.1) CALL GRAF(WS,WSTEP,WL,0.,1.,5.)
IF(IX.EQ.2) CALL GRAF(0.,0.2,1.0,0.,1.,5.)
C
C DRAW AXES
XX(1)=WS
XX(2)=WL
YY(1)=0.
YY(2)=0.
CALL CURVE(XX,YY,2,0)
XX(1)=WS
XX(2)=WS
YY(1)=0.
YY(2)=5.
CALL CURVE(XX,YY,2,0)
C
CALL CURVE(X,Y,IMAX,0)
WRITE(6,8) IMAX
8 FORMAT(2X,5HIMAX=,15)
CALL ENDPL(0)
CALL DONEPL
RETURN
END
```

```

*DECK NEQAIR
C THIS IS THE BEGINNING OF THE MODULE NUMBER 1
C THIS MODULE CONTAINS THE FOLLOWING SUBROUTINES
C   NEQAIR
      SUBROUTINE NEQAIR(NMETH,NFIN1,NFIN2,NFOUT,NPRT1,NPRT2,NERR,NARRAY
1,NSAVE,WAVELS,WAVELL,STARK,WIDTF,D,UWX,UVC,SMF,ESCF,T,TU,TE,
2 TARB,ANTOT, FN, FNP, FO, FOP, FNE, FN2P, FN2, FNO, FO2, FCN, FC, WVEL,
3 EMIS, ABSB, TOTPW, AN)
C
C CALCULATES NONEQUILIBRIUM RADIATION FROM AIR
C
C INPUT PARAMETERS
C   NMETH=CALCULATING METHOD. 0=NO RADIATION. 1=EMITTED POWER ONLY
C       2=EMITTED POWER + SPECTRA
C   NFIN1=UNIT NO. OF EXCITATION DATA
C   NFIN2=UNIT NO. OF RADIATION DATA
C   NFOUT=UNIT NO. OF OUTPUT PRINTS
C   NPRT1=PRINT CONTROL FOR INPUT DATA. 0=NO PRINT. 1=SMALL PRINT
C       2=LARGE PRINT
C   NPRT2=PRINT CONTROL FOR OUTPUT PRINT. 0=NO PRINT. 1=SMALL PRINT
C       2=LARGE PRINT
C   NERR=UNIT NO. OF ERROR MESSAGES
C   NARRAY=LENGTH OF SPECTRAL ARRAY
C   NSAVE=UNIT NO. OF SPECTRAL OUTPUT
C   WAVELS=SHORT WAVELENGTH LIMIT, ANGSTROM
C   WAVELL=LONG WAVELENGTH LIMIT, ANGSTROM
C   STARK=STARK WIDTH FOR MOLECULES, ANGSTROM
C   WIDTF=LORENTZ WIDTH MULTIPLICATION FACTOR
C   D=PHYSICAL DEPTH, CM
C   UWX(3,2)=U.V. LINE ESCAPE FACTORS FOR ATOMS
C   UVC(3,2)=U.V. CONTINUUM ESCAPE FACTORS FOR ATOMS
C   SMF(20,2)=EMISSION STRENGTH MULTIPLICATION FACTORS
C   ESCF(5,5)=MOLECULAR RADIATION ESCAPE FACTORS
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE
C   TU=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   TARB=ARBITRARY EQUILIBRIUM RADIATION TEMPERATURE
C   ANTOT=TOTAL NUMBER DENSITY, CM-3
C   FN=MOLE FRACTION OF N
C   FNP=MOLE FRACTION OF N+
C   FO=MOLE FRACTION OF O
C   FOP=MOLE FRACTION OF O+
C   FNE=MOLE FRACTION OF E-
C   FN2P=MOLE FRACTION OF N2+
C   FN2=MOLE FRACTION OF N2
C   FNO=MOLE FRACTION OF NO
C   FO2=MOLE FRACTION OF O2
C   FCN=MOLE FRACTION OF CN
C   FC=MOLE FRACTION OF C
C OUTPUT PARAMETERS
C   WVEL(NARRAY)=WAVELENGTH, ANGSTROM
C   EMIS(NARRAY)=EMISSION COEFFICIENT, W/(CM3-MICRON-SR)
C   ABSB(NARRAY)=ABSORPTION + STIMULATED EMISSION COEFFICIENT, CM-1
C   TOTPW(3)=EMITTED POWER. (1)=ALL WAVELENGTH. (2)=ABOVE 2500 A,
C       (3)=ABOVE 3500 A. IN W/CM3

```

```

C AN(20,2)=EQUILIBRIUM-EQUIVALENT NUMBER DENSITY FOR EACH
C SPECTRAL SYSTEM, 'CM-3
REAL N,NP,NE,N2P,N2,NO
DIMENSION UUX(3,2),UVC(3,2),SMF(20,2),ESCF(5,5,5),TOTPWR(3)
1, RHO(23,2),TEXA(2),TEXM(5,5),TEXM1(20),FACTAM(2),
2 FACTRN(20),AN(20,2)
DIMENSION WAVEL(1)
DIMENSION EMIS(1)
DIMENSION ABSB(1)
DATA WN/14.007/,WNP/14.007/,WO/16./,WOP/16./,WN2P/28.014/,
1 WN2/28.014/,WNO/30.007/,WO2/32./,WON/26.02/,WNE/5.5E-4/,
2 WC/12.01/

```

```

C
C NORMALIZE FRACTIONS
FTOT=FN+FNP+FO+FOP+FN2P+FN2+FNE+FNO+F02+FCN+FC
FN=FN/FTOT
FNP=FNP/FTOT
FO=FO/FTOT
FOP=FOP/FTOT
FN2P=FN2P/FTOT
FN2=FN2/FTOT
FNE=FNE/FTOT
FNO=FNO/FTOT
F02=F02/FTOT
FCN=FCN/FTOT
FC=FC/FTOT

```

```

C
C CYCLE OVER TOTAL NUMBER DENSITY ANTOT
N=ANTOT*FN
NP=ANTOT*FNP
O=ANTOT*FO
OP=ANTOT*FOP
NE=ANTOT*FNE
N2P=ANTOT*FN2P
N2=ANTOT*FN2
NO=ANTOT*FNO
O2=ANTOT*F02
CN=ANTOT*FCN
C=ANTOT*FC

```

```

C
C CALCULATE THERMODYNAMIC CONDITIONS
P=ANTOT*1.3805E-16*T
PATM=P/1.0133E6
DENS=N*WN+N2P*WNP+O*WO+OP*WOP+NE*WNE+N2*WN2P+N2*WN2+NO*WNO
1 +O2*WO2+CN*WON+C*WC
DENS=DENS*1.66E-24
EN=7.82E-12*N
ENP=3.11E-11*NP
EO=4.10E-12*O
EOP=2.59E-11*OP
ENE=0.
EN2P=2.496E-11*N2P
EN2=0.

```

```

END=3.00E-12*NO
ECN=0.
EC=0.
EO2=0.
ETA=2.5*1.38E-16*(NHNP+O+OP+C)*T
ETM=3.5*1.38E-16*(N2P+N2+NO+CN+O2)*T
ENE=2.5*1.38E-16*NE*TE
EV=1.38E-16*(N2P+N2+NO+O2+CN)*TV
ETOT=EN+ENP+EO+EOP+ENE+EN2P+EN2+ENO+EO2+ECN+EC
1 +ETA+ETM+ENE+EV
ENTH=ETOT/DENS
IF(NPRT2.GT.0) WRITE(NFOUT,11) PATM,DENS,ENTH
11 FORMAT(/10H PRESSURE=,1PE10.3,4H ATM,3X,8HDENSITY=,E10.3,
1 6H G/CM3,3X,9HENTHALPY=,E10.3,6H ERG/G)

```

C

C CALCULATE EXCITATION

```

CALL EXCT(N,NP,O,OP,NE,N2P,N2,NO,O2,CN,C,T,TV,TE,TARB,UAX,
1 UVC,ESCF,D,NFIN1,NFOUT,NPRT1,NPRT2,NERR,RHO,TEXA,TEXM,
2 TEXM1,FACTAM,FACTRN)

```

C

C CALCULATE THE EQUILIBRIUM-EQUIVALENT NUMBER DENSITIES

```

AN(1,1)=N*FACTAM(1)
AN(2,1)=N
AN(3,1)=NP
AN(4,1)=O*FACTAM(2)
AN(5,1)=O
AN(6,1)=OP
AN(1,2)=N2P*FACTRN(1)
AN(2,2)=N2P*FACTRN(2)
AN(3,2)=N2*FACTRN(3)
AN(4,2)=N2*FACTRN(4)
AN(5,2)=N2*FACTRN(5)
AN(6,2)=N2*FACTRN(6)
AN(7,2)=N2*FACTRN(7)
AN(8,2)=N2*FACTRN(8)
AN(9,2)=N2*FACTRN(9)
AN(10,2)=NO*FACTRN(10)
AN(11,2)=NO*FACTRN(11)
AN(12,2)=NO*FACTRN(12)
AN(13,2)=NO*FACTRN(13)
AN(14,2)=O2*FACTRN(14)
AN(15,2)=O2*FACTRN(15)
AN(16,2)=O2*FACTRN(16)
AN(17,2)=O2*FACTRN(17)
AN(18,2)=CN*FACTRN(18)
AN(19,2)=CN*FACTRN(19)
AN(20,2)=CN*FACTRN(20)

```

C

C CALCULATE RADIATION

```

IF(NMETH.GT.0) CALL RADCAL(N,NP,O,OP,N2,N2P,O2,NO,CN,NE,T,
1 TV,TE,TEXM1,PATM,RHO,DENS,SMF,WIDTF,STARK,WAVELS,WAVELL,
2 NARRAY,NFIN2,NFOUT,NPRT1,NPRT2,NERR,NMETH,WAVEL,EMIS,
3 ABSB,TOTPW)

```



```

C
C SAVE SPECTRAL OUTPUT
      IF(NSAVE.GT.0) WRITE(NSAVE)NARRAY,WAVEL,EMIS,ABSB
      RETURN
      END
*DECK EXCT
C THIS IS THE BEGINNING OF THE MODULE NUMBER 2
C THIS MODULE CONTAINS THE FOLLOWING SUBROUTINES
C   EXCT,EXCTAM,ARBITA,ESCAL,GBAR,ATOMIN,QSS,MINV,EONE,MOLIN,
C   MOLEXT,QSSM,MINV1,ARBIT,EXCTML,GAMI,GAMC,AI3,SIMP,ELECD,
C   CROSAB,EQC,PARTM,TAINT,RATED
      SUBROUTINE EXCT(N,NP,D,OP,NE,N2P,N2,NO,O2,CN,C,T,TV,
1  TE,TARB,UWX,UVC,ESCF,D,NFIN,NFOUT,NPRT1,NPRT2,NFERR,
2  RHO,TEXA,TEXM,TEXM1,FACTAM,FACTRN)
C THIS IS THE CONTROLLING SUBROUTINE FOR CALCULATION OF NONEQUILIBRIUM
C EXCITATION OF ATOMS AND MOLECULES
C N, D, N2+, N2, NO, O2, AND CN ARE CONSIDERED
C USES QUASI-STEADY-STATE ASSUMPTION
C CHUL PARK, OCTOBER 1983
C
C INPUT PARAMETERS
C   N=NUMBER DENSITY OF N ATOMS, CM-3
C   NP=NUMBER DENSITY OF N+ IONS, CM-3
C   D=NUMBER DENSITY OF D ATOMS, CM-3
C   OP=NUMBER DENSITY OF O+ IONS, CM-3
C   NE=ELECTRON DENSITY, CM-3
C   N2P=NUMBER DENSITY OF N2+ IONS, CM-3
C   N2=NUMBER DENSITY OF N2 MOLECULES, CM-3
C   NO=NUMBER DENSITY OF NO MOLECULES, CM-3
C   O2=NUMBER DENSITY OF O2 MOLECULES, CM-3
C   CN=NUMBER DENSITY OF CN MOLECULES, CM-3
C   C=NUMBER DENSITY OF C ATOMS, CM-3
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE
C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   TARB=ARBITRARILY SPECIFIED TEMPERATURE FOR EQUIVALENT EQUILIBRIUM
C   RADIATIVE TRANSFER CALCULATION
C   UWX(JL,ISP)=LINE RADIATION ESCAPE FACTOR FOR THE FIRST 3
C   LW LINES OF ATOMS. ISP=1: N; =2: O.
C   UVC(JL,ISP)=CONTINUUM RADIATION ESCAPE FACTOR FOR THE FIRST
C   3 LW CONTINUA OF ATOMS. ISP=1: N; =2: O.
C   ESCF(M,IB)=RADIATION ESCAPE FACTOR FOR MOLECULES.
C   M=LEVEL NUMBER. IB=MOLECULE NUMBER (1=N2+, 2=N2,
C   3=NO, 4=O2, 5=CN)
C   D=PHYSICAL DEPTH DIMENSION, CM. NEEDED ONLY WHEN UWX AND UVC
C   ARE NOT SPECIFIED
C   NFIN=FILE NUMBER OF EXCITATION DATA INPUT
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT1=PRINT CONTROL FOR EXCITATION DATA INPUT
C   0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C   NPRT2=PRINT CONTROL FOR THERMODYNAMIC DATA INPUT AND OUTPUT
C   0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C   NFERR=FILE NUMBER OF ERROR MESSAGES

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C OUTPUT PARAMETERS
C   RHO(JL,ISP)=NONEQUILIBRIUM POPULATION PARAMETER FOR ATOMS
C       JL=1 TO 22 FOR N. =1 TO 19 FOR O.
C   TEXA(ISP)=EQUIVALENT EXCITATION TEMPERATURE OF ATOMS
C   TEXM(M,IB)=ELECTRONIC EXCITATION TEMPERATURE OF M-TH ELECTRONIC
C       LEVEL OF IB-TH MOLECULE
C   FACTAM(IB)=EFFECTIVE DENSITY MULTIPLICATIVE FACTOR FOR ATOMS
C   FACTRN(JSPEC)=EFFECTIVE DENSITY MULTIPLICATIVE FACTOR FOR
C       20 MOLECULAR SPECTRAL SYSTEMS
C   TEXM1(JSPEC)=SAME AS TEXM, ARRANGED IN THE ORDER OF MOLECULAR
C       SPECTRAL SYSTEMS
C   REAL N,NP,NE,N2P,N2,NO
C   DIMENSION UWX(3,2),UVC(3,2),ESCF(5,5,5),TEXA(2),TEXM(5,5),
C       1 TEXM1(20),FACTAM(2),FACTRN(20),RHO(23,2),ANXA(23,2),
C       2 ANXM(5,5)
C   DATA ITIME/0/

C
C READ EXCITATION INPUT DATA
C   IF(ITIME.NE.0) GO TO 1
C   CALL ATOMIN(NFIN,NFOUT,NPRT1,NFERR)
C   CALL MOLIN(NFIN,NFOUT,NPRT1,NFERR)
C   ITIME=1

C
C CARRY OUT CALCULATION
C   1 CALL EXCTAM(N,NP,O,OP,NE,T,TE,TARB,D,UWX,UVC,NFOUT,NPRT2,
C       1 NFERR,RHO,ANXA,TEXA,FACTAM)
C   CALL MOLEXT(N,NP,O,OP,N2,N2P,O2,NO,CN,C,NE,T,TV,TE,TARB,
C       1 ESCF,NFOUT,NPRT2,NFERR,ANXM,TEXM,FACTRN,TEXM1)
C   RETURN
C   END
*DECK EXCTAM
C   SUBROUTINE EXCTAM(N,NP,O,OP,NE,T,TE,TARB,D,UWX,UVC,NFOUT,
C       1 NPRT,NFERR,RHO,ANX,TEX,FACTAM)
C CALCULATES NONEQUILIBRIUM EXCITATION OF N AND O
C INPUT VARIABLES
C   N=NUMBER DENSITY OF N ATOMS, CM-3
C   NP=NUMBER DENSITY OF N+ IONS, CM-3
C   O=NUMBER DENSITY OF O ATOMS, CM-3
C   OP=NUMBER DENSITY OF O+ IONS, CM-3
C   NE=ELECTRON DENSITY, CM-3
C   T=HEAVY PARTICLE TEMPERATURE, K
C   TE=ELECTRON TEMPERATURE, K
C   TARB=ARBITRARY TEMPERATURE FOR EQUILIBRIUM RADIATIVE
C       TRANSFER CALCULATION
C   D=PHYSICAL DEPTH DIMENSION, CM
C   UWX(JU,JL,ISP)=LINE RADIATION ESCAPE FACTOR FOR THE LOWEST 3
C       STATES
C   UVC(JU,JL,ISP)=CONTINUUM ESCAPE FACTOR FOR THE LOWEST 3 STATES
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C OUTPUT PARAMETERS
C   RHO(JP,ISP)=NONEQUILIBRIUM POPULATION PARAMETER
C       JP=LEVEL NUMBER. ISP=SPECIES NUMBER (1=N, 2=O)
C   ANX(JP,ISP)=NUMBER DENSITY OF JP-TH LEVEL OF ISP-TH ATOM

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C   TEX(ISP)=MEAN EFFECTIVE EXCITATION TEMPERATURE
C   FACTAM(ISP)=DENSITY MULTIPLICATIVE FACTOR
      REAL N,NP,NE
      DIMENSION ANX(23,2),UWX(3,2),UVC(3,2),RHO(23,2),
1     TEX(2),FACTAM(2)
C
C   DETERMINE LINE ESCAPE FACTORS UWX IF D IS FINITE
      IF(D.GT.1.0E-10) CALL ESCAL(N,D,T,TE,D,UWX)
C
C   DETERMINE NONEQUILIBRIUM POPULATION USING QUASI-STEADY-STATE
C   (QSS) ASSUMPTION
      DO 1 ISP=1,2
      IF(ISP.EQ.1) ANN=N
      IF(ISP.EQ.1) ANP=NP
      IF(ISP.EQ.2) ANN=0
      IF(ISP.EQ.2) ANP=0P
      CALL QSS(ISP,TE,NE,ANN,ANP,UWX(1,ISP),UVC(1,ISP),NFOUT,NPRT,
1     > NFERR,RHO(1,ISP),ANX(1,ISP))
1     CONTINUE
C
C   DETERMINE MEAN EQUIVALENT EXCITATION TEMPERATURE TEX AND EFFECTIVE
C   DENSITY MULTIPLICATIVE FACTOR FACTAM
      CALL ARBITA(N,D,ANX,TARB,NFOUT,NPRT,NFERR,TEX,FACTAM)
C
C   WRITE OUT RESULTS
      IF(NPRT.GT.0) WRITE(NFOUT,2) TEX(1),FACTAM(1),TEX(2),FACTAM
1     (2)
2     FORMAT(27H N: EXCITATION TEMPERATURE=,F10.1,2X,
1     1 31H DENSITY MULTIPLICATIVE FACTOR=,1PE10.3/
2     2 27H 0: EXCITATION TEMPERATURE=,0PF10.1,2X,
3     3 31H DENSITY MULTIPLICATIVE FACTOR=,1PE10.3)
      RETURN
      END
*DECK ARBITA
      SUBROUTINE ARBITA(N,D,ANX,TARB,NFOUT,NPRT,NFERR,TEX,FACTAM)
C   CALCULATES MEAN EXCITATION TEMPERATURE TEX AND DENSITY FACTOR
C   FACTAM FOR N AND 0
C   INPUT PARAMETERS
C   N=NUMBER DENSITY OF N, CM-3
C   0=NUMBER DENSITY OF 0, CM-3
C   ANX(JP,ISP)=NUMBR DENSITY OF JP-TH LEVEL OF ISP-TH ATOM
C   TARB=ARBITRARILY SPECIFIED TEMPERATURE FOR EQUILIBRIUM RADIATION
C   CALCULATION
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   OUTPUT PARAMETERS
C   TEX(ISP)=EFFECTIVE EXCITATION TEMPERATURE, K
C   FACTAM(ISP)=DENSITY MULTIPLICATIVE FACTOR
      REAL N
      COMMON/EXCTA/ELEV(23,2),STWT(23,2),AL(23,23,2),
1     HAV(23,23,2),EION(2),EIONA(2),NLEV(2),TERM(7,23,2),
2     LLEV,GP(4,2),EP(4,2),ATOMX(2,2),CN(23,2),AN(23,2)
      DIMENSION ANX(23,2),TEX(2),FACTAM(2)

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C
  DO 1 ISP=1,2
    MLEV=NLEV(ISP)
    MLEV1=MLEV-1
    IF(ISP.EQ.1) ANT=N
    IF(ISP.EQ.2) ANT=0
C
C CALCULATE TRUE NONEQUILIBRIUM RADIATION POWER IN VISIBLE RANGE
  RADT=0.
  DO 2 JL=4,MLEV1
    JUL=JL+1
    DO 2 JU=JUL,MLEV
      2 RADT=RADT+ANX(JU,ISP)*AL(JU,JL,ISP)*(ELEV(JU,ISP)-ELEV(JL,ISP))
C
C DETERMINE THE LEAST POSSIBLE EXCITATION TEMPERATURE
  TEX(ISP)=100000.
  DO 12 K=4,MLEV
    TEXX=-1.43877+ELEV(K,ISP)/ALOG(ANX(K,ISP)*STWT(1,ISP)/
    1 (ANX(1,ISP)*STWT(K,ISP)))
    TEX(ISP)=AMIN1(TEX(ISP),TEXX)
  12 CONTINUE
C
C ITERATE OVER TEX
  ITER=0
  TEX1=0.
  RAD=0.
  RAD1=0.
  3 CONTINUE
  ITER=ITER+1
C
C CALCULATE PARTITION FUNCTION FOR TEX
  Q=0.
  DO 4 JP=1,MLEV
    Q=Q+STWT(JP,ISP)*EXP(-1.43877+ELEV(JP,ISP)/TEX(ISP))
  4 CONTINUE
C
C CALCULATE RADIATION BASED ON ASSUMED TEX
  DO 5 JL=4,MLEV1
    JUL=JL+1
    DO 5 JU=JUL,MLEV
      IF(AL(JU,JL,ISP).LT.1.) GO TO 5
      RAD=RAD+AL(JU,JL,ISP)*STWT(JU,ISP)*EXP(-1.43877*
      1 ELEV(JU,ISP)/TEX(ISP))*ANT*(ELEV(JU,ISP)-ELEV(JL,
      2 ISP))/Q
    5 CONTINUE
    IF(RAD.GT.RADT) GO TO 6
    RAD1=RAD
    TEX1=TEX(ISP)
    TEX(ISP)=TEX(ISP)+10.
    IF(ITER.LT.1000) GO TO 3
    WRITE(NFERR,10)ISP
  10 FORMAT(48H CAN NOT FIND EXCITATION TEMPERATURE FOR SPECIES, 12)
  STOP
  6 TEX(ISP)=TEX1+(TEX(ISP)-TEX1)*(RADT-RAD1)/(RAD-RAD1)

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C
C DETERMINE DENSITY MULTIPLICATIVE FACTOR
  Q=0.
  DO 7 JP=1,MLEV
  7 Q=Q+STWT(JP,ISP)*EXP(-1.43877*ELEV(JP,ISP)/TARB)
  RAD=0.
  DO 8 JL=4,MLEV1
  JU1=JL+1
  DO 8 JU=JU1,MLEV
  8 RAD=RAD+ANT*AL(JU,JL,ISP)*STWT(JU,ISP)*EXP(-1.43877*
  1 ELEV(JU,ISP)/TARB)*(ELEV(JU,ISP)-ELEV(JL,ISP))/Q
  FACTAM(ISP)=RADT/RAD
  1 CONTINUE
  RETURN
  END
*DECK ESCAL
  SUBROUTINE ESCAL(N,O,T,TE,D,UWX)
C CALCULATE LINE RADIATION ESCAPE FACTORS FOR N AND O ASSUMING
C ISOLATED LINES WITH DOPPLER PROFILE
C CONSIDERS ONLY THE STRONGEST TRANSITIONS
C INPUT VARIABLES
C   N=NUMBER DENSITY OF N ATOMS, CM-3
C   O=NUMBER DENSITY OF O ATOMS, CM-3
C   T=HEAVY PARTICLE TEMPERATURE, K
C   TE=ELECTRON TEMPERATURE, K
C   D=PHYSICAL DEPTH DIMENSION, CM
C OUTPUT PARAMETERS
C   UWX(JL,IB)=ESCAPE FACTORS FOR THE LINES WITH LOWER STATE
C   JL, FOR IB-TH ATOM
  REAL N
  DIMENSION WAVEL(13),GL(13),GU(13),F(13),UWX(3,2),ELEV(3,2),
  1 GLEV(3,2),ATOMWT(2),IND(3,13),RADT(3,2)
  DATA WAVEL/1199.55,1200.22, 1200.71, 1492.62,1494.67,1492.67,
  1 1742.73,1745.25,1745.26, 1742.72, 1302.17,1408.87,1306.04/
  DATA GL/4.,4.,4., 6.,4.,4., 4.,2.,4.,2., 5.,3.,1./
  DATA GU/6.,4.,2., 4.,2.,4., 4.,2.,2.,4., 3.,3.,3./
  DATA F/0.18,0.11,0.059, 0.12,0.984,0.019,
  1 0.082,0.059,0.015,0.032, 0.031,0.032,0.031/
  DATA GLEV/ 4.,10.,6., 9.,5.,1./
  DATA ELEV/0.,15228.,28840., 0.,15868.,33792./
  DATA ATOMWT/14.007,16./
C IND(1,L)=UPPER STATE INDEX. (2,L)=LOWER STATE INDEX. (3,L)=MOLECULE INDEX
  DATA IND/4,1,1, 4,1,1, 4,1,1, 5,2,1, 5,2,1, 5,2,1,
  >5,3,1, 5,3,1, 5,3,1, 5,3,1, 5,1,2, 5,1,2, 5,1,2/
C
C PRESET UWX AND RADT TO ZERO
  DO 2 IB=1,2
  DO 2 JL=1,3
  RADT(JL,IB)=0.
  2 UWX(JL,IB)=0.
C
C CALCULATE
  DO 1 L=1,13
  JU=IND(1,L)
  JL=IND(2,L)

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IB=IND(3,L)
IF (IB.EQ.1) ANLL=N
IF (IB.EQ.2) ANLL=0
ANL=ANLL*(GL(L)/GLEV(1,IB))*EXP(-1.43877*ELEV(JL,IB)/TE)
DE=1.0E6/WAVEL(L)
UXX=GBAR(NL,D,ATOM*MT(1B),GU(L),GL(L),F(JL),DE,T)
A=0.687*(GL(L)/GU(L))*F(L)*1.0E16/WAVEL(L)**2
RADT(JL,IB)=RADT(JL,IB)+GU(L)*A
UXX(JL,IB)=UXX*GU(L)*A+UXX(JL,IB)
1 CONTINUE
DO 3 IB=1,2
DO 3 JL=1,3
IF(RADT(JL,IB).LT.1.0E-20) GO TO 3
UXX(JL,IB)=UXX(JL,IB)/RADT(JL,IB)
3 CONTINUE
RETURN
END
*DECK GBAR
FUNCTION GBAR(NL,D,M,GU,GL,F,DE,T)
C EVALUATES LINE RADIATION ESCPE FACTOR ASSUMING A DOPPLER PROFILE
C INPUT PARAMETERS
C NL=NUMBER DENSITY OF LOWER STATE, CM-3
C D=DIAMETER, CM
C M=ATOMIC WEIGHT
C GU=UPPER STATE STATISTICAL WEIGHT
C GL=LOWER STATE STATISTICAL WEIGHT
C F=OSCILLATOR STRENGTH
C DE=ENERGY GAP, CM-1
C T=TEMPERATURE, K
C OUTPUT PARAMETER
C GBAR=ESCAPE FACTOR
REAL NL,M
TAU=NL*D*SORT(M/T)*GL*F/(8.60E5*GU*DE)
IF(TAU.GT.4.0) GO TO 3
TAUP = 1.0
HSUM = 0.0
SIGN = -1.0
HNFAC = 1.0
HN = 1.0
1 TAUP = TAUP*TAU
SIGN = -1.0*SIGN
HNFAC = HNFAC*HN
HTER = SIGN*TAUP/(SQRT(HN+1.0)*HNFAC)
HSUM = HSUM + HTER
HN = HN+1.0
IF(HN.LT.15.0) GO TO 1
GBAR = 1.0-HSUM
GO TO 2
2 GBAR = 1.0/(TAU*SORT(3.142*ALOG(TAU)))
2 RETURN
END
*DECK ATOMIN
SUBROUTINE ATOMIN(NFIN,NFOUT,IPRT,NFERR)
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C READ IN DATA FOR CALCULATION OF NONEQUILIBRIUM EXCITATION OF AIR
C   ATOMS: N AND O
C ENERGY LEVELS EXTEND TO N=10
C INPUT PARAMETERS
C   NFIN=FILE NUMBER OF INPUT DATA
C   NFOUT=FILE NUMBER OF OUTPUT PRINT
C   IPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   COMMON/EXCTA/ELEV(23,2),STWT(23,2),AL(23,23,2),
1   HAV(23,23,2),EION(2),EIONA(2),NLEV(2),TERM(7,23,2),
2   LLEV,GP(4,2),EP(4,2),ATOMX(2,2),CN(23,2),AN(23,2)
C
C CYCLE OVER TWO SPECIES
  DO 11 ISP=1,2
C
C READ IN ENERGY LEVEL DATA
  READ(NFIN,22) ATOMX(1,ISP),ATOMX(2,ISP),EIONA(ISP),(GP(I,ISP),
1 I=1,4),(EP(I,ISP),I=1,4)
22 FORMAT(1X,2A4,1X,E10.3/8E10.3)
  IF(IPRT.NE.0)WRITE(NFOUT,23)ATOMX(1,ISP),ATOMX(2,ISP),EIONA(
1 ISP),(GP(I,ISP),I=1,4),(EP(I,ISP),I=1,4)
23 FORMAT(/1X,2A4,2X,5HEION=,F10.1,5H CM-1/
1 5H ION:,2X,2HG=,4F7.1,2X,2HE=,4F8.1/
EDEL=109679./121.
EION(ISP)= EIONA(ISP)-EDEL
LLEV=3
C
C SET COEFFICIENTS TO ZERO
  DO 301JL = 1,23
  DO 302JU = 1,23
  HAV(JL,JU,ISP) = 1.0E-15
302 AL(JL,JU,ISP)=0.
  CN(JL,ISP)=0.
301 AN(JL,ISP)=0.
C
C READ IN ENERGY LEVEL DATA
  IF(IPRT.GT.1) WRITE(NFOUT,24)
24 FORMAT(/32H  JP  N  ELEV  STWT  )
  J=0
1 J=J+1
  READ(NFIN,2)M,M1,ELEV(J,ISP),STWT(J,ISP),(TERM(I,J,ISP),I=1,7)
  IF(IPRT.GT.1)WRITE(NFOUT,3) M,M1, ELEV(J,ISP),STWT(J,ISP)
  > ,(TERM(I,J,ISP),I=1,7)
2 FORMAT(2I5, 2E10.3,7(A4))
3 FORMAT(2I5,F10.0,F10.0,7(A4))
  IF(STWT(J,ISP).GT.0.5) GO TO 1
  NLEV(ISP)=J-1
C
C READ IN LINE DATA
  IF(IPRT.GT.1) WRITE(NFOUT,6)
6 FORMAT(/22H  JL  JU  AL(JU,JL)  )
  J=0

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4 J=J+1
  READ(NFIN,2)JL,JU,AZ
  IF(IPRT.GT.1) WRITE(NFOUT,5) JL,JU,AZ
  IF(JU.EQ.0) GO TO 18
  AL(JL,JU,ISP) = AZ
  AL(JU,JL,ISP)=AZ
  GO TO 4
5 FORMAT(2I5,1PE10.3)
18 CONTINUE

C
C READ IN CONTINUUM DATA
  IF(IPRT.GT.1) WRITE (NFOUT,85)
85 FORMAT(1H0,1X,33HCONTINUUM ABSORPTION COEFFICIENTS/)
  M=0
87 M=M+1
55 FORMAT (I10,2E10.3)
  READ (NFIN,55) JP,CZ,ANZ
  IF(IPRT.GT.1) WRITE(NFOUT,55) JP,CZ,ANZ
  IF(JP.EQ.0) GO TO 28
  AN(JP,ISP)=ANZ
  CN(JP,ISP)=CZ
  GO TO 87
28 CONTINUE

C
C READ IN COLLISIONAL EXCITATION RATE DATA
  IF(IPRT.GT.1) WRITE(NFOUT,17)
17 FORMAT(29H COLLISIONAL EXCITATION RATES)
10 READ(NFIN,7) J1,K1,A1,E1,J2,K2,A2,E2,J3,K3,A3,E3,J4,K4,A4,E4
7 FORMAT(4(2I3,1PE8.1,0PF5.2))
  IF(J1) 8,8,9
9 IF(IPRT.GT.1)
  >WRITE(NFOUT,7)J1,K1,A1,E1,J2,K2,A2,E2,J3,K3,A3,E3,J4,K4,A4,E4
  IF(K1.LE.NLEV(ISP)) HAV(J1,K1,ISP) = A1
  IF(K1.LE.NLEV(ISP)) HAV(K1,J1,ISP) = E1
  IF(K2.LE.NLEV(ISP)) HAV(J2,K2,ISP) = A2
  IF(K2.LE.NLEV(ISP)) HAV(K2,J2,ISP) = E2
  IF(K3.LE.NLEV(ISP)) HAV(J3,K3,ISP) = A3
  IF(K3.LE.NLEV(ISP)) HAV(K3,J3,ISP) = E3
  IF(K4.LE.NLEV(ISP)) HAV(J4,K4,ISP) = A4
  IF(K4.LE.NLEV(ISP)) HAV(K4,J4,ISP) = E4
  GO TO 10
8 CONTINUE

C
C CONSTRUCT WORKING EXCITATION RATE COEFFICIENTS
  NLEV1 = NLEV(ISP) - 1
  MLEV=NLEV(ISP)
  DO 12 JP = 1,NLEV1
  JQ1=JP+1
  DO 13 JQ=JQ1,MLEV
  IF(JP.EQ.JQ) GO TO 13
  EPX=EION(ISP)-ELEV(JP,ISP)
  EQ=EION(ISP)-ELEV(JQ,ISP)
  AP = SQRT(109679.0/EPX)
  AQ = SQRT(109679.0/EQ)

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FA = AP**5 * AQ**5 * (1.0/AP**2 - 1.0/AQ**2)**4
HAV(JP,JQ,ISP) =HAV(JP,JQ,ISP) * STWT(JQ,ISP)/FA
13 CONTINUE
12 CONTINUE
11 CONTINUE
RETURN
END
*DECK QSS
SUBROUTINE QSS(ISP,TEMP,EDEN,ANN,ANION,UUX,UVC,NFOUT,NPRT,
1 NFERR,RHO,ANX)
C CALCULATE NONEQUILIBRIUM POPULATION ASSUMING QUASI-STEADY-STATE
C
C INPUT VARIABLES
C ISP=SPECIES INDEX. 1=N,2=0
C TEMP=ELECTRON TEMPERATURE,K
C EDEN=ELECTRON DENSITY,CM-3
c ann=atom density, cm-3
C ANION=ION DENSITY, CM-3
C UUX=U.V. LINE ESCAPE FACTOR, DIMENSIONED 3
C UVC=U.V. CONTINUUM ESCAPE FACTOR, DIMENSIONED 3
C NFOUT=FILE NUMBER OF OUTPUT PRINTS
C NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C NFERR=FILE NUMBER OF ERROR MESSAGES
C OUTPUT VARIABLES
C RHO=NONEQUILIBRIUM POPULATION, DIMENSIONED 23
c anx=number density, dimensioned 23
COMMON/EXCTA/ELEV(23,2),STWT(23,2),AL(23,23,2),
1 HAV(23,23,2),EION(2),EIONA(2),NLEV(2),TERM(7,23,2),
2 LLEV,GP(4,2),EP(4,2),ATOMX(2,2),CN(23,2),AN(23,2)
DIMENSION APEN(23),BK(23,2),BKPC(23),C(23,23),RHO(23),UUX(3)
1,BKPG(23,23),UVC(3),UWL(23),ANX(23)
EXTERNAL EONE
C
C SET NET OPTICAL TRANSITION RATES
LLEV1=LLEV+1
MLEV=NLEV(ISP)
DO 25 JQ=1,LLEV
DO 25 JP=LLEV1,MLEV
25 AL(JQ,JP,ISP)=UUX(JQ)*AL(JP,JQ,ISP)
DO 15 JP=1,MLEV
UWL(JP)=1.0
IF(JP.LE.LLEV) UWL(JP)=UVC(JP)
15 CONTINUE
C
C SET BKPG TO ZERO
DO 26 JL=1,MLEV
DO 26 JU=1,MLEV
26 BKPG(JL,JU)=0.
C
C SET UP ION PARTITION FUNCTION AND RELATED PARAMETERS
TEMP1=1.0/TEMP
TEMP2=SQRT(TEMP1)
TEMP3=TEMP1*TEMP2
PARTI=0.
DO 14 JP=1,4

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14 PARTI=PARTI+GP(JP,ISP)*EXP(-1.43877*EP(JP,ISP)*TEMP1)
   AZ=2.07E-16*AN!ON*TEMP3/PARTI
C
C GENERATE BKPQ FOR UPWARD TRANSITIONS
   MLEV1=MLEV-1
   DO 18 JL=1,MLEV1
     JU1=JL+1
     DO 18 JU=JU1,MLEV
       18 BKPQ(JL,JU)=HAU(JL,JU,ISP)*(0.0001*TEMP)**HAU(JU,JL,
         > ISP)*EXP(-1.43877*(ELEV(JU,ISP)-ELEV(JL,ISP))*TEMP1)
C
C CONSTRUCT COEFFICIENTS APEN AND BKPC ARRAYS
   DO 22 JP = 1,MLEV
     EPX= EIONA(ISP)- ELEV (JP,ISP)
     EKT = 1.43877 *EPX*TEMP1
     APEN(JP)=AZ*STWT(JP,ISP)*EXP(EKT)
     EKT1 = 0.56 + EKT
     SUM = 0.62 * EONE(EKT)/EKT - 0.534 * EONE(EKT1)/EKT1
     22 BKPC(JP) = 5.45 * SUM * TEMP3
C
C GENERATE BKPQ FOR DOWNWARD TRANSITION
   DO 3 JL=1,MLEV1
     JU1=JL+1
     DO 3 JU=JU1,MLEV
       3 BKPQ(JU,JL)=(APEN(JL)/APEN(JU))*BKPQ(JL,JU)
C
C DETERMINE NONEQUILIBRIUM PARAMETER CHI
   ANAEQ=0.
   DO 23 JP=1,MLEV
     23 ANAEQ=ANAEQ+APEN(JP)
     ANEQ=ANAEQ*EDEN
     CHI=ANN/ANEQ
C
C CONSTRUCT LHS MATRIX IN QSS EQUATION
   EDEN1 = 1.0 /EDEN
   DO 5 JP = 1, MLEV
     DO 7 JQ = 1, MLEV
       IF(JP.GT.1) GO TO 8
       C(JP,JQ) = APEN(JQ)
       GO TO 7
     8 IF (JP - JQ ) 2,9,17
     2 C(JP,JQ)=BKPQ (JP,JQ)+APEN(JQ)*AL(JP,JQ,ISP)/(APEN(JP)*EDEN)
       GO TO 11
     17 C(JP,JQ) = BKPQ(JP,JQ)
       GO TO 11
     9 C(JP,JQ ) = - BKPC (JP)
       DO 12 JQS = 1, MLEV
         IF (JQS - JP) 43,12,19
     43 C(JP,JQ)= C(JP,JQ) -BKPQ (JP, JQS)-AL(JQS,JP,ISP) * EDEN1
       GO TO 12
     19 C(JP,JQ)= C(JP,JQ)- BKPQ(JP,JQS)
     12 CONTINUE
     11 CONTINUE
     7 CONTINUE
     5 CONTINUE

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ORIGINAL FACTOR
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C
C NORMALIZE LHS OF QSS EQUATION
  DET = 0.0
  DO 10 JP=1,MLEV
  DO 10 JQ=1,MLEV
10 DET = DET+ ABS(C(JP,JQ))
  DET = 2.0 *(ALOG(EDEN) - 20.0 )*FLOAT(MLEV*MLEV) *
  1(1.0E4/TEMP)**1.2 /DET
  DO 13 JP=1,MLEV
  DO 13 JQ=1,MLEV
13 C(JP,JQ) = C(JP,JQ) * DET
C
C CONSTRUCT RHS OF QSS EQUATION
  BK(1,1) = 0.0
  BK(1,2) = DET
  DO 55 JP = 2,MLEV
  BK(JP,1)=- (BKPC(JP)+UUL(JP)*CN(JP,ISP)*(0.0001*TEMP)**AN(JP,
  >ISP)/APEN(JP))*DET
  BK(JP,2) = 0.0
55 CONTINUE
C
C SOLVE QSS EQUATION
  CALL MINV (C, MLEV,BK, 2, DETERM)
C
C CONSTRUCT NORMALIZED POPULATION RHO AND NUMBER DENSITY ANX
  DO 6 JP=1,MLEV
  BK(JP,2)=BK(JP,2)*ANAEQ
  RHO(JP)=BK(JP,1)+BK(JP,2)*CHI
  ANX(JP)=(APEN(JP)*EDEN)*RHO(JP)
  6 CONTINUE
C
C WRITE OUT RESULTS
  IF(NPRT.LT.2) RETURN
  WRITE(NFOUT,1) (ATOMX(I,ISP),I=1,2)
  1 FORMAT(/1X, 2A4/
  1 46H JP STWT ELEV RHO TERM )
  DO 20 JP=1,MLEV
  WRITE(NFOUT,16) JP,STWT(JP,ISP),ELEV(JP,ISP),RHO(JP),(TERM
  1 (I,JP,ISP),I=1,7)
  16 FORMAT(15,F10.0,F10.1,1PE10.3,7(A4))
  20 CONTINUE
  RETURN
  END
*DECK MINV
  SUBROUTINE MINV(A,N,B,M,DETERM)
C MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
  DIMENSION IPIVOT(23),PIVOT(23),INDEX(23,2)
  DIMENSION A(23,23),B(23,2)
  EQUIVALENCE (IROW,JROW),(ICOL,JCOL),(AMAX,T,SWAP)
C
C INITIALIZATION
  10 DETERM=1.0
  15 DO 20 J=1,N
  20 IPIVOT(J)=0

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30 DO 550 I=1,N
40 AMAX=0.0
C
C SEARCH FOR PIVOT ELEMENT
45 DO 105 J=1,N
50 IF(IPIVOT(J)-1) 60,105,60
60 DO 100 K=1,N
70 IF(IPIVOT(K)-1) 80,100,740
80 IF(ABS(AMAX)-ABS(A(J,K))) 85,100,100
85 IROW=J
90 ICOLUM=K
95 AMAX=A(J,K)
100 CONTINUE
105 CONTINUE
110 IPIVOT(ICOLUM)=IPIVOT(ICOLUM)+1
C
C INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
130 IF(IROW-ICOLUM) 140,260,140
140 DETERM=-DETERM
150 DO 200 L=1,N
160 SWAP=A(IROW,L)
170 A(IROW,L)=A(ICOLUM,L)
200 A(ICOLUM,L)=SWAP
205 IF(M) 260,260,210
210 DO 250 L=1,M
220 SWAP=B(IROW,L)
230 B(IROW,L)=B(ICOLUM,L)
250 B(ICOLUM,L)=SWAP
260 INDEX(I,1)=IROW
270 INDEX(I,2)=ICOLUM
310 PIVOT(I)=A(ICOLUM,ICOLUM)
320 DETERM=DETERM*PIVOT(I)
C
C DIVIDE PIVOT ROW BY PIVOT ELEMENT
330 A(ICOLUM,ICOLUM)=1.0
340 DO 350 L=1,N
350 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT(I)
355 IF(M) 380,380,360
360 DO 370 L=1,M
370 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT(I)
C
C REDUCE NON-PIVOT ROWS
380 DO 550 L1=1,N
390 IF(L1-ICOLUM) 400,550,400
400 T=A(L1,ICOLUM)
420 A(L1,ICOLUM)=0.0
430 DO 450 L=1,N
450 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
455 IF(M) 550,550,460
460 DO 500 L=1,M
500 B(L1,L)=B(L1,L)-B(ICOLUM,L)*T
550 CONTINUE

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C
C INTERCHANGE COLUMNS
600 DO 710 I=1,N
610 L=N+1-I
620 IF(INDEX(L,1)-INDEX(L,2)) 630,710,630
630 JROW=INDEX(L,1)
640 JCOLUM=INDEX(L,2)
650 DO 705 K=1,N
660 SWAP=A(K,JROW)
670 A(K,JROW)=A(K,JCOLUM)
700 A(K,JCOLUM)=SWAP
705 CONTINUE
710 CONTINUE
740 RETURN
END
*DECK EONE
FUNCTION EONE(W)
IF(W.LE.1.) GO TO 1
W1 = 1.0/W
UP = W**3*(8.57333 +18.05902 *W1+8.63476 *W1**2+0.267774 *
1 W1**3)
DOWN = W**3*(9.57332 +25.63296 *W1+21.09965 *W1**2+3.958497 *
1 W1**3)
EONE = ((W**4 + UP)/(W**4 + DOWN))/(W * EXP(W))
GO TO 20
1 SUM = -0.577216 +0.999992 *W-0.249911 *W**2+ 0.0551997 *W**3
1 -0.00976004 *W**4+0.00107857 *W**5
EONE = -ALOG(W) + SUM
20 CONTINUE
RETURN
END
*DECK MOLIN
SUBROUTINE MOLIN(NFIN,NFOUT,NPRT,NFERR)
C READS AND DIGESTS MOLECULAR LEVEL DATA
COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
1 5),ILST(3,6,5),QAV(22,28,21),EE(8,21),SIGMA(8,21),
2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
DIMENSION TITLE(20)
C
C VARIABLES
C IB=BAND INDEX, FROM 1 TO 5
C AMOLEC(1-2,IB)=NAME OF BAND
C (3,IB)=MOLECULAR WEIGHT
C LMOLEC(1,IB)=NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION
C DATA SET. MAXIMUM 4 ALLOWED
C (2,IB)=NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION
C DATA SET. MAXIMUM 6 ALLOWED
C (3,IB)=NUMBER OF ENERGY LEVELS. MAXIMUM 8 ALLOWED
C (4,IB)=NUMBER OF FIRST FEW ELECTRONIC LEVELS
C FOR WHICH QUASI-STEADY-STATE CALCULATION IS MADE
C MAXIMUM 4 ALLOWED
C SPEC2(I,J,IB)=MOLECULAR CONSTANTS, CM-1
C (1,J,IB)=ELECTRONIC DEGENERACY
C (2,J,IB)=ELECTRONIC TERM VALUE
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C      (3,J,IB)=WE
C      (4,J,IB)=WEXE
C      (5,J,IB)=WEYE
C      (6,J,IB)=WEZE
C      (7,J,IB)=BE
C      (8,J,IB)=ALPHA
C      ATOM(I,J,IB)=ATOMS AT DISSOCIATION LIMIT
C          J=1,2 TWO ATOMS
C      (1-2,J,IB)=NAME
C      (3,J,IB)=ATOMIC WEIGHT
C      (4,J,IB)=DISSOCIATION ENERGY, CM-1
C      (5,J,IB)=STATISTICAL WEIGHT
C      ILST(1-2,IT,IB)=LOWER AND UPPER ELECTRONIC STATE INDEX.
C      (3,IT,IB)=IORD(THE THIRD DIMENSION IN QVV ARRAY)
C      IT=TRANSITION NUMBER IN A MOLECULE
C      QVV(V1,V2,IORD)=FRANCK-CONDON FACTOR. V1,V2=UPPER AND LOWER
C          STATE. IORD=RUNNING ORDER
C      ED(1-8,IT,IB)=ELECTRON ENERGY, EV, FOR DISSOCIATION CROSS-
C          SECTIONS
C      SIGMD(1-8,IT,IB)=CROSS-SECTIONS, CM2, FOR DISSOCIATION
C      EE(1-8,IT,IB)=ELECTRON ENERGY, EV, FOR EXCITATION CROSS-
C          SECTIONS
C      SIGMA(1-8,IT,IB)=CROSS-SECTION, CM2, FOR EXCITATION
C      UNIT(1-2,IB)=UNIT OF EE AND SIGMA, A3, (EV OR RYD, CM2 OR
C          PIA02)
C
C START CYCLE OVER SPECIES
C      IORD=0
C      DO 21 IB=1,5
C
C READ MOLECULAR CONSTANTS
C      READ(NFIN,22) (AMOLEC(I,IB),I=1,3),(LMOLEC(I,IB),I=1,4)
C      22 FORMAT(1X,2A3,3X,F10.3,6I5)
C      IF(NPRT.GT.0) WRITE(NFOUT,23) (AMOLEC(I,IB),I=1,3),(LMOLEC(I,IB),
C          1 I=1,4)
C      23 FORMAT(//21H MOLECULAR BAND NAME=,2A3,19H MOLECULAR WEIGHT=,F10.
C          1 3/58H NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION SET=,
C          2 12/58H NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION SET =,
C          > 12/58H NUMBER OF ELECTRONIC LEVELS =,
C          > 12/58H NUMBER OF LEVELS IN QUASI-STEADY-STATE CALC. =,
C          3 I2 /80H DEGEN
C          5 TERM WE WEXE WEYE WEZE BE AL
C          6PHA )
C      N1=LMOLEC(3,IB)
C      IF(N1.GT.10) WRITE(NFERR,20) (AMOLEC(I,IB),I=1,2),N1
C      20 FORMAT(15H ERROR IN DATA.,2X,2A3,2X,3HNI=,I3)
C      DO 26 JN=1,N1
C      READ(NFIN,6) (SPEC2(I,JN,IB),I=1,8)
C      6 FORMAT(8E10.3)
C      IF(NPRT.GT.1) WRITE(NFOUT,28) (SPEC2(I,JN,IB),I=1,8)
C      28 FORMAT(6F10.3,F10.5,1PE10.3)
C      26 CONTINUE

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C
C READ THE ATOMIC STATES RESULTING FROM DISSOCIATION
  IF(NPRT.GT.1) WRITE(NFOUT,3)
  3 FORMAT(/18H DISSOCIATED STATE )
  DO 1 J=1,2
  READ(NFIN,2) (ATOM(I,J,IB),I=1,5)
  2 FORMAT(1X,2A3,3X,7E10.3)
  IF(NPRT.GT.1) WRITE(NFOUT,4) (ATOM(I,J,IB),I=1,5)
  4 FORMAT(1X,2A3,3X,10HATOM. WT.=,F8.3,2X,15HDISSOC. ENERGY=,F9.0,
  1 5H CM-1,2X,16HSTATISTICAL WT.=,F5.1)
  1 CONTINUE

C
C SET RADIATIVE TRANSITION PROBABILITIES TO ZERO
  DO 32 I=1,4
  DO 32 J=1,4
  32 ARAD(I,J,IB)=0.

C
C READ IN ELECTRON-IMPACT DISSOCIATION CROSS-SECTION DATA
  NDIS=LMOLEC(1,IB)
  IF(NDIS.EQ.0) GO TO 33
  IF(NPRT.GT.1) WRITE(NFOUT,35)
  35 FORMAT(/44H ELECTRON-IMPACT DISSOCIATION CROSS-SECTIONS )
  DO 34 IDIS=1,NDIS
  READ(NFIN,12) (TITLE(I),I=1,20)
  IF(NPRT.GT.1) WRITE(NFOUT,12) (TITLE(I),I=1,20)
  READ(NFIN,15) (ED(I,IDIS,IB),I=1,8)
  IF(NPRT.GT.1) WRITE(NFOUT,16) (ED(I,IDIS,IB),I=1,8)
  READ(NFIN,15) (SIGMD(I,IDIS,IB),I=1,8)
  IF(NPRT.GT.1) WRITE(NFOUT,17) (SIGMD(I,IDIS,IB),I=1,8)
  34 CONTINUE
  33 CONTINUE

C
C READ FRANCK-CONDON FACTORS FOR CALCULATING ELECTRON-IMPACT EXCITATION
C RATES
  NT=LMOLEC(2,IB)
  IF(NT.EQ.0) GOTO 11
  IF(NPRT.GT.1) WRITE(NFOUT,36)
  36 FORMAT(/26H FRANCK-CONDON FACTOR DATA )
  DO 5 IT=1,NT
  IORD=IORD+1
  IF(NPRT.GT.1)WRITE(NFOUT,29) IORD
  29 FORMAT(6H IORD=,I3)
  ILST(3,IT,IB)=IORD
  DO 18 I=1,22
  DO 18 J=1,28
  18 QW(I,J,IORD)=0.
  READ(NFIN,7) SPELL1,SPELL2,(ILST(I,IT,IB),I=1,2),NCARD
  7 FORMAT(1X,2A3,3X,3I5)
  IF(NPRT.GT.1) WRITE(NFOUT,8)SPELL1,SPELL2,(ILST(I,IT,IB),I=
  >1,2),NCARD
  8 FORMAT(1X,2A3,3X,12HLOWER STATE=,I2,2X,12HUPPER STATE=,I2,
  1 3X,16HNUMBER OF CARDS=,I3)
  DO 9 ICARD=1,NCARD
  READ(NFIN,10) J1,J2,F1,J3,J4,F2,J5,J6,F3,J7,J8,F4,J9,J10,F5
  10 FORMAT(5(2I3,E10.3))

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19 FORMAT(1X,5(2I3,1PE10.3))
   IF((J1.LT.20).AND.(J2.LT.28))QW(J1+1,J2+1,IORD)=F1
   IF((J3.LT.20).AND.(J4.LT.28))QW(J3+1,J4+1,IORD)=F2
   IF((J5.LT.20).AND.(J6.LT.28)) QW(J5+1,J6+1,IORD)=F3
   IF((J7.LT.20).AND.(J8.LT.28)) QW(J7+1,J8+1,IORD)=F4
   IF((J9.LT.20).AND.(J10.LT.20))QW(J9+1,J10+1,IORD)=F5
   IF(NPRT.GT.1) WRITE(NFOUT,19)J1,J2,QW(J1+1,J2+1,IORD),
1   J3,J4,QW(J3+1,J4+1,IORD),J5,J6,QW(J5+1,J6+1,IORD),
2   J7,J8,QW(J7+1,J8+1,IORD),J9,J10,QW(J9+1,J10+1,IORD)
9 CONTINUE
C
C READ ELECTRON-IMPACT EXCITATION CROSS-SECTION DATA
C CROSS-SECTIONS ARE FOR FRANCK-CONDON FACTOR OF UNITY
   READ(NFIN,12) (TITLE(I),I=1,20)
12 FORMAT(20A4)
   IF(NPRT.GT.1) WRITE(NFOUT,12) (TITLE(I),I=1,20)
   READ(NFIN,15) (EE(I,IORD),I=1,8)
15 FORMAT(8E10.3)
   IF(NPRT.GT.1) WRITE(NFOUT,16) (EE(I,IORD),I=1,8)
16 FORMAT(17H ELECTRON ENERGY=,8F10.2)
   READ(NFIN,15) (SIGMA(I,IORD),I=1,8)
   IF(NPRT.GT.1) WRITE(NFOUT,17) (SIGMA(I,IORD),I=1,8)
17 FORMAT(17H CROSS SECTION =,1P8E10.3)
C
C READ RADIATIVE TRANSITION PROBABILITY
   ML=ILST(1,IT,IB)
   MU=ILST(2,IT,IB)
   READ(NFIN,15) ARAD(MU,ML,IB)
   IF(NPRT.GT.1) WRITE(NFOUT,30) ARAD(MU,ML,IB)
30 FORMAT(34H RADIATIVE TRANSITION PROBABILITY=,1PE10.3)
C
5 CONTINUE
C
11 CONTINUE
21 CONTINUE
   RETURN
   END
*DECK MOLEXT
   SUBROUTINE MOLEXT(N,NP,O,OP,N2,N2P,O2,NO,CN,C,NE,T,TV,TE,TARB,
1   ESCF, NFOUT,NPRT,NFERR,ANX,TEX,FACTRN,TEX1)
C CALCULATE NONEQUILIBRIUM EXCITATION OF MOLECULES
C INPUT PARAMETERS
C   N=NUMBER DENSITY OF N
C   NP=NUMBER DENSITY OF N+
C   O=NUMBER DENSITY OF O
C   OP=NUMBER DENSITY OF O+
C   N2=NUMBER DENSITY OF N2
C   N2P=NUMBER DENSITY OF N2+
C   O2=NUMBER DENSITY OF O2
C   NO=NUMBER DENSITY OF NO
C   CN=NUMBER DENSITY OF CN
C   C=NUMBER DENSITY OF C
C   NE=ELECTRON DENSITY
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE

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C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   TARB=ARBITRARY TEMPERATURE FOR EQUILIBRIUM RADIATION CALCULATION
C   ESCF(MU,ML,IB)=LINE RADIATION ESCAPE FACTOR, FROM MU TO ML
C   NFOUT=FILE NUMBER OF OUTPUT PRINT
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   OUTPUT PARAMETERS
C   ANX(M,IB)=NUMBER DENSITY OF M-TH ELECTRONIC STATE OF IB-TH MOLECULE
C   TEX(M,IB)=ELECTRONIC EXCITATION TEMPERATURE OF M-TH ELECTRONIC
C           STATE OF IB-TH MOLECULE
C   FACTRN(JSPEC)=EFFECTIVE DENSITY FACTOR FOR JSPEC-TH SPECTRAL
C           BAND
C   REAL N,NP,N2,N2P,NO,NE,MOSUM,MOLF
C   COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
C   1 5),ILST(3,6,5),QUV(22,28,21),EE(8,21),SIGMA(8,21),
C   2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
C   DIMENSION RHO(5),ANX(5,5),TEX(5,5),FACTRN(20),TEX1(20)
C   ),ESCF(5,5,5)
C
C   SUM NUMBER DENSITIES
C   ATSUM=N+NP+O+OP
C   MOSUM=N2+N2P+O2+NO+ON
C   TTSUM=ATSUM+MOSUM
C   ATOMF=ATSUM/TTSUM
C   MOLF=MOSUM/TTSUM
C
C   PRESET VALUES
C   DO 1 IB=1,5
C   DO 1 M=1,5
C   TEX(M,IB)=TE
C   1 ANX(M,IB)=1.0E10
C   DO 3 JSPEC=1,20
C   3 FACTRN(JSPEC)=1.0
C
C
C   N2+
C
C   CALCULATE POPULATION USING QSS METHOD FOR LEVELS UP TO 4
C   CALL QSSM(1,T,TV,TE,TTSUM,ATOMF,MOLF,NE,N2P,N,NP,ESCF(1,1,1),
C   1 NFOUT,NPRT,NFERR,RHO,ANX(1,1),TEX(1,1),MLEV)
C   CALCULATE POPULATION OF C 2 SIGMA U+ (UPPER STATE OF SECOND NEGATIVE)
C   ASSUMING LOCAL EQUILIBRIUM WITH FREE (ATOMIC) STATE
C   AN2PP=(N/EQC(1,5,T,TV,TE,NFOUT,NPRT,NFERR))*NP
C   TERM=SPEC2(2,5,1)
C   QM=PARTQ(1,T,TV,TE,NFOUT,NPRT,NFERR)
C   Q2PP=PARTM(1,5,T,TV,1.0E8,NFOUT,NPRT,NFERR)
C   TEX(5,1)=-1.43877*TERM/ALOG((AN2PP/N2P)*(QM/Q2PP))
C   ANX(5,1)=AN2PP
C
C
C   N2
C
C   CALCULATE POPULATION USING QSS METHOD FOR LEVELS UP TO 4
C   CALL QSSM(2,T,TV,TE,TTSUM,ATOMF,MOLF,NE,N2,N,N,ESCF(1,1,2),
C   1 NFOUT,NPRT,NFERR,RHO,ANX(1,2),TEX(1,2),MLEV)

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C CALCULATE POPULATION OF C3 P1-U (UPPER STATE OF SECOND POSITIVE)
  AN2P=(N/EQC(2,5,T,TV,TE,NFOUT,NPRT,NFERR))*N
  COLF=(N/AN2P)*(4.84E-14*N)*SQRT(T)*EXP(-1.4388*10259./T)
  AN2P=AN2P*COLF/(COLF+3.70E7*ESCF(5,3,2))
  TERM=SPEC2(2,5,2)
  QM=PARTQ(2,T,TV,TE,NFOUT,NPRT,NFERR)
  Q2P=PARTM(2,5,T,TV,1.0E8,NFOUT,NPRT,NFERR)
  TEX(5,2)=-1.43877*TERM/ALOG((AN2P/N2)*(QM/Q2P))
  ANX(5,2)=AN2P

C
C NO
C
C CALCULATE POPULATION USING QSS METHOD
  CALL QSSM(3,T,TV,TE,TTSUM,ATOMF,MOLF,NE,NO,N,D,ESCF(1,1,3),
  1 NFOUT,NPRT,NFERR,RHO,ANX(1,3),TEX(1,3),MLEV)

C
C O2
C
C CALCULATE POPULATION OF B3 SIGMA U- (UPPER STATE OF SCHUMANN-RUNGE)
  ANSR=(O/EQC(4,5,T,TV,TE,NFOUT,NPRT,NFERR))*O
  COLF=(O/ANSR)*(4.53E-14*O)*SQRT(T)*EXP(-1.43877*8098./T)
  ANSR=ANSR*COLF/(COLF+1.22E8*ESCF(3,1,4))
  TERM=SPEC2(2,5,4)
  QM=PARTQ(4,T,TV,TE,NFOUT,NPRT,NFERR)
  QSR=PARTM(4,5,T,TV,1.0E8,NFOUT,NPRT,NFERR)
  TEX(5,4)=-1.43877*TERM/ALOG((ANSR/O2)*(QM/QSR))
  ANX(5,4)=ANSR

C
C ON
C
C CALCULATE POPULATION USING QSS METHOD
  CALL QSSM(5,T,TV,TE,TTSUM,ATOMF,MOLF,NE,CN,C,N,ESCF(1,1,5),
  1 NFOUT,NPRT,NFERR,RHO,ANX(1,5),TEX(1,5),MLEV)

C
C CALCULATE EFFECTIVE DENSITY MULTIPLICATIVE FACTOR FACTRN(JSPEC)
C   FOR ARBITRARILY GIVEN TEMPERATURE TARB
  CALL ARBIT(T,TE,TV,TEX,TARB,FACTRN,TEX1,NFOUT,NPRT,NFERR)
  IF(NPRT.EQ.0) RETURN
  DO 4 IB=1,5
  WRITE(NFOUT,2) (AMOLEC(I,IB),I=1,2),(ANX(M,IB),M=1,5),
  1 (TEX(M,IB),M=1,5)
  2 FORMAT(/1X,2A3/38H NUMBER DENSITIES OF ELECTRONIC STATE= ,
  1 1P5E10.3,4H CM3/
  2 38H ELECTRONIC EXCITATION TEMPERATURE = ,0P5F10.1,2H K)
  4 CONTINUE
  WRITE(NFOUT,5) (FACTRN(JSPEC),JSPEC=1,20)
  5 FORMAT(31H DENSITY MULTIPLICATIVE FACTOR= ,1P5E10.3/
  1 (31X,5E10.3))
  WRITE(NFOUT,6) (TEX1(JSPEC),JSPEC=1,20)
  6 FORMAT(31H EXCITATION TEMPERATURE = ,5F10.1/
  1 (31X,5F10.1))
  RETURN
  END

```

ORIGINAL PAGE IS
OF POOR QUALITY

```

*DECK QSSM
      SUBROUTINE QSSM(IB,T,TV,TE,NH,ATOMF,MOLF,NE,NM,ATOM1,ATOM2,
      1 ESCF,NFOUT,NPRT,NFERR,RHO,ANX,TEX,MLEV)
C CALCULATES NONEQUILIBRIUM POPULATION USING QUASI-STEADY-STATE
C ASSUMPTION FOR MOLECULAR ELECTRONIC STATES
C INPUT PARAMETERS
C   IB=SPECIES INDEX
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE, K
C   TV=VIBRATIONAL TEMPERATURE, K
C   TE=ELECTRON TEMPERATURE, K
C   NH=HEAVY PARTICLE NUMBER DENSITY
C   ATOMF=ATOM FRACTION
C   MOLF=MOLECULAR FRACTION
C   NE=ELECTRON DENSITY, CM-3
C   NM=MOLECULE DENSITY, CM-3
C   ATOM1=DENSITY OF FIRST ATOM IN FREE STATE, CM-3
C   ATOM2=DENSITY OF SECOND ATOM IN FREE STATE, CM-3
C   ESCF(MU,ML)=LINE RADIATION ESCAPE FACTOR, FROM MU TO ML
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C OUTPUT PARAMETERS
C   RHO=NONEQUILIBRIUM POPULATION
C   ANX(M)=NUMBER DENSITY OF M-TH ELECTRONIC LEVEL
C   TEX(M)=EFFECTIVE ELECTRONIC EXCITATION TEMPERATURE OF M-TH
C           ELECTRONIC LEVEL
C   MLEV=NUMBER OF ELECTRONIC LEVELS
      REAL NH,MOLF,NE,NM
      COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
      1 5),ILST(3,6,5),QWV(22,28,21),EE(8,21),SIGMA(8,21),
      2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
      DIMENSION APEN(5),BK(5,2),BKPC(5),C(5,5),RHO(5),BKPQ(
      1 5,5),ANX(5),TEX(5),ESCF(5,5)
C
C SET MOLECULAR PARAMETERS
      MLEV=LMOLEC(4,IB)
      EDIS=ATOM(4,1,IB)
C
C SET RHO TO 1 AND BKPQ TO 0
      DO 26 JL=1,5
      RHO(JL)=1.0
      DO 26 JU=1,5
      26 BKPQ(JL,JU)=0.
C
C CALCULATE EQUILIBRIUM NUMBER DENSITIES APEN(J)=(N(J)/ATOM1)E
C AND THEIR TOTAL AMTOTE=(NM/ATOM1)E
      AMTOTE=0.
      DO 14 M=1,MLEV
      APEN(M)=ATOM2/EQC(IB,M,T,TV,TE,NFOUT,NPRT,NFERR)
      AMTOTE=AMTOTE+APEN(M)
      14 CONTINUE

```

```

C
C CONSTRUCT COEFFICIENTS BKPQ AND BKPC ARRAYS
  DO 22 JP=1,MLEV
    DE=EDIS-SPEC2(2,JP,IB)
    BKPC(JP)=RATED(IB,DE,ATOMF,MOLF,T,NFOUT,NPRT,NFERR)*(NH/NE)
  1 +ELECD(IB,JP,TE,NFOUT,NPRT,NFERR)
C
  DO 3 JQ=1,MLEV
    IF(JQ-JP) 54,33,4
  4 CALL EXCTML(IB,JP,JQ,T,TV,TE,NFOUT,NPRT,NFERR,RATEC)
    BKPQ(JP,JQ)=RATEC
    GO TO 3
  54 BKPQ(JP,JQ)=(APEN(JQ)/APEN(JP))*BKPQ(JQ,JP)
    GO TO 3
  33 BKPQ(JP,JQ)=0.
  3 CONTINUE
  22 CONTINUE
C
C CONSTRUCT LHS MATRIX IN QSS EQUATION
  DO 5 JP=1,MLEV
    DO 7 JQ=1,MLEV
      IF(JP.GT.1) GO TO 8
      C(JP,JQ)=APEN(JQ)
      GO TO 7
  8 IF(JP-JQ) 2,9,2
  2 C(JP,JQ)=BKPQ(JP,JQ)+(APEN(JQ)/APEN(JP))*(ARAD(JQ,JP,
  1 IB)*ESCF(JQ,JP)/NE)
      GO TO 7
  9 C(JP,JQ)=-BKPC(JP)
  DO 12 JQS=1,MLEV
    C(JP,JQ)=C(JP,JQ)-BKPQ(JP,JQS)-ARAD(JP,JQS,IB)*ESCF(JP,JQS)/NE
  12 CONTINUE
  7 CONTINUE
  5 CONTINUE
C
C NORMALIZE LHS OF QSS EQUATION
  DET =0.
  DO 10 JP=1,MLEV
    DO 10 JQ=1,MLEV
  10 DET=DET+ABS(C(JP,JQ))
    DET=2.0*(ALOG(NE)-20.)*FLOAT(MLEV**MLEV)*(10000./TE)**1.2/DET
  DO 13 JP=1,MLEV
    DO 13 JQ=1,MLEV
  13 C(JP,JQ)=C(JP,JQ)*DET
C
C CONSTRUCT RHS OF QSS EQUATION
  BK(1,1)=0.
  BK(1,2)=DET
  DO 55 JP=2,MLEV
    BK(JP,1)=-BKPC(JP)*DET
    BK(JP,2)=0.
  55 CONTINUE
C
C SOLVE QSS EQUATION
  1 CALL MINV1(C,MLEV,BK,2,DETERM)

```

```

C
C CONSTRUCT NORMALIZED POPULATION RHO, NUMBER DENSITY ANX, AND
C EXCITATION TEMPERATURE TEX
AX=((ATOM1/NM)*ATOM2)/EQC(IB,0,T,TV,TE,NFOUT,NPRT,NFERR)
AX=ALOG(AX)
DO 6 JP=1,MLEV
RHO(JP)=BK(JP,1)+BK(JP,2)*(NM/ATOM1)
ANX(JP)=RHO(JP)*APEN(JP)*ATOM1
IF(JP.EQ.1) GO TO 6
TERM=SPEC2(2,JP,IB)
IF(RHO(JP).GT.1.0E-20) ALOGRO=ALOG(RHO(JP))
IF(RHO(JP).LE.1.0E-20) ALOGRO=0.
DOWN=1.0-(TE/(1.43877*TERM))*(ALOGRO+AX)
IF(DOWN.LT.1.0E-4) WRITE(NFERR,16) (AMOLEC(II,IB),II=1,2),
1 JP,DOWN
16 FORMAT(1X,2A3,3X,3HJP=,I1,3X,5HDOWN=,1PE10.3)
TEX(JP)=TE/DOWN
6 CONTINUE
C
C WRITE RESULTS
CHI=(NM/ATOM1)/AMTOTE
IF(NPRT.GT.1) WRITE(NFOUT,15) (AMOLEC(I,IB),I=1,2),
1 CHI,(RHO(JP),JP=1,5),(ANX(JP),JP=1,5),(TEX(JP),JP=1,
2 5)
15 FORMAT(1X,2A3,3X,4HCHI=,1PE10.3,3X,4HRHO=,1P5E10.3,
1 /10X,4HANX=,5E10.3,3X,4HTEX=,0P5F10.1)
RETURN
END
*DECK MINV1
SUBROUTINE MINV1(A,N,B,M,DETERM)
C MATRIX INVERSION WITH ACCOMPANYING SOLUTION OF LINEAR EQUATIONS
DIMENSION IPIVOT(5),PIVOT(5),INDEX(5,2)
DIMENSION A(5,5),B(5,2)
EQUIVALENCE (IROW,JROW),(ICOLUJ,JCOLUJ),(AMAX,T,SWAP)
C
C INITIALIZATION
10 DETERM=1.0
15 DO 20 J=1,N
20 IPIVOT(J)=0
30 DO 550 I=1,N
40 AMAX=0.0
C
C SEARCH FOR PIVOT ELEMENT
45 DO 105 J=1,N
50 IF(IPIVOT(J)-1) 60,105,60
60 DO 100 K=1,N
70 IF(IPIVOT(K)-1) 80,100,740
80 IF(ABS(AMAX)-ABS(A(J,K))) 85,100,100
85 IROW=J
90 ICOLUJ=K
95 AMAX=A(J,K)
100 CONTINUE
105 CONTINUE
110 IPIVOT(ICOLUJ)=IPIVOT(ICOLUJ)+1

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C
C INTERCHANGE ROWS TO PUT PIVOT ELEMENT ON DIAGONAL
130 IF(IROW-ICOLUM) 140,260,140
140 DETERM=-DETERM
150 DO 200 L=1,N
160 SWAP=A(IROW,L)
170 A(IROW,L)=A(ICOLUM,L)
200 A(ICOLUM,L)=SWAP
205 IF(M) 260,260,210
210 DO 250 L=1,M
220 SWAP=B(IROW,L)
230 B(IROW,L)=B(ICOLUM,L)
250 B(ICOLUM,L)=SWAP
260 INDEX(I,1)=IROW
270 INDEX(I,2)=ICOLUM
310 PIVOT(I)=A(ICOLUM,ICOLUM)
320 DETERM=DETERM*PIVOT(I)

C
C DIVIDE PIVOT ROW BY PIVOT ELEMENT
330 A(ICOLUM,ICOLUM)=1.0
340 DO 350 L=1,N
350 A(ICOLUM,L)=A(ICOLUM,L)/PIVOT(I)
355 IF(M) 380,380,360
360 DO 370 L=1,M
370 B(ICOLUM,L)=B(ICOLUM,L)/PIVOT(I)

C
C REDUCE NON-PIVOT ROWS
380 DO 550 L1=1,N
390 IF(L1-ICOLUM) 400,550,400
400 T=A(L1,ICOLUM)
420 A(L1,ICOLUM)=0.0
430 DO 450 L=1,N
450 A(L1,L)=A(L1,L)-A(ICOLUM,L)*T
455 IF(M)550,550,460
460 DO 500 L=1,M
500 B(L1,L)=B(L1,L)-B(ICOLUM,L)*T
550 CONTINUE

C
C INTERCHANGE COLUMNS
600 DO 710 I=1,N
610 L=N+1-I
620 IF(INDEX(L,1)-INDEX(L,2)) 630,710,630
630 JROW=INDEX(L,1)
640 JCOLUM=INDEX(L,2)
650 DO 705 K=1,N
660 SWAP=A(K,JROW)
670 A(K,JROW)=A(K,JCOLUM)
700 A(K,JCOLUM)= SWAP
705 CONTINUE
710 CONTINUE
740 RETURN
END
*DECK ARBIT
SUBROUTINE ARBIT(T,TE,TV,TEX,TARB,FACTRN,TEX2,NFOUT,NPRT,
1 NFERR)

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C CALCULATE EFFECTIVE DENSITY MULTIPLICATIVE FACTOR THAT, WHEN MULTIPLIED
C TO AN EQUILIBRIUM RADIATION CODE, GIVES THE CORRECT NONEQUILIBRIUM
C RADIATION EMISSION FOR OPTICALLY THIN CASE
C INPUT PARAMETERS
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   TV=VIBRATIONAL TEMPERATURE
C   TEX(M,IB)=EFFECTIVE EXCITATION TEMPERATURE OF M-TH ELECTRONIC
C     LEVEL OF IB-TH MOLECULE
C   TARB=ARBITRARILY SPECIFIED TEMPERATURE
C OUTPUT PARAMETERS
C   FACTRN(JSPEC)=EFFECTIVE DENSITY FACTOR FOR JSPEC-TH SPECTRAL
C     BAND
C   TEX2(JSPEC)=SAME AS TEX, BUT ARRANGED ACCORDING TO JSPEC
C     COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
C     1 5),ILST(3,6,5),QW(22,28,21),EE(8,21),SIGMA(8,21),
C     2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
C     DIMENSION AI(2),TEX(5,5),FACTRN(20),I(3,20),TEX2(20)
C INDEX I MUST MATCH THE MOLECULAR SPECTRAL DATA
C   1,2=N2+ 1-. 3,4=N2 1+. 5=N2 2+. 6-8=N2 BH2.
C   9-11=NO BETA. 12,13=NO GAMMA. 14-17=O2 SR.
C   18=CN VIOLET. 19,20=CN RED.
C     DATA I/1,3,1, 1,3,1, 2,3,2, 2,3,2, 2,5,3, 2,5,1, 2,5,1,
C     1 2,5,1, 3,3,1, 3,3,1, 3,3,1, 3,2,1, 3,2,1, 4,5,1,
C     > 4,5,1, 4,5,1, 4,5,1, 5,3,1, 5,2,1, 5,2,1/
C
C CYCLE OVER SPECTRAL BAND
C   DO 1 JSPEC=1,20
C     IB=I(1,JSPEC)
C     MU=I(2,JSPEC)
C     ML=I(3,JSPEC)
C     TEXX=TEX(MU,IB)
C     TEX2(JSPEC)=TEXX
C     TERMU=SPEC2(2,MU,IB)
C     TERML=SPEC2(2,ML,IB)
C
C DETERMINE DENSITY FACTOR FOR N2 2+ AND O2 SR, ETC
C   IF(MU.LT.5) GO TO 6
C     QM=1./EQC(IB,0,T,TV,TE,NFOUT,NPRT,NFERR)
C     QI=1./EQC(IB,MU,T,TV,TE,NFOUT,NPRT,NFERR)
C     F1=(QI/QM)*EXP(-1.43877*(TERMU-TERML)/TEXX)
C     QM=1./EQC(IB,0,TARB,TARB,TARB,NFOUT,NPRT,NFERR)
C     QI=1./EQC(IB,MU,TARB,TARB,TARB,NFOUT,NPRT,NFERR)
C     F2=(QI/QM)*EXP(-1.43877*(TERMU-TERML)/TARB)
C     FACTRN(JSPEC)=F1/F2
C     GO TO 1
C
C 6 CONTINUE
C   NT=LMOLEC(2,IB)
C   FACTRN(JSPEC)=0.
C   DO 4 ITX=1,NT
C     IF((ML.EQ.ILST(1,ITX,IB)).AND.(MU.EQ.ILST(2,ITX,IB)))IT=ITX
C 4 CONTINUE
C   IORD=ILST(3,IT,IB)

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C
C SET MOLECULAR CONSTANTS
WEL=SPEC2(3,ML,IB)
WEU=SPEC2(3,MU,IB)
WEXEL=SPEC2(4,ML,IB)
WEXEU=SPEC2(4,MU,IB)
WEYEL=SPEC2(5,ML,IB)
WEYEU=SPEC2(5,MU,IB)
WEZEL=SPEC2(6,ML,IB)
WEZEU=SPEC2(6,MU,IB)
BEL=SPEC2(7,ML,IB)
BEU=SPEC2(7,MU,IB)
ALPHAL=SPEC2(8,ML,IB)
ALPHAU=SPEC2(8,MU,IB)

C
C CYCLE OVER TWO TEMPERATURES
DO 5 ITIME=1,2
IF(ITIME.EQ.1) T1=T
IF(ITIME.EQ.1) TV1=TV
IF(ITIME.EQ.1) TEX1=TEXX
IF(ITIME.EQ.2) T1=TARB
IF(ITIME.EQ.2) TV1=TARB
IF(ITIME.EQ.2) TEX1=TARB

C
C START CYCLING OVER UPPER VIBRATIONAL NUMBER
S1=0.
DO 2 JVU=1,22
VU=JVU-0.5
BU=BEU-ALPHAU*VU
GU=VU*WEU-WEXEU*VU**2+WYEU*VU**3+WEZEU*VU**4

C
C CYCLE OVER LOWER VIBRATIONAL NUMBER
S2=0.
DO 3 JVL=1,28
FRANCK=QUV(JVU,JVL,IORD)
IF(FRANCK.LT.1.0E-10) GO TO 3
VL=JVL-0.5
BL=BEL-ALPHAL*VL
GL=VL*WEL-WEXEL*VL**2+WYEL*VL**3+WEZEL*VL**4
A1=TERMU-TERML+GU-GL+(BEU-BEL)/BEU
DE=TERMU-TERML+GU-GL
S2=S2+DE**4*FRANCK*(T1/(1.43877*BU))*A1
3 CONTINUE
S1=S1+EXP(-1.43877*GU/TV1)*S2
2 CONTINUE
AI(ITIME)=EXP(-1.43877*TERMU/TEX1)*S1
5 CONTINUE
IF(AI(2).LT.1.0E-20) GO TO 1
FACTRN(JSPEC)=AI(1)/AI(2)
1 CONTINUE
RETURN
END
*DECK EXCTML
SUBROUTINE EXCTML(IB,ML,MU,T,TV,TE,NFOUT,NPRT,NFERR,RATEC)

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C CALCULATES AVERAGE ELECTRON-IMPACT EXCITATION RATE COEFFICIENT
C BETWEEN TWO ELECTRONIC STATES OF A MOLECULE
C INPUT PARAMETERS
C   IB=MOLECULE INDEX
C   ML=INITIAL (LOWER) ELECTRONIC STATE INDEX
C   MU=FINAL (UPPER) ELECTRONIC STATE INDEX
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE, K
C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   NFOUT=FILE NUMBER OF OUTPUT PRINT
C   NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C OUTPUT PARAMETERS
C   RATEC=RATE COEFFICIENT, CM3/S
C     COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
C     1 5),ILST(3,6,5),QW(22,28,21),EE(8,21),SIGMA(8,21),
C     2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
C
C PRESET RATEC TO ZERO
C   RATEC=0.
C
C FIND IT AND IORD
C   NT=LMOLEC(2,IB)
C   DO 4 ITX=1,NT
C     IF((ML.EQ.ILST(1,ITX,IB)).AND.(MU.EQ.ILST(2,ITX,IB)))IT=ITX
C   4 CONTINUE
C   IORD=ILST(3,IT,IB)
C
C CALCULATE AP AND BP AT ROOM TEMPERATURE FROM GIVEN CROSS-SECTION DATA
C   TERML=SPEC2(2,ML,IB)
C   TERMU=SPEC2(2,MU,IB)
C   DE=TERMU-TERML
C   CALL CROSAB(EE(1,IORD),SIGMA(1,IORD),DE,300.,NFOUT,NPRT,
C   1 AP,BP)
C   IF(AP.LT.1.0E-10) RETURN
C
C SET SPECTROSCOPIC CONSTANTS FOR THE LOWER AND UPPER STATES
C   WEL=SPEC2(3,ML,IB)
C   WEU=SPEC2(3,MU,IB)
C   WEXEL=SPEC2(4,ML,IB)
C   WEXEU=SPEC2(4,MU,IB)
C   WEYEL=SPEC2(5,ML,IB)
C   WEYEU=SPEC2(5,MU,IB)
C   WEZEL=SPEC2(6,ML,IB)
C   WEZEU=SPEC2(6,MU,IB)
C   BEL=SPEC2(7,ML,IB)
C   BEU=SPEC2(7,MU,IB)
C   ALPHAL=SPEC2(8,ML,IB)
C   ALPHAU=SPEC2(8,MU,IB)
C
C CONSTRUCT LOWER STATE PARTITION FUNCTION
C   QL=0.
C   DO 5 JVL=1,10
C     VL=JVL-0.5

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BE1=BEL-ALPHAL*VL
QR=T/(1.43877*BE1)
GL=VL*WEL-VL**2*WEXEL+VL**3*WEYEL+VL**4*WEZEL
QL=QL+EXP(-1.43877*GL/TV)*QR
5 CONTINUE
C
C SUMMATION OVER UPPER VIBRATIONAL STATES BEGINS
SUMU=0.
DO 1 JVu=1,22
VU=JVU-0.5
BE2=BEU-ALPHA*VU
GU=VU*WEU-VU**2*WEXEU+VU**3*WEYEU+VU**4*WEZEU
C
C SUMMATION OVER LOWER VIBRATIONAL STATES BEGINS
SUML=0.
DO 2 JVL=1,28
FRANCK=QUJ(JVU,JVL,IORD)
IF(FRANCK.LT.1.E-4) GO TO 2
VL=JVL-0.5
GL=VL*WEL-VL**2*WEXEL+VL**3*WEYEL+VL**4*WEZEL
BE1=BEL-ALPHAL*VL
D1=1.43877*(BE2-BE1)/TE
D2=1.43877*BE1/T
D=D1/(D1+D2)
IF(D.EQ.0.) GO TO 2
DE=TERMU-TERML+GU-GL
C=AP+BP*1.43877*DE/TE
C CASE OF (D1+D2)>0
IF((D1+D2).LE.0.) GO TO 7
IF(((D1+D2).GT.0.).AND.(D1.LT.0.)) GO TO 11
F1=0.8862*C+1.3293*BP*D
S1=5.47E-11*SQRT(TE)*EXP(-1.43877*DE/TE-1.43877*GL/TV)*F1
1 /((D1+D2)**1.5)
IF(S1.LT.0.) WRITE(NFERR,10) ML,MU,D1,D2,F1,S1
10 FORMAT(1X,3HML=,I2,2X,3HMU=,I2,2X,3HD1=,1PE10.3,2X,3HD2=,
> E10.3,2X,3HF1=,E10.3,2X,3HS1=,E10.3)
IF(S1.LT.0.) GO TO 2
GO TO 8
C CASE OF (D1+D2)>0 AND D1<0
11 C1=-C/(BP*D)
IF(C1.LT.4) F1=C*GAMI(1.5,C1)+BP*D*GAMI(2.5,C1)
IF(C1.GT.4) F1=C*(0.8862-GAMC(1.5,C1))+BP*D*(1.3293-
1 GAMC(2.5,C1))
S1=5.47E-11*SQRT(TE)*EXP(-1.43877*DE/TE-1.54877*GL/TV)*F1
1 /((D1+D2)**1.5)
IF(S1.LT.0.) WRITE(NFERR,10) ML,MU,D1,D2,F1,S1
IF(S1.LT.0.) GO TO 2
GO TO 8
C CASE OF (D1+D2)<0
7 D3=-D1-D2
C1=C/(BP*D)
IF(C1.LE.0.) WRITE(NFERR,9) (AMOLEC(II,IB),II=1,2),ML,MU,
1 D1,D2,D3,C1

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9 FORMAT(1X,2A3,2X,3HML=,12,2X,3HMU=,12,2X,3HD1=,1PE10.3,2X,
1 3HD2=,E10.3,2X,3HD3=,E10.3,2X,3HC1=,E10.3)
F1=C*A13(0.5,C1)-BP*D*A13(1.5,C1)
S1=5.47E-11*SQRT(TE)*EXP(-1.43877*DE/TE-1.43877*GL/TV)
1 *F1/D3**1.5
IF(S1.LT.0.) WRITE(NFERR,10) ML,MU,D1,D2,F1,S1
IF(S1.LT.0.) GO TO 2
8 CONTINUE
SUMUL=SUMUL+S1*FRANCK
2 CONTINUE
C
SUMU=SUMU+SUMUL
1 CONTINUE
C
RATEC=SUMU/QL
IF(NPRT.GT.1) WRITE(NFOUT,3) ML,MU,T,TV,TE,RATEC
3 FORMAT(29H MOLECULAR EXCITATION. ML,MU=,2I3,3X, 8HT,TV,TE=,
1 3F9.1,3X,6HRATEC=,1PE10.3)
RETURN
END
*DECK GAMI
FUNCTION GAMI(A,X)
C EVALUATES INCOMPLETE GAMMA (SMALL LETTER) FUNCTION
C VALID ONLY WHEN X<4
DIMENSION FACT(20)
DATA IT/0/
IF(IT.NE.0) GO TO 1
FACT(1)=1.
DO 2 I=2,20
2 FACT(I)=FACT(I-1)*I
IT=1
1 CONTINUE
GAMI=0.
IF(X.LT.1.0E-20) RETURN
IF(A.LT.1.0E-10) RETURN
SUM=1./A
DO 3 I=1,15
3 SUM=SUM+(-X)**I/((A+I)*FACT(I))
GAMI=SUM**X**A
RETURN
END
FUNCTION GAMC(A,X)
C EVALUATES INCOMPLETE GAMMA (CAPITAL LETTER) FUNCTION
C VALID ONLY WHEN X>4
4 Z=1./X
SUM=1.+(A-1)*Z+(A-1)*(A-2)*Z**2
GAMC=X**(A-1)*EXP(-X)*SUM
RETURN
END
*DECK A13
FUNCTION A13(AN,A)
C EVALUATES INTEGRAL OF X**AN*EXP(X) FROM ZERO TO A
DIMENSION X(200),Y(200)
A13=0.
IF(AN.LT.-20.) RETURN

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IF(AN.GT.20.) RETURN
IF(A.LT.1.0E-10) RETURN
IF(A.GT.20.) RETURN
XLIM=EXP(A)
N=10*XLIM
IF(N.LT.10) N=10
IF(N.GT.200) N=200
DO 1 I=1,N
X(I)=1.0001+(XLIM-1.0001)*FLOAT(I-1)/FLOAT(N-1)
IF(X(I).EQ.1.0) Y(I)=1.0
IF(X(I).NE.1.0) Y(I)=ALOG(X(I))*AN
1 CONTINUE
CALL SIMP(ANS,X,Y,N,IER)
A13=ANS
RETURN
END
*DECK SIMP
SUBROUTINE SIMP(R,X,Y,N,IER)
DIMENSION X(N),Y(N)
R=0.0
IF(N.GT.1) GO TO 1
IER=2
RETURN
1 IF(X(1).EQ.X(2)) GO TO 12
NM1=N-1
IF(N.EQ.2) GO TO 13
IF(X(1).LT.X(2)) GO TO 3
C TEST FOR X TO BE MONOTONICALLY DECREASING
DO 2 I=2,NM1
IF(X(I+1).GE.X(I)) GO TO 12
2 CONTINUE
GO TO 5
C TEST FOR X TO BE MONOTONICALLY INCREASING
3 DO 4 I=2,NM1
IF(X(I+1).LE.X(I)) GO TO 12
4 CONTINUE
5 NM2=N-2
IF(MOD(N,2).EQ.0) GO TO 14
P=0.0
N1=1
6 S1=X(N1+1)-X(N1)
S2=X(N1+2)-X(N1+1)
S3=X(NM1)-X(NM2)
S4=X(N)-X(NM1)
R=(2.*S1**2+S1*S2-S2**2)/S1*Y(N1)+(2.*S4**2+S3*S4-S3**2)/S4*Y(N)
N1=N1+1
DO 7 I=N1,NM1,2
S1=X(I)-X(I-1)
S2=X(I+1)-X(I)
7 R=R+(S1+S2)**3/(S1*S2)*Y(I)
IF(N.LT.5) GO TO 9
N1=N1+1
DO 8 I=N1,NM2,2
S1=X(I-1)-X(I-2)

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      S2=X(I)-X(I-1)
      S3=X(I+1)-X(I)
      S4=X(I+2)-X(I+1)
      8 R=R+((2.*S2**2+S1*S2-S1**2)/S2+(2.*S3**2+S3*S4-S4**2)/S3)*Y(I)
      9 R=R/6.+P
      10 CONTINUE
          IER=1
          RETURN
      11 IER=3
          RETURN
      12 IER=4
          RETURN
C TRAPEZOIDAL RULE FOR N=2
      13 R=(X(2)-X(1))*(Y(1)+Y(2))/2.0
          GO TO 10
C FIT POLYNOMIAL THRU FIRST 3 POINTS AND INTEGRATE FROM X(1) TO X(2).
      14 S1=X(2)-X(1)
          S2=X(3)-X(1)
          S3=Y(2)-Y(1)
          S4=Y(3)-Y(1)
          P=S1/6.*(2.*S3+6.*Y(1)+(S2**2*S3-S1**2*S4)/(S2*(S2-S1)))
          N1=2
          GO TO 6
      END
*DECK ELECD
      FUNCTION ELECD(IB,M,TE,NFOUT,NPRT,NFERR)
C CALCULATES RATE OF DISSOCIATION BY ELECTRON-IMPACT
C INPUT PARAMETERS
C   IB=SPECIES INDEX
C   M=ELECTRONIC ENERGY LEVEL NUMBER
C   TE=ELECTRON TEMPERATURE
C   NFOUT=FILE NUMBER OF OUTPUT PRINT
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C OUTPUT PARAMETER
C   ELECD=DISSOCIATION RATE COEFFICIENT, CM3/S
      COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
      1 5),ILST(3,6,5),QW(22,28,21),EE(8,21),SIGMA(8,21),
      2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
      DISS=ATOM(4,1,IB)
      TERM=SPEC2(2,M,IB)
      DE=DISS-TERM
      CALL CROSAB(ED(1,M,IB),SIGMD(1,M,IB),DE,300.,NFOUT,NPRT,
      1 AP,BP)
      ELECD=5.47E-11*SQRT(TE)*EXP(-1.43877*DE/TE)*(AP+(1.43877*DE/
      1 TE)*BP)
      IF(NPRT.GT.1) WRITE(NFOUT,1) (AMOLEC(I,IB),I=1,2),M,TE,ELECD
      1 FORMAT(1X,2A3,3X,6HLEVEL=,12,3X,3HTE=,F9.0,3X,6HELECD=,1PE10.3)
      RETURN
      END
*DECK CROSAB
      SUBROUTINE CROSAB(EE,SIGMA,DE,T,NFOUT,NPRT,A,B)
C EVALUATES A AND B IN EXCITATION RATE EXPRESSION
C INPUT PARAMETERS

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C   EE=ELECTRON ENERGY, IN EV OR RYD
C   SIGMA=CROSS SECTION, IN CM2 OR PI*A0**2
C   DE=THRESHOLD ENERGY, CM-1
C   T=EXCITATION TEMPERATURE, K
C   NFOUT=FILE NUMBER OF OUTPUT PRINT
C   NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=
C       LARGE PRINT
C   OUTPUT PARAMETERS
C   A=A
C   B=B
      DIMENSION EE(8),SIGMA(8),GZI(15),W(15),Y(15)
      DATA GZI/0.093308,0.49269,1.21560,2.26995,3.66762,5.42534
1,7.56592,10.12022,13.13028,16.65440,20.77648,25.62389,31.40752,
2 38.53068,48.02609/
      DATA W/2.18235E-1,3.42210E-1,2.63028E-1,1.26426E-1,4.02069E-2,
1 8.56388E-3,1.21244E-3,1.116744E-4,6.45993E-6,2.22632E-7,
24.22743E-9,3.92190E-11,1.45652E-13,1.48303E-16,1.60059E-20/
      DATA NEE/8/
      A=0.
      B=0.
      IF(DE.LT.0.00001) RETURN
      MON=0
      DO 1 JX=1,8
      EEX=(T/11605.)*GZI(JX)+EE(1)
      IF(EEX.LT.EE(8)) GO TO 4
      YX=SIGMA(8)*EE(8)/EEX
      GO TO 5
4 CONTINUE
      CALL TAINTE(EE,SIGMA,EEX,YX,NEE,2,IER,MON)
      IF(YX.LT.0.) YX=0.
5 Y(JX)=YX/0.879E-16
1 CONTINUE
      DO 2 JX=1,8
      A=A+W(JX)*Y(JX)*GZI(JX)
2 B=B+W(JX)*Y(JX)
      IF(NPRT.GT.1) WRITE(NFOUT,3)T,A,B
3 FORMAT(1X,3H T=,F10.1,3X,2HA=,1PE10.3,2X,2HB=,E10.3)
      RETURN
      END
*DECK EQC
      FUNCTION EQC(IB,M,T,TV,TE,NFOUT,NPRT,NFERR)
C   FOR DISSOCIATION M=A+B, CALCULATE EQUILIBRIUM CONSTANT
C   (QA)*(QB)*EXP(-E/KT)/(QM) INCLUDING TRANSLATIONAL COMPONENT
C   IN THE CGS UNIT
C   INPUT VARIABLES
C   IB=SPECIES INDEX. 1=N2+,2=N2,3=NO,4=O2,5=CN
C   M=ELECTRONIC STATE INDEX
C   =0 TOTAL MOLECULE. >0 INDIVIDUAL ELECTRONIC LEVEL
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE
C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT

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C   NFERR=FILE NUMBER OF ERROR MESSAGES
      COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
1 5),ILST(3,6,5),QVV(22,28,21),EE(8,21),SIGMA(8,21),
2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
      DIMENSION QTA(2)
      IF(M.GT.0) QRM=PARTM(IB,M,T,TV,TE,NFOUT,NPRT,NFERR)
      IF(M.GT.0) GO TO 3
      QRM=0.
      LEVELS=LMOLEC(3,IB)
C PARTITION FUNCTION OF AN ELECTRONIC STATE PARTM IS MEASURED
C FROM THE MOLECULE GROUND STATE
      DO 2 IM=1,LEVELS
2 QRM=QRM+PARTM(IB,IM,T,TV,TE,NFOUT,NPRT,NFERR)
3 CONTINUE
      WT=AMOLEC(3,IB)
      QTM=(3.281E13*WT*T)**1.5
      QM=QRM*QTM
C CHEMICAL ENERGY DE IS THE DISSOCIATION ENERGY IN ALL CASES
C BECAUSE PARTM IS MEASURED FROM THE GROUND STATE
      DE=ATOM(4,1,IB)
      DO 1 IA=1,2
      WT=ATOM(3,IA,IB)
1 QTA(IA)=(3.281E13*WT*T)**1.5*ATOM(5,IA,IB)
      EQC=(QTA(1)/QM)*(QTA(2)*EXP(-1.43766*DE/TE))
      IF(NPRT.GT.1) WRITE(NFOUT,4) (AMOLEC(I,IB),I=1,2),M,
1 T,TV,TE,EQC
4 FORMAT(1X,2A3,3X,7H LEVEL=,I2,3X,8HT,TV,TE=,3F9.1,3X,
1 4HEQC=,1PE10.3)
      RETURN
      END
*DECK PARTQ
      FUNCTION PARTQ(IB,T,TV,TE,NFOUT,NPRT,NFERR)
C CALCULATES INTERNAL PARTITION FUNCTION OF A MOLECULE
C WITHOUT TRANSLATION
C INPUT PARAMETERS
C   IB=SPECIES INDEX
C   T=ROTATIONAL TEMPERATURE
C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRONIC EXCITATION TEMPERATURE
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX
C   NFERR=FILE NUMBER OF ERROR MESSAGES
      COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
1 5),ILST(3,6,5),QVV(22,28,21),EE(8,21),SIGMA(8,21),
2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
      LEVELS=LMOLEC(3,IB)
      PARTQ=0.
      DO 1 M=1,LEVELS
      PARTQ=PARTQ+PARTM(IB,M,T,TV,TE,NFOUT,NPRT,NFERR)
1 CONTINUE
      RETURN
      END
*DECK PARTM
      FUNCTION PARTM(IB,M,T,TV,TE,NFOUT,NPRT,NFERR)

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C CALCULATES PARTITION FUNCTIONS FOR MOLECULES
C INPUT PARAMETERS
C   IB=SPECIES INDEX. 1=N2+,2=N2,3=NO,4=O2,5=CN
C   M=ELECTRONIC STATE INDEX
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE
C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   COMMON/EXCTB/AMOLEC(3,5),LMOLEC(4,5),SPEC2(8,8,5),ATOM(5,2,
1 5),ILST(3,6,5),QUV(22,28,21),EE(8,21),SIGMA(8,21),
2 ARAD(4,4,5),ED(8,6,5),SIGMD(8,6,5)
C
C EQUATE TEMPERATURES AND NUMBER DENSITY
  TROT=T
  TVIB=TV
  TELECT=TE
  DEGEN = SPEC2(1,M,IB)
  TERM  = SPEC2(2,M,IB)
  WE    = SPEC2(3,M,IB)
  WEXE  = SPEC2(4,M,IB)
  WEYE  = SPEC2(5,M,IB)
  WEZE  = SPEC2(6,M,IB)
  BE    = SPEC2(7,M,IB)
  ALPHA = SPEC2(8,M,IB)
C
C CALCULATE PARTITION FUNCTION
  PARTM=0.
  QVR=0.0
  QV=0.0
  EVIB1=0.0
  V=0.0
60  EVIB2=WE*(V+0.5) -WEXE*(V+0.5)**2 +WEYE*(V+0.5)**3
    1  +WEZE*(V+0.5)**4
    DELTQV=EXP(-1.43879*EVIB2/TVIB)
C COMPARE DELTA Q-VIBRATIONAL TO 0.1 PERCENT OF THE QV SUM TO THIS
C POINT.
  IF (DELTQV .LE. 0.001*QV) GO TO 70
C HAS THE VIBRATIONAL ENERGY REACHED A FICTITIOUS PEAK.
  IF (EVIB2 .LE. EVIB1) GO TO 70
  QV=QV+DELTQV
  IF ((BE-ALPHA*(V+0.5)).LE.1.0E-8) GO TO 70
  QVR=QVR +TROT*DELTQV/(1.43879*(BE-ALPHA*(V+0.5)))
65  CONTINUE
  EVIB1=EVIB2
  V=V+1.0
  GO TO 60
70  PARTM=PARTM +QVR*DEGEN*EXP(-1.43879*TERM/TELECT)
C
C WRITE OUT RESULTS
  IF(NPRT.GT.1) WRITE(NFOUT,2) (AMOLEC(I,IB),I=1,2),M,
1 T,TV,TE,PARTM
2 FORMAT(1X,2A3,2X,6HLEVEL=,12,2X,8HT,TV,TE=,3F8.0,2X,
1 19HPARTITION FUNCTION=,1PE10.3)

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RETURN
END
*DECK TAINI
SUBROUTINE TAINI(XTAB,FTAB,X,FX,N,K,NER, MON)
DIMENSION XTAB(N),FTAB(N),T(10),C(10)
CPS0400 TAINI SUBROUTINE- IN FORTRAN II.
IF (N - K) 1,1,2
1 NER=2
RETURN
2 IF (K-9) 3,3,1
3 IF ( MON) 4,4,5
5 IF ( MON-2) 6,7,4
4 J=0
NM1=N-1
DO 8 I=1,NM1
IF (XTAB(I)-XTAB(I+1)) 9,11,10
11 NER=3
RETURN
9 J=J-1
GO TO 8
10 J=J+1
8 CONTINUE
MON=1
IF (J) 12,6,6
12 MON=2
7 DO 13 I=1,N
IF (X-XTAB(I)) 14,14,13
14 J=1
GO TO 18
13 CONTINUE
GO TO 15
6 DO 16 I=1,N
IF (X-XTAB(I)) 16,17,17
17 J=1
GO TO 18
16 CONTINUE
15 J=N
18 J=J-(K+1)/2
IF (J) 19,19,20
19 J=1
20 M=J+K
IF (M-N) 21,21,22
22 J=J-1
GO TO 20
21 KP1=K+1
JSAVE=J
26 DO 23 L=1,KP1
C(L)=X-XTAB(J)
T(L)=FTAB(J)
23 J=J+1
DO 24 J=1,K
I=J+1
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25 T(I)=(C(J)*T(I)-C(I)*T(J))/(C(J)-C(I))
   I=I+1
   IF (I-KP1) 25,25 ,24
24 CONTINUE
   FX=T(KP1)
   NER=1
   RETURN
   END
*DECK RATED
   FUNCTION RATED(IB,DE,ATOMF,MOLF,T,NFOUT,NPRT,NFERR)
C CALCULATES DISSOCIATION RATE DUE TO HEAVY PARTICLE COLLISION
C INPUT PARAMETERS
C   IB=SPECIES INDEX
C   DE=DISSOCIATION ENERGY, CM-1
C   ATOMF=FRACTION OF ATOMS
C   MOLF=FRACTION OF MOLECULES
C   T=HEAVY PARTICLE TEMPERATURE, K
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT.
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C OUTPUT PARAMETER
C   RATED=DISSOCIATION RATE COEF, CM3/S
   REAL MOLF,N
   DIMENSION C(2,5),N(2,5)
C RATE CONSTANTS C AND N TAKEN FROM PARK-MENEES JGR VOL 83,NO C8,
C   P4029, AUG 1978
C THE CONSTANTS FOR CN ASSUMED TO BE THE SAME AS FOR NO
   DATA C/0.0184,0.00614,0.0184,0.00614,7.63E-7,3.82E-7,
   1 1.37E-4,4.56E-5,7.63E-7,3.82E-7/
   DATA N/-1.6,-1.6,-1.6,-1.6,-0.5,-0.5,-1.0,-1.0,-0.5,-0.5/
C C(1,IB)=RATE CONSTANT FOR ATOM COLLISION
C C(2,IB)=RATE CONSTANT FOR MOLECULE COLLISION
C N(1,IB)=TEMPERATURE EXPONENT FOR ATOM COLLISION
C N(2,IB)=TEMPERATURE EXPONENT FOR MOLECULE COLLISION
   D=1.4388*DE
   RATED=(ATOMF*C(1,IB)+MOLF*C(2,IB))*T**N(1,IB)*EXP(-D/T)
   IF(NPRT.GT.1) WRITE(NFOUT,1) IB,DE,RATED
   1 FORMAT(1X,12HMOLECULE NO.,13,2X,3HDE=,F10.1,2X,
   1 7H RATED=,1PE10.3)
   RETURN
   END
*DECK RADIN
C THIS IS THE BEGINNING OF THE MODULE NUMBER 3
C THE MODULE CONTAINS THE FOLLOWING SUBROUTINES
C   RADIN,RADCAL,BFCNT,TAINT,FFCNT,ATOMIC,SETUP,VUWL,
C   ZERO,ONE,S2PI2,FAST,SAXPY,GLBPWR
C   SUBROUTINE RADIN(NFIN,NFOUT,NPRT)
C
C READ IN RADIATION DATA FOR NONEQUILIBRIUM RADIATION CALCULATION
C
C INPUT ARGUMENTS
C   NFIN=FILE NUMBER OF INPUT DATA (NORMALLY 5)
C   NFOUT=FILE NUMBER OF OUTPUT DATA (NORMALLY 6)
C   NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT

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C
C COMMON/RADA/ CONTAINS ATOMIC DATA
      COMMON/RADA/ATOM(4,2),LATOM(4,2),GLEV(8,2,2),ELEV(8,2,2),BLINE
      1 (13,180,2),NBFCON(2,35,2),BFCON(14,35,2),TFF(5),EEFF(6),
      2 FFCON(6,5,2)
C
C COMMON/RADB/ CONTAINS MOLECULAR DATA
      COMMON/RADB/AMOLEC(3,20),LMOLEC(6,20),SPEC2(8,20,20),VIB(4,100,20)
C
C
C CYCLE OVER 2 SPECIES. ISP=1: NITROGEN; =2: OXYGEN
      DO 2 ISP=1,2
C
C READ IN BASIC ATOMIC DATA
C VARIABLES
C   ATOM(1-2,ISP)=NAME OF ATOM
C   (3,ISP)=ATOMIC WEIGHT
C   (4,ISP)=IONIZATION POTENTIAL, CM-1
C   LATOM(1,ISP)=NUMBER OF LINES
C   (2,ISP)=NUMBER OF BOUND-FREE CONTINUUM
C   (3,ISP)=NUMBER OF FREE-FREE CONTINUUM (=5)
      READ(NFIN,3) (ATOM(I,ISP),I=1,4),(LATOM(I,ISP),I=1,3)
      3 FORMAT(1X,2A3,3X,2E10.3,3I5)
      IF(NPRT.GT.0) WRITE(NFOUT,1) (ATOM(I,ISP),I=1,4),(LATOM(I,ISP),I=
      1 1,3)
      1 FORMAT(//16H BASIC ATOM DATA/6H NAME=,2A3,3X,14HATOMIC WEIGHT=,F10
      1.3,3X,21HIONIZATION POTENTIAL=,F10.1,5H CM-1/ 75H NUMBER OF LINES,
      2BOUND-FREE CONTINUUM, AND FREE-FREE CONTINUUM PARAMETERS = ,3I6)
C
C READ IN MULTIPLICITY AND ENERGY LEVEL OF NEUTRAL AND IONIZED STATES
      IF(NPRT.GT.1) WRITE(NFOUT,8)
      8 FORMAT(/60H MULTIPLICITY AND ENERGY LEVEL OF NEUTRAL AND IONIZED S
      1TATES )
      DO 5 ION=1,2
      READ(NFIN,6) ((GLEV(I,ION,ISP),ELEV(I,ION,ISP)),I=1,8)
      6 FORMAT(8E10.3)
      IF(NPRT.GT.1) WRITE(NFOUT,7)((GLEV(I,ION,ISP),ELEV(I,ION,ISP)),I=
      1 1,8)
      7 FORMAT(4(2X,F6.1,F10.1))
      5 CONTINUE
C
C LINE DATA
      IF(NPRT.GT.1) WRITE(NFOUT,9)
      9 FORMAT(/ 10H LINE DATA/ 99H   GAM       EXPN   GL   GU   TERM
      1   EINSTN   LAMCL   ST(L)  ST(U)  I(L)  I(U)
      2           )
      MLINE=LATOM(1,ISP)
      DO 12 ILINE=1,MLINE
      READ(NFIN,13) (BLINE(I,ILINE,ISP),I=1,13)
      13 FORMAT(2E10.3,2F5.1,3E10.3,1X,2A3,1X,2A3,2F3.0)
      IF(NPRT.GT.1) WRITE(NFOUT,14) (BLINE(I,ILINE,ISP),I=1,13)
      14 FORMAT(1P2E10.3,0P2F5.1,1P3E10.3,1X,2A3,1X,2A3,0P2F3.0)
      12 CONTINUE

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C
C BOUND-FREE CONTINUUM DATA
  IF(NPRT.GT.1) WRITE(NFOUT,15)
15 FORMAT(/ 48H BOUND-FREE CONTINUUM GAUNT FACTORS, FROM PEACH )
  NCON=LATOM(2,ISP)
  DO 16 ICON=1,NCON
    READ(NFIN,17) NBFCON(1,ICON,ISP),(BFCON(1,ICON,ISP),I=11,14),
    1 NBFCON(2,ICON,ISP),(BFCON(1,ICON,ISP),I=1,10)
17 FORMAT(1X,I1,A2,A3,3X,2F10.2,110/10F8.4)
    IF(NPRT.GT.1) WRITE(NFOUT,17) NBFCON(1,ICON,ISP),(BFCON(1,ICON,
    1 ISP),I=11,14),NBFCON(2,ICON,ISP),(BFCON(1,ICON,ISP),I=1,10)
16 CONTINUE

C
C FREE-FREE CONTINUUM DATA
  NCON=LATOM(3,ISP)
  READ(NFIN,6) (EEFF(I),I=1,6)
  IF(NPRT.GT.1) WRITE(NFOUT,33) (EEFF(I),I=1,6)
33 FORMAT(/41H FREE-FREE CONTINUUM FACTORS, FROM PEACH /
> 19H ELECTRON ENERGIES=,6F8.3)
  DO 19 ICON=1,5
    READ(NFIN,6) TFF(ICON),(FFCON(1,ICON,ISP),I=1,6)
    IF(NPRT.GT.1) WRITE(NFOUT,20) TFF(ICON),(FFCON(1,ICON,
    1 ISP),I=1,6)
20 FORMAT(F10.0,6F10.3)
19 CONTINUE
  2 CONTINUE

C
C
C READ IN MOLECULAR DATA
C
C VARIABLES
C   IB=BAND INDEX, FROM 1 TO 20
C   AMOLEC(1-2,IB)=NAME OF BAND
C   (3,IB)=MOLECULAR WEIGHT
C   LMOLEC(1,IB)=TYPE INDEX
C   (2,IB)=NUMBER OF BANDS
C   (3,IB)=NUMBER OF ENERGY LEVELS
C   (4,IB)=MOLECULE INDEX IN THE NONEQUILIBRIUM SCHEME
C   (5,IB)=ORDER WITHIN A MOLECULE
C   SPEC2(I,J,IB)=MOLECULAR CONSTANTS
C   VIB(V1,V2,IB)=VIBRATIONAL DATA
C
  NB=20
  DO 21 IB=1,NB
    READ(NFIN,22) (AMOLEC(1,IB),I=1,3),(LMOLEC(1,IB),I=1,5)
22 FORMAT(1X,2A3,3X,F10.3,6I5)
    IF(NPRT.GT.0) WRITE(NFOUT,23) (AMOLEC(1,IB),I=1,3),(LMOLEC(1,IB),
    1 I=1,5)
23 FORMAT(//21H MOLECULAR BAND NAME=,2A3,19H MOLECULAR WEIGHT=,F10.
    1 3/ 6HINDEX=,I2,3X,13HNO. OF BANDS=,I3,3X,14HNO. OF LEVELS=,
    2 I3,3X,13HMOLECULE NO.=,I2,3X, 6HORDER=,I2)
    READ(NFIN,24) LMOLEC(3,IB),(SPEC2(1,1,IB),I=2,9),(SPEC2(1,2,IB),
    1 I=1,8)

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24 FORMAT(110,7E10.3/8E10.3)
   IF(NPRT.GT.1) WRITE(NFOUT,25) LMOLEC(3,IB),(SPEC2(1,1,IB),I=2,8),
   1 (SPEC2(1,2,IB),I=1,8)
25 FORMAT(15H NO. OF LEVELS=,I2,1X,7HALTNAT=,F5.1,1X,4HDEU=,
   1 1PE10.3,1X, 6HBETAU=,E10.3,1X,4HREU=,E10.3,1X, 7HDZEROU=,OPF10.2
   2,1X, 6HCAPAU=, F8.2,1X, 6HCAPLU=,F4.1/ 4H MU=, F8.2,6X, 7HNUSPIN=,
   3F5.1,1X,4HDEL=,1PE10.3,1X, 6HBETAL=,E10.3,1X, 4HREL=,E10.3,1X,
   4 7HDZEROL=,OPF10.2,1X, 6HCAPAL=, F8.2,1X,6HCAPLL=,F4.1/80H DEGEN
   5   TERM      WE      WEXE      WEYE      WEZE      BE      AL
   6PHA      )
   N1=LMOLEC(3,IB)+2
   NV=LMOLEC(2,IB)-1
   DO 26 JN=3,N1
   READ(NFIN,6) (SPEC2(1,JN,IB),I=1,8)
   IF(NPRT.GT.1) WRITE(NFOUT,28) (SPEC2(1,JN,IB),I=1,8)
28 FORMAT(6F10.3,F10.5,1PE10.3)
26 CONTINUE

C
C INDIVIDUAL VIBRATIONAL BANDS
   IF(NPRT.GT.1) WRITE(NFOUT,29)
29 FORMAT(65H VU VL SUMREZ FRANCK VU VL SUMREZ FRANKCK
   >CK      )
   DO 30 JV=1,NV,2
   READ(NFIN,31) (VIB(I,JV,IB),I=1,4),(VIB(I,JV+1,IB),I=1,4)
31 FORMAT(2(2F5.1,2E10.3))
   IF(NPRT.GT.1) WRITE(NFOUT,32) (VIB(I,JV,IB),I=1,4),(VIB(I,JV+1,
   1 IB),I=1,4)
32 FORMAT(2(OP2F5.1,1P2E10.3))
30 CONTINUE
21 CONTINUE
   RETURN
   END
*DECK RADCAL
   SUBROUTINE RADCAL(N,NP,G,OP,N2,N2P,O2,NO,CN,NE,T,TV,TE,TEX,
   > PRESS,RHO,DENS,SMF,WIDTF,STARK,WAVELS,WAVELL,NARRAY,NFIN,
   > NFOUT,NPRT1,NPRT2,NFERR,NMETH,WAVEL,EMIS,ABSB,TOTPWR)
C CALCULATES RADIATION
C INPUT PARAMETERS
C N=NUMBER DENSITY OF N
C NP=NUMBR DENSITY OF N+
C O=NUMBER DENSITY OF O
C OP=NUMBER DENSITY OF O+
C N2=NUMBER DENSITY OF N2
C N2P=NUMBER DENSITY OF N2+
C O2=NUMBER DENSITY OF O2
C NO=NUMBER DENSITY OF NO
C CN=NUMBER DENSITY OF CN
C NE=NUMBER DENSITY OF ELECTRONS
C T=HEAVY PARTICLE TEMPERATURE(=ROTATIONAL TEMPERATURE)
C TV=VIBRATIONAL TEMPERATURE
C TEX(JSPEC)=ELECTRONIC EXCITATION TEMPERATURE OF JSPEC-TH
C MOLECULAR SYSTEM
C PRESS=PRESSURE, ATM
C RHO=NONEQUILIBRIUM POPULATION PARAMETERS FOR ATOM, DIMENSIONED
C (23,2)

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C   DENS=GAS DENSITY, G/CM3
C   SMF=STRENGTH MULTIPLICATION FACTOR, DIMENSIONED (20,2)
C       (1,1)=N LINE
C       (2,1)=N BOUND-FREE CONTINUUM
C       (3,1)=N+ FREE-FREE CONTINUUM
C       (4,1)=O LINE
C       (5,1)=O BOUND-FREE CONTINUUM
C       (6,1)=O+ FREE-FREE CONTINUUM
C       (JSPEC2,2)=MOLECULAR BAND
C   WIDTHF=LORENTZ WIDTH MULTIPLICATION FACTOR FOR MOLECULE
C   STARK=STARK WIDTH FOR MOLECULE AT NE=1.E16 AND TE=10000
C   WAVELS=SHORT-WAVELENGTH LIMIT, A
C   WAVELL=LONG-WAVELENGTH LIMIT, A
C   NARRAY=LENGTH OF RADIATION ARRAYS)
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   NMETH=1, TOTAL POWER CALCULATION. =2, SPECTRAL CALCULATION
C OUTPUT PARAMETERS
C   WAVEL=WAVELENGTH, A
C   EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
C   ABSB=ABSORPTION+STIMULATED EMISSION COEFFICIENT, CM-1
C   TOTPWR(3)=TOTAL EMITTED POWER. 1=TOTAL, 2=ABOVE 2500 A
C       3=ABOVE 3500 A
C   REAL N,NP,N2,N2P,NO,NE
C   COMMON/RADA/ATOM(4,2),LATOM(4,2),GLEV(8,2,2),ELEV(8,2,2),BLINE
C   1 (13,180,2),NBFCO(2,35,2),BFCO(14,35,2),TFF(5),EEFF(6),
C   2 FFCO(6,5,2)
C   COMMON/RADB/AMOLEC(3,20),LMOLEC(6,20),SPEC2(8,20,20),VIB(4,
C   1 100,20)
C   DIMENSION TEX(20)
C   DIMENSION WAVEL(1)
C   DIMENSION EMIS(1)
C   DIMENSION ABSB(1)
C   DIMENSION ANMOL(20),AN(2,2),RHO(23,2),SMF(20,2),NLEV(2),
C   > TOTPWR(3)
C   DATA INIT/0/,NLEV/22,19/
C   IF((NMETH.EQ.1).AND.(NARRAY.GT.1000)) NARRAY=1000
C
C READIN RADIATION DATA AND PRODUCE WAVELENGTH ARRAY
C   IF(INIT.NE.0) GO TO 4
C   CALL RADIN(NFIN,NFOUT,NPRT1)
C   DELLAM=(1./WAVELS-1./WAVELL)/(NARRAY-1)
C   DO 3 M=1,NARRAY
C 3   WAVEL(M)=1./(1./WAVELS-(M-1)*DELLAM)
C   INIT=1
C   4 CONTINUE
C
C NULL EMIS, ABSB, AND TOTPWR ARRAYS
C   DO 8 M=1,NARRAY
C   EMIS(M)=0.
C 8   ABSB(M)=0.
C   DO 9 M=1,3
C 9   TOTPWR(M)=0.

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C
C ATOMIC CALCULATION STARTS
  AN(1,1)=N
  AN(2,1)=0
  AN(1,2)=NP
  AN(2,2)=OP
  DO 1 ISP=1,2
    I=3*(ISP-1)
    IF(SMF(I+1,1).GT.1.0E-10) CALL ATOMIC(ISP,NE,TE,T,RHO(1,ISP),
1 NLEV(ISP),AN(ISP,1),AN(ISP,2),PRESS,DENS,SMF(I+1,1),WAVEL,EMIS,
2 ABSB,NARRAY,NFOUT,NPRT2,NFERR,NMETH,TOTPW)
C
C CALCULATE GLOBAL (4 PI STER-RADIAN) POWER EMISSION
  IF(NMETH.GT.1)CALL GLBPWR(WAVEL,EMIS,NARRAY,PWR1,PWR2,PWR3)
  IF((NPRT2.GT.0).AND.(NMETH.GT.1)) WRITE(NFOUT,5)PWR1,
> PWR2,PWR3
  IF((NPRT2.GT.0).AND.(NMETH.EQ.1)) WRITE(NFOUT,5)(TOTPW
1 (I),I=1,3)
C
  IF(SMF(I+2,1).GT.1.0E-10) CALL BFCONT(ISP,RHO(1,ISP),NLEV(ISP),
1 NE,TE,AN(ISP,1),AN(ISP,2),SMF(I+2,1),WAVEL,EMIS,ABSB,NARRAY,
2 NFOUT,NPRT2,NFERR,NMETH,TOTPW)
  IF(SMF(I+3,1).GT.1.0E-10) CALL FFCONT(ISP,NE,TE,
1 AN(ISP,2),SMF(I+3,1),WAVEL,EMIS,ABSB,NARRAY,NFOUT,
2 NPRT2,NFERR,NMETH,TOTPW)
  IF(NPRT2.GT.0)WRITE(NFOUT,6)(ATOM(I,ISP),I=1,2)
6 FORMAT(1X,2A3,14H ATOM FINISHED )
C
C CALCULATE GLOBAL(4 PI STER-RADIAN) POWER EMISSION
  IF(NMETH.GT.1)CALL GLBPWR(WAVEL,EMIS,NARRAY,PWR1,PWR2,PWR3)
  IF((NPRT2.GT.0).AND.(NMETH.GT.1)) WRITE(NFOUT,5)PWR1,
> PWR2,PWR3
  IF((NPRT2.GT.0).AND.(NMETH.EQ.1)) WRITE(NFOUT,5) (TOTPW
1(I),I=1,3)
1 CONTINUE
C
C CALCULATION OF MOLECULAR RADIATION
  ANMOL(1)=N2P
  ANMOL(2)=N2P
  ANMOL(3)=N2
  ANMOL(4)=N2
  ANMOL(5)=N2
  ANMOL(6)=N2
  ANMOL(7)=N2
  ANMOL(8)=N2
  ANMOL(9)=NO
  ANMOL(10)=NO
  ANMOL(11)=NO
  ANMOL(12)=NO
  ANMOL(13)=NO
  ANMOL(14)=O2
  ANMOL(15)=O2
  ANMOL(16)=O2
  ANMOL(17)=O2
  ANMOL(18)=CN

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ANMOL(19)=CN
ANMOL(20)=CN
DO 2 JSPEC2=1,20
IF(SMF(JSPEC2,2).LT.1.0E-10) GO TO 2
CALL SETUP(JSPEC2,SMF(JSPEC2,2),ANMOL(JSPEC2),T,TV,TEX)
CALL UUVL(JSPEC2,SMF(JSPEC2,2),NE,PRESS,WIDTF,STARK,
>DENS,WAVEL,EMIS,ABSB,NARRAY,NFOUT,NPRT2,NFERR,NMETH,TOTPWR)
IF(NPRT2.GT.0) WRITE(NFOUT,7) (AMOLEC(I,JSPEC2),I=1,2)
7 FORMAT(1X,2A3,10H FINISHED )
C
C CALCULATE GLOBAL(4-PI STER-RADIAN) POWER EMISSION
IF(NMETH.GT.1)CALL GLBPWR(WAVEL,EMIS,NARRAY,PWR1,PWR2,PWR3)
IF((NPRT2.GT.0).AND.(NMETH.GT.1)) WRITE(NFOUT,5)PWR1,
> PWR2,PWR3
IF(NMETH.EQ.1) GO TO 10
TOTPWR(1)=PWR1
TOTPWR(2)=PWR2
TOTPWR(3)=PWR3
10 CONTINUE
5 FORMAT(30H GLOBAL POWER EMISSION. TOTAL=,1PE12.5,2X,
1 13HABOVE 2500 A=,E12.5,2X,13HABOVE 3500 A=,E12.5,
2 6H W/CM3)
IF((NMETH.EQ.1).AND.(NPRT2.GT.0)) WRITE(NFOUT,5) (TOTPWR
1(I),I=1,3)
2 CONTINUE
RETURN
END
*DECK BFCONT
SUBROUTINE BFCONT(ISP,RHO,NLEV,ANE,TE,AN,ANP,SMF,WAVEL,EMIS,
> ABSB,NARRAY,NFOUT,NPRT,NFERR,NMETH,TOTPWR)
C
C CALCULATES EMISSION AND ABSORPTION COEFFICIENTS DUE TO BOUND-FREE
C CONTINUUM
C SUBROUTINE RADIN MUST BE EXECUTED BEFORE THIS SUBROUTINE CAN BE
C EXECUTED
C INPUT PARAMETERS
C ISP=SPECIES INDEX. 1=N, 2=0
C RHO=NONEQUILIBRIUM POPULATION PARAMETER, DIMENSIONED 23
C NLEV=NUMBER OF LEVELS
C ANE=ELECTRON DENSITY, CM-3
C TE=ELECTRON TEMPERATURE, K
C AN=NUMBER DENSITY OF ATOM
C ANP=NUMBER DENSITY OF ION
C SMF=STRENGTH MULTIPLICATION FACTOR
C WAVEL=WAVELENGTH, A
C NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
C NFOUT=FILE NUMBER OF OUTPUT PRINTS
C NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C NFERR=FILE NUMBER OF ERROR MESSAGES
C NMETH=1, EMITTED POWER ONLY. =2 SPECTRAL CALCULATION
C OUTPUT PARAMETERS
C EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
C ABSB=ABSORPTION+STIMULATED EMISSION COEFFICIENT, CM-1
C TOTPWR(3)=POWER EMITTED
COMMON/RADA/ATOM(4,2),LATOM(4,2),GLEV(8,2,2),ELEV(8,2,2),BLINE

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1 (13,180,2),NBFCN(2,35,2),BFCN(14,35,2),TFF(5),EEFF(6),
2 FFCN(6,5,2)
  DIMENSION RHO(23),WCUTS(35),WCUTL(35),EX(10),RHOLG(23)
  > ,TOTPWR(3)
  DIMENSION WAVEL(1)
  DIMENSION EMIS(1)
  DIMENSION ABSB(1)
  DATA EX/0.,0.05,0.1,0.15,0.2,0.25,0.3,0.35,0.4,0.45/
C
C NULL EMIS ARRAY FOR TOTAL POWER CALCULATION
  IF(NMETH.GT.1) GO TO 12
  DO 11 M=1,NARRAY
11 EMIS(M)=0.
12 CONTINUE
C
C CALCULATE PARAMETERS
  EION=ATOM(4,ISP)
  TE1=1./TE
  TE2=SQRT(TE1)
  TE3=TE1*TE2
  PARTI=0.
  DO 1 JLEV=1,4
1 PARTI=PARTI+GLEV(JLEV,2,ISP)*EXP(-1.43877*ELEV(JLEV,2,ISP)*
  >TE1)
  AZ=2.07E-16*ANP*TE3/PARTI
C
C GENERATE ALOG OF RHO
  DO 2 JLEV=1,NLEV
  RHOJ=RHO(JLEV)
  IF(RHOJ.GT.1.0E-30) GO TO 6
  WRITE(NFERR,7) ISP,JLEV,RHOJ
7 FORMAT(22H ERROR IN BFCNT. ISP=,I3,3X,6H JLEV=,I3,
  >3X,4HRHO=,1PE10.3,3X,18H RHO SET TO 1.E-10)
  RHOJ=1.0E-10
6 RHOLG(JLEV)=ALOG(RHOJ)
2 CONTINUE
C
C GENERATE CUT-OFF WAVELENGTHS
C WCUTS=SHORT-WAVE END. WCUTL=LONG-WAVE END.
  NCON=LATOM(2,ISP)
  DO 3 J=1,NCON
  EJ=BFCN(14,J,ISP)
  WCUTL(J)=1.0E8/(EION-EJ)
  WCUTS(J)=1.0E8/(EION-EJ+0.5*109679.)
3 CONTINUE
C
C
C CYCLE OVER WAVELENGTHS
  DO 4 L=1,NARRAY
  WAVEX=WAVEL(L)
  DO 5 J=1,NCON
  IF((WAVEX.LT.WCUTS(J)).OR.(WAVEX.GT.WCUTL(J))) GO TO 5
  HNU=1.0E8/WAVEX
  EE=(HNU-(EION-EJ))/109679.
  CC=7.908E-18*(109679./HNU)**3/NBFCN(1,J,ISP)**5

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MON=0
CALL TAIN(T,EX,BFCN(1,J,ISP),EE,GAUNT,10,3,IER,MON)
CROS=CC*GAUNT
C
C CONSTRUCT EMISSION AND ABSORPTION COEFFICIENTS
GL=BFCN(13,J,ISP)
NG=NBFCN(2,J,ISP)
APEN=AZ*GL*EXP(1.43877*(EION-EJ)*TE1)
ANJ=APEN*ANE*RHO(NG)
C
C EXCITATION TEMPERATURE TEX
TEX=1.43877*(EION-EJ)/(RHOLG(NG)+1.43877*(EION-EJ)*TE1)
C
XLAM=WAVEX*1.0E-8
AX=EXP(-1.43877/(XLAM*TEX))
BX=XLAM**5
BLAM=1.1904E-16*AX/(BX*(1.0-AX))
ABSBL=ANJ*CROS*SMF
EMISL=ABSBL*BLAM
ABSB(L)=ABSB(L)+ABSBL
EMIS(L)=EMIS(L)+EMISL
5 CONTINUE
4 CONTINUE
C
C CALCULATE GLOBAL POWER EMISSION
IF(NMETH.GT.1) GO TO 10
CALL GLBPWR(WAVEL,EMIS,NARRAY,PWR1,PWR2,PWR3)
IF(NPRT.GT.1) WRITE(NFOUT,9)(ATOM(I,ISP),I=1,2),PWR1,
1 PWR2,PWR3
9 FORMAT(1X,2A3,1X,33H BOUND-FREE CONT.,PWR1,PWR2,PWR3=,
1 1P3E10.3)
TOTPWR(1)=TOTPWR(1)+PWR1
TOTPWR(2)=TOTPWR(2)+PWR2
TOTPWR(3)=TOTPWR(3)+PWR3
10 CONTINUE
C
C PRINT OUT
IF(NPRT.GT.1) WRITE(NFOUT,8) (ATOM(I,ISP),I=1,2)
8 FORMAT(1X,2A3,30H BOUND-FREE CONTINUUM FINISHED )
RETURN
END
*DECK FFCONT
SUBROUTINE FFCONT(ISP,ANE,TE,ANP,SMF,WAVEL,EMIS,ABSB,
> NARRAY,NFOUT,NPRT,NFERR,NMETH,TOTPWR)
C COMPUTES FREE-FREE CONTINUUM
C INPUT PARAMETERS
C ISP=SPECIES INDEX. 1=N. 2=0
C ANE=ELECTRON DENSITY, CM-3
C TE=ELECTRON DENSITY, K
C ANP=ION DENSITY
C SMF=STRENGTH MULTIPLICATION FACTOR
C WAVEL=WAVELENGTH, A
C NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
C NFOUT=FILE NUMBER OF OUTPUT PRINTS
C NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT

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C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   NMETH=1, EMITTED POWER CALC ONLY. =2 SPECTRAL CALC.
C OUTPUT PARAMETERS
C   EMIS=EMISSION COEFFICIENT
C   ABSB=ABSORPTION COEFFICIENT
C   TOTPW(3)=TOTAL EMITTED POWER
      REAL LAMBDA
      COMMON/RADA/ATOM(4,2),LATOM(4,2),GLEV(8,2,2),ELEV(8,2,2),BLINE
1   (13,180,2),NBFCN(2,35,2),BFCN(14,35,2),TFF(5),EEFF(6),
2   FFCN(6,5,2)
      DIMENSION Y(6),SIGMA(6),TOTPW(3)
      DIMENSION WAVE(1)
      DIMENSION EMIS(1)
      DIMENSION ABSB(1)
      RYD=109679.
      RYD1=1./RYD
      TE1=1./TE
      C1 = 1.368E-23*ANE*ANP*SQRT(TE1)
C
C NULL EMIS ARRAY FOR TOTAL POWER CALCULATION ONLY
      IF(NMETH.GT.1) GO TO 3
      DO 4 M=1,NARRAY
4   EMIS(M)=0.
3   CONTINUE
C
C INTERPOLATE D OF PEACH FOR TE
      DO 6 JS=1,6
      MON=0
      DO 7 JT=1,5
7   Y(JT)=FFCN(JS,JT,ISP)
      CALL TAIN(TFF,Y,TE,SIG,5,2,IER,MON)
6   SIGMA(JS)=SIG
C
C CYCLE OVER WAVELENGTH
      MON=0
      DO 1 M=1,NARRAY
      LAMBDA=1.0E-8*WAVE(M)
      OMEG=1.0/LAMBDA
      AZ=OMEG*RYD1
      CALL TAIN(EEFF,SIGMA,AZ,D,6,3,IER,MON)
      GHPPF=1.0+0.1728*(AZ**0.333333)*(1.0+1.39*TE*LAMBDA)
      GAUNT=GHPPF*(1.0+D)*SMF
      ABSBX=C1*GAUNT*(LAMBDA**3)
      AZ=EXP(-1.43879*OMEG*TE1)
      BZ=LAMBDA**5
      BLAM=1.1904E-16*AZ/(BZ*(1.0-AZ))
      EMISX=ABSBX*BLAM
      EMIS(M)=EMIS(M)+EMISX
      ABSB(M)=ABSB(M)+ABSBX
1   CONTINUE
C
C CALCULATE GLOBAL POWER EMISSION
      IF(NMETH.GT.1) GO TO 10
      CALL GLBPWR(WAVE,EMIS,NARRAY,PWR1,PWR2,PWR3)
      IF(NPRT.GT.1) WRITE(NFOUT,9) (ATOM(I,ISP),I=1,2),PWR1,

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1 PWR2,PWR3
9 FORMAT(1X,2A3,1X,32H FREE-FREE CONT.,PWR1,PWR2,PWR3= ,
1 1P3E10.3)
TOTPWR(1)=TOTPWR(1)+PWR1
TOTPWR(2)=TOTPWR(2)+PWR2
TOTPWR(3)=TOTPWR(3)+PWR3
10 CONTINUE

C
C PRINT OUT
IF(NPRT.GT.1) WRITE(NFOUT,2) (ATOM(I,ISP),I=1,2)
2 FORMAT(1X,2A3,33H ION FREE-FREE CONTINUUM FINISHED )
RETURN
END

*DECK ATOMIC
SUBROUTINE ATOMIC(ISP,ANE,TE,T,RHO,NLEV,AN,ANP,PRESS,DENS,SMF,
> WAVEL,EMIS,ABSB,NARRAY,NFOUT,NPRT,NFERR,NMETH,TOTPWR)
C COMPUTES ATOMIC LINE
C INPUT ARGUMENTS
C ISP=SPECIES INDEX. 1=N. 2=0
C ANE=ELECTRON DENSITY, CM-3
C TE=ELECTRON TEMPERATURE, K
C T=HEAVY PARTICLE TEMPERATURE, K
C RHO=NONEQUILIBRIUM POPULATION PARAMETER
C NLEV=NUMBER OF ENERGY LEVELS
C AN=NUMBER DENSITY OF NEUTRAL ATOM
C ANP=NUMBER DENSITY OF ION
C PRESS=PRESSURE, ATM
C DENS=GAS DENSITY, G/CM3
C SMF=STRENGTH MULTIPLICATION FACTOR
C WAVEL=WAVELENGTH
C NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
C NFOUT=FILE NUMBER OF OUTPUT PRINTS
C NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C NFERR=FILE NUMBER OF ERROR MESSAGES
C NMETH=1, EMITTED POWER ONLY. =2, SPECTRAL CALCULATION
C OUTPUT PARAMETERS
C EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
C ABSB=ABSORPTION+STIMULATED EMISSION COEFFICIENT, -1
C TOTPWR(3)=TOTAL EMITTED POWER
REAL LAMCL,LAMBDA
COMMON/RADA/ATOM(4,2),LATOM(4,2),GLEV(8,2,2),ELEV(8,2,2),BLINE
1 (13,180,2),NBFCN(2,35,2),BFCN(14,35,2),TFF(5),EEFF(6),
2 FFCN(6,5,2)
DIMENSION RHO(23),TOTPWR(3)
DIMENSION WAVEL(1)
DIMENSION EMIS(1)
DIMENSION ABSB(1)

C
PWR1=0.
PWR2=0.
PWR3=0.

C
C CALCULATE PARAMETERS
DELLAM=(1.0/WAVEL(1)-1.0/WAVEL(NARRAY))/(NARRAY-1)
EION=ATOM(4,ISP)

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TE1=1./TE
TE2=SQRT(TE1)
TE3=TE1*TE2
QA=0.
QP=0.
DO 1 J=1,8
QA=QA+GLEV(J,1,ISP)*EXP(-1.43877*ELEV(J,1,ISP)*TE1)
1 QP=QP+GLEV(J,2,ISP)*EXP(-1.43877*ELEV(J,2,ISP)*TE1)
AZ=2.07E-16*ANP*TE3/QP
C
C DETERMINE NUMBER DENSITY AND AVERAGE ATOMIC WEIGHT OF
C FOREIGN GAS
ANREST=1.0E10
IF(PRESS.GT.1.0E-20) ANREST=0.8338E22*PRESS/T-AN
AMREST=20.*1.66E-24
IF(DENS.GT.1.0E-20) AMREST=(DENS-1.66E-24*ATOM(3,ISP)
) *AN)/ANREST
AMREST=AMREST/1.66E-24
IF(AMREST.LT.10.) AMREST=10.
IF(AMREST.GT.28.85) AMREST=28.85
CW3=(1.33E-29*SQRT(2./ATOM(3,ISP)))*AN+5.85E-30*SQRT
)(2./AMREST)*ANREST)*SQRT(T)
C
C CYCLE OVER LINES
NLINE=LATOM(1,ISP)
DO 6 K=1,NLINE
GAM=BLINE(1,K,ISP)
EXPV=BLINE(2,K,ISP)
GL=BLINE(3,K,ISP)
GU=BLINE(4,K,ISP)
TERMU=BLINE(5,K,ISP)
EINSTN=BLINE(6,K,ISP)
LAMCL=BLINE(7,K,ISP)
TERML=TERMU-1.0E8/LAMCL
IF((GL.LT.0.5).OR.(GU.LT.0.5)) WRITE(NFERR,3) ISP,K,
) LAMCL,GL,GU
3 FORMAT(22H ERROR IN ATOMIC, ISP=,I2,3X,5HLINE=,I3,3X,
1 6HLAMCL=,F8.1,3X,3HGL=,F5.1,2X,3HGU=,F5.1)
C
C DETERMINE NUMBER DENSITIES OF UPPER AND LOWER STATES
APENL=AZ*ANE*GL*EXP(1.43877*(EION-TERML)*TE1)
APENU=AZ*ANE*GU*EXP(1.43877*(EION-TERMU)*TE1)
NGL=BLINE(12,K,ISP)
NGU=BLINE(13,K,ISP)
ANL=APENL*RRHO(NGL)
ANU=APENU*RRHO(NGU)
C
C FIND INTEGRATED LINE INTENSITY DUE TO SPONTANEOUS EMISSION
E=1.580E-16*EINSTN*ANU/LAMCL
E=E*SMF
C
C DETERMINE TOTAL POWER FOR NMETH=1
IF(NMETH.GT.1) GO TO 11
IF(LAMCL.GT.WAVEL(1)) PWR1=PWR1+12.57*E
IF(LAMCL.GT.2500.) PWR2=PWR2+12.57*E

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        IF(LAMCL.GT.3500.) PWR3=PWR3+12.57*E
        GO TO 6
    11 CONTINUE
C
C NONEQUILIBRIUM EXCITATION TEMPERATURE TEX
    TEX=1.43877*(TERMU-TERML)/ALOG(GU*ANL/(GL*ANU))
C
C LINE WIDTH CALCULATION
    WIDTHG=7.15E-7*LAMCL*SQRT(T/ATOM(3,ISP))
    RANGE=30.
    IF(TERML.LT.40000.) RANGE=100.
    IF(TERML.LT.10000.) RANGE=200.
C LORENTZ LINEWIDTH WIDTHL IS A SUM OF WIDTH1(NATURAL), WIDTH2(STARK),
C WIDTH3(VAN DE WAALS), AND WIDTH4(RESONANCE) WIDTHS
    IF(GAM.LT.1.0E-8) EXPN=0.35
    DE=EION-TERMU
    IF(DE.LT.(109679./25.)) DE=109679./25.
    IF(GAM.LT.1.0E-8) GAM=0.42*(LAMCL**2)/(DE**2)
    5 CONTINUE
    WIDTH1=1.18E-4
    WIDTH2=2.0*GAM*(TE*1.0E-4)**EXPN*ANE*1.0E-16
    WIDTH3=CW3*LAMCL**2
    WIDTH4=1.03E-25*(1.0E-20*LAMCL**5)*SQRT(GU/GL)*EINSTN*ANL
    WIDTHL=WIDTH1+WIDTH2+WIDTH3+WIDTH4
C
C FIND THE VOIGT LINE WIDTH AT HALF-HEIGHT
    WIDTHV=WIDTHL/2.0+SQRT(WIDTHL**2/4.0+WIDTHG**2)
C
C TEST IF LINE LIES WITHIN THE RANGE
    W1=LAMCL-RANGE*WIDTHV
    W2=LAMCL+RANGE*WIDTHV
    IF(W2.LT.WAVEL(1)) GO TO 6
    IF(W1.GT.WAVEL(NARRAY)) GO TO 6
    DELLOC=LAMCL**2*DELLAM
    NSPRED=1.1+RANGE*WIDTHV/DELLOC
C
C SET CONSTANTS USED TO DISTRIBUTE ATOMIC LINE
    NCENTR=(1./WAVEL(1)-1.0/LAMCL)/DELLAM+1
    NSTART=NCENTR-NSPRED
    IF(NSTART.LT.1) NSTART=1
    NEND=NCENTR+NSPRED
    IF(NEND.GT.NARRAY)NEND=NARRAY
C
C DISTRIBUTE ATOMIC LINE
    WDI=1/WIDTHV
    XLAM=LAMCL*1.0E-8
    AX=EXP(-1.43877/(XLAM*TEX))
    BX=XLAM**5
    BLAM=1.1904E-16*AX/(BX*(1.-AX))
C
C TEST IF SHAPE IS NEARLY DISPERSIVE
    IF((WIDTHG/WIDTHL).GT.0.2) GO TO 8

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C
C LINE IS NEARLY DISPERSIVE
  WD2=2.0*WD1
  DO 10 M=NSTART,NEND
  LAMBDA=WAVEL(M)
  IF(LAMBDA.LT.W1) GO TO 10
  IF(LAMBDA.GT.W2) GO TO 10
  DELL=ABS(LAMBDA-LAMCL)
  EMISX=0.3183E4*E*WD2/(1.0+(DELL*WD2)**2)
  ABSBX=EMISX/BLAM
  ABSB(M)=ABSB(M)+ABSBX
10 EMIS(M)=EMIS(M)+EMISX
  GO TO 6

C
C LINE IS VOIGHT
  8 CONTINUE
  CSPRD2=WIDTHL/WIDTHV
  CSPRD3=(1.065+0.447*CSPRD2+0.058*CSPRD2**2)*WIDTHV*1.0E-4
  CSPRD1=(1.-CSPRD2)/CSPRD3
  CSPRD2=CSPRD2/CSPRD3
  DO 2 M=NSTART,NEND
  LAMBDA=WAVEL(M)
  CSPRD3=ABS((LAMBDA-LAMCL)*WD1)
  CSP2=CSPRD3**2
  CSP3=CSP2*SQRT(SQRT(CSPRD3))
  EMISX=E*(CSPRD1*EXP(-2.772*CSP2)+CSPRD2/(1.+4.*CSP2)+0.016*
1CSPRD2*(1.0-WIDTHL*WD1)*(EXP(-0.4*CSP3)-10.0/(10.0+CSP3)))
  ABSBX=EMISX/BLAM
  ABSB(M)=ABSB(M)+ABSBX
  2 EMIS(M)=EMIS(M)+EMISX

C
C PRINT OUT
  IF(NPRT.GT.1) WRITE(NFOUT,7) (ATOM(I,ISP),I=1,2),
  > LAMCL,WIDTHG,WIDTH1,WIDTH2,WIDTH3,WIDTH4,WIDTHL,WIDTHV
  7 FORMAT(1X,2A3,2X,6HLAMCL=,F8.1,2X,
  >25HLINEWIDTHS:G,1,2,3,4,L,V=,1P7E9.2)
  6 CONTINUE

C
C WRITE TOTAL POWER EMITTED
  IF((NMETH.EQ.1).AND.(NPRT.GT.1)) WRITE(NFOUT,12) (ATOM
  1 (I,ISP),I=1,2),PWR1,PWR2,PWR3
  12 FORMAT(1X,2A3,1X,22H LINES:PWR1,PWR2,PWR3=,1P3E10.3)
  IF(NMETH.GT.1) GO TO 13
  TOTPWR(1)=TOTPWR(1)+PWR1
  TOTPWR(2)=TOTPWR(2)+PWR2
  TOTPWR(3)=TOTPWR(3)+PWR3
  13 CONTINUE

C
C PRINT OUT
  IF(NPRT.GT.0) WRITE(NFOUT,4) (ATOM(I,ISP),I=1,2)
  4 FORMAT(1X,2A3,15H LINES FINISHED )
  RETURN
  END

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*DECK SETUP
  SUBROUTINE SETUP(JSPEC2,SMF,ANMOL,T,TV,TEX)
C SETS UP SPECTROSCOPIC CONSTANTS AND STORES
C INPUT PARAMETERS
C   JSPEC2=SPECTRA NUMBER
C   SMF=STRENGTH MULTIPLICATION FACTOR
C   ANMOL=NUMBER DENSITY OF MOLECULE
C   T=HEAVY PARTICLE TRANSLATIONAL AND ROTATIONAL TEMPERATURE
C   TV=VIBRATIONAL TEMPERATURE
C   TE=ELECTRON TEMPERATURE
  REAL MU,NUSPIN,NUBAR0
  COMMON/RADB/AMOLEC(3,20),LMOLEC(6,20),SPEC2(8,20,20),VIB(4,
>100,20)
  COMMON/CBAND1/ALPHAU,BEU,BETAU,CAPAU,CAPLU,DEU,DZEROU,REU,TERMU,
1     ALPHAL,BEL,BETAL,CAPAL,CAPLL,DEL,DZEROL,REL,TERML
  COMMON/CBAND2/WEU,WEXEU,WEYEU,WEZEU,BVU,DVU,DEGENU,MU,ALTNAT,
1     WEL,WEXEL,WEYEL,WEZEL,BVL,DVL,      NUSPIN
  COMMON/CTEMP/TELECT,TVIB,TROT
  COMMON/CTRAN/PARTCC,NUBAR0,Q,A0E,CINT1,CINT2,KMIN,KMAX,R0
1,PWR1,PWR2,PWR3
  COMMON/CEXTRA/INDEX,      SYSTEM,TOTAL
  COMMON/CFAST/SPEED,NSPEED,LINE1,NSTART,NEND,LAMCL,E,CSPRD1,CSFRD2
  DIMENSION TEX(20)
  DIMENSION ALPHA(12),BE(12),DEGEN(12),TERM(12),WE(12),
1     WEXE(12),WEYE(12),WEZE(12)
  LOGICAL LINE1
C
C EQUATE TEMPERATURES AND NUMBER DENSITY
  TEMP=T
  TROT=T
  TVIB=TV
  TELECT=TEX(JSPEC2)
  PARTCC=ANMOL
C
  LINE1=.TRUE.
  ALTNAT = SPEC2(2,1,JSPEC2)
  DEU    = SPEC2(3,1,JSPEC2)
  BETAU  = SPEC2(4,1,JSPEC2)
  REU    = SPEC2(5,1,JSPEC2)
  DZEROU = SPEC2(6,1,JSPEC2)
  CAPAU  = SPEC2(7,1,JSPEC2)
  CAPLU  = SPEC2(8,1,JSPEC2)
  MU     = SPEC2(1,2,JSPEC2)
  NUSPIN = SPEC2(2,2,JSPEC2)
  DEL    = SPEC2(3,2,JSPEC2)
  BETAL  = SPEC2(4,2,JSPEC2)
  REL    = SPEC2(5,2,JSPEC2)
  DZEROL = SPEC2(6,2,JSPEC2)
  CAPAL  = SPEC2(7,2,JSPEC2)
  CAPLL  = SPEC2(8,2,JSPEC2)
  LEVELS=LMOLEC(3,JSPEC2)
  DO 40 M=1,LEVELS
  DEGEN(M) = SPEC2(1,M+2,JSPEC2)
  TERM (M) = SPEC2(2,M+2,JSPEC2)
  WE (M) = SPEC2(3,M+2,JSPEC2)

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WEXE (M) = SPEC2(4,M+2,JSPEC2)
WEYE (M) = SPEC2(5,M+2,JSPEC2)
WEZE (M) = SPEC2(6,M+2,JSPEC2)
BE (M) = SPEC2(7,M+2,JSPEC2)
40 ALPHA(M) = SPEC2(8,M+2,JSPEC2)
ALPHAU=ALPHA(1)
ALPHAL=ALPHA(2)
BEU=BE(1)
BEL=BE(2)
DEGENU=DEGEN(1)
TERMU=TERM(1)
TERML=TERM(2)
WEU=WE(1)
WEL=WE(2)
WEXEU=WEXE(1)
WEXEL=WEXE(2)
WEYEU=WEYE(1)
WEYEL=WEYE(2)
WEZEU=WEZE(1)
WEZEL=WEZE(2)
INDEX=LMOLEC(1,JSPEC2)
C
C FIND Q, THE PARTITION FUNCTION REFERENCED TO THE EQUILIBRIUM POSITION
C OF THE GROUND STATE POTENTIAL WELL.

Q=0.0
DO 70 M=1,LEVELS
  QVR=0.0
  QV=0.0
  EVIB1=0.0
  V=0.0
60  EVIB2=WE(M)*(V+0.5) -WEXE(M)*(V+0.5)**2 +WEYE(M)*(V+0.5)**3
    1  +WEZE(M)*(V+0.5)**4
    DELTQV=EXP(-1.43879*EVIB2/TVIB)

C COMPARE DELTA Q-VIBRATIONAL TO 0.1 PERCENT OF THE QV SUM TO THIS
C POINT.
  IF (DELTQV .LE. 0.001*QV) GO TO 70
C HAS THE VIBRATIONAL ENERGY REACHED A FICTITIOUS PEAK.

  IF (EVIB2 .LE. EVIB1) GO TO 70
  QV=QV+DELTQV
  IF (ABS(BE(M)-ALPHA(M)*(V+0.5)).LE.1.0E-8) GO TO 65
  QVR=QVR +TROT*DELTQV/(1.43879*(BE(M)-ALPHA(M)*(V+0.5)))
65  CONTINUE
  EVIB1=EVIB2
  V=V+1.0
  GO TO 60
70  Q=Q +QVR*DEGEN(M)*EXP(-1.43879*TERM(M)/TELECT)
C FIND STRENGTH FACTOR MAXIMUM
NV=LMOLEC(2,JSPEC2)
SYSTEM=0.
DO 1 JV=1,NV
VL=VIB(2,JV,JSPEC2)

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SUMRE2=VIB(3,JV,JSPEC2)*SMF
FRANCK=VIB(4,JV,JSPEC2)
EVIB=VL*WEL-VL**2*WEXEL+VL**3*WEYEL+VL**4*WEZEL+TERML
S=SUMRE2*FRANCK*EXP(-1.4388*EVIB/TVIB)
SYSTEM=AMAX1(S,SYSTEM)
```

```
1 CONTINUE
  PWR1=0.
  PWR2=0.
  PWR3=0.
  RETURN
  END
```

*DECK VUWL

```
  SUBROUTINE VUWL(JSPEC2,SMF,ANE,PRESS,WIDTHF,STARK,DENS,WAVEL,
    > EMIS,ABSB,NARRAY,NFOUT,NPRT,NFERR,NMETH,TOTPAWR)
  C SETS CONSTANTS FOR EACH VIBRATIONAL BAND AND CALCULATE
  C INPUT PARAMETERS
  C JSPEC2=SPECTRA NUMBER
  C SMF=STRENGTH MULTIPLICATION FACTOR
  C ANE=ELECTRON DENSITY, CM-3
  C PRESS=PRESSURE, ATM. ZERO SETS NUM. DEN. OF FOREIGN GAS TO 0
  C WIDTHF=LORENTZ WIDTH MULTIPLICATION FACTOR
  C STARK=STARK WIDTH AT ANE=1.E16 AND TE=10000
  C DENS=DENSITY, G/CM3
  C WAVEL=WAVELENGTH, A
  C NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
  C NFOUT=FILE NUMBER OF OUTPUT PRINTS
  C NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
  C NFERR=FILE NUMBER OF ERROR MESSAGES
  C NMETH=1, EMITTED POWER CALC ONLY. =2, SPECTRAL CALC.
  C OUTPUT PARAMETERS
  C EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
  C ABSB=ABSORPTION+STIMULATED EMISSION COEFFICIENT, CM-1
  C TOTPAWR(3)=TOTAL EMITTED POWER
  REAL MU,NUSPIN,NAME,NUBARO,LAMMIN
  COMMON/RADB/AMOLEC(3,20),LMOLEC(6,20),SPEC2(8,20,20),VIB(4,
    >100,20)
  COMMON/COMH/CONF
  COMMON /CFAST/SPEED,NSPEED,LINE1,NSTART,NEND,LAMCL,E,CSPRD1,CSPRD2
  COMMON/CBAND1/ALPHAU,BEU,BETAU,CAPAU,CAPLU,DEU,DZEROU,REU,TERMU,
  1 ALPHAL,BEL,BETAL,CAPAL,CAPLL,DEL,DZEROL,REL,TERML
  COMMON/CBAND2/WEU,WEXEU,WEYEU,WEZEU,BVU,DVU,DEGENU,MU,ALINAT,
  1 WEL,WEYEL,WEYEL,WEZEL,BVL,DVL, NUSPIN
  COMMON/CTEMP/TELECT,TVIB,TROT
  COMMON/CWIDTH/WIDTHL,WIDTHV,RANGE,DELLAM,LAMMIN
  COMMON/CTRAN/PARTCC,NUBARO,Q,A0E,CINT1,CINT2,KMIN,KMAX,R1
  1,PWR1,PWR2,PWR3
  COMMON/CEXTRA/INDEX, SYSTEM,TOTAL
  DIMENSION WAVEL(1)
  DIMENSION EMIS(1)
  DIMENSION ABSB(1)
  DIMENSION TOTPAWR(3)
  LOGICAL LINE1
  LAMMIN=1/WAVEL(1)
  DELLAM=(1./WAVEL(1)-1./WAVEL(NARRAY))/(NARRAY-1)
  A0E=2.5415785E-19
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C=2.9979E+10
PI=3.1415927
TEMP=TROT
NVIB=LMOLEC(2,JSPEC2)
C
C DETERMINE NUMBER DENSITY AND AVERAGE MOLECULAR WEIGHT OF
C FOREIGN GAS
ANREST=1.0E10
IF(PRESS.GT.1.0E-20) ANREST=0.8338E22*PRESS/TEMP-PARTCC
AMREST=20.*1.66E-24
IF(DENS.GT.1.0E-20) AMREST=(DENS-1.66E-24*AMOLEC(3,JSPEC2)
1 *PARTCC)/ANREST
AMREST=AMREST/1.66E-24
IF(AMREST.LT.10.) AMREST=10.
IF(AMREST.GT.28.85) AMREST=28.85
C
C CYCLE OVER BANDS
DO 1 JVIB=1,NVIB
  VU = VIB(1,JVIB,JSPEC2)
  VL = VIB(2,JVIB,JSPEC2)
C
C COMPUTE ROTATIONAL CONSTANTS FOR THIS BAND
BVU=BEU-ALPHAU*(VU+0.5)
BVL=BEL-ALPHAL*(VL+0.5)
DVU=DEU+BETAU*(VU+0.5)
DVL=DEL+BETAL*(VL+0.5)
SUMRE2=VIB(3,JVIB,JSPEC2)*SMF
FRANCK =VIB(4,JVIB,JSPEC2)
KMIN=2
ESUM=TERML+VL*WEL-VL**2*WEXEL+VL**3*WEYEL+VL**4*WEZEL
IF(SYSTEM.LT.1.0E-10) KMAX=100
IF(SYSTEM.LT.1.0E-10) GO TO 3
AMAX=(0.695*TROT*ALOG(1.0E5*SUMRE2*FRANCK/SYSTEM))-
) (TROT/TVIB)*ESUM)/BVL
IF(AMAX.LT.25.) GO TO 1
KMAX=SQRT(AMAX)
3 RANGE=15.
C
C SET UP CONSTANTS FOR INTENSITY EQUATION IN ROTATIONAL STRUCTURE
C AND COMPUTE NUBAR0, THE BAND ORIGIN
CINT1=TERMU/TELECT+(WEU*(VU+0.5)-WEXEU*(VU+0.5)**2+
1 WEYEU*(VU+0.5)**3+WEZEU*(VU+0.5)**4)/TVIB
CINT2=(16.0E-7*C*PARTCC*FRANCK*SUMRE2*PI**3)/(3.0*Q)
GPU=WEU*(VU+0.5)-WEXEU*(VU+0.5)**2+WEYEU*(VU+0.5)**3+WEZEU*(
)VU+0.5)**4
GPL=WEL*(VL+0.5)-WEXEL*(VL+0.5)**2+WEYEL*(VL+0.5)**3+WEZEL*(
)VL+0.5)**4
NUBAR0=TERMU-TERML+GPU-GPL
R1=EXP(1.43877*((TERMU-TERML)/TELECT+(GPU-GPL)/TVIB))
ORIGIN=1.0E+8/NUBAR0
IF((2.0*ORIGIN).LT.WAVEL(1)) GO TO 1
IF((0.5*ORIGIN).GT.WAVEL(NARRAY)) GO TO 1
WIDTHG=7.16E-7*ORIGIN*SQRT(TEMP/AMOLEC(3,JSPEC2))

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C
C LORENTZ LINEWIDTH WIDTHL IS A SUM OF WIDTH1(COLLISIONS WITH LIKE MOLE-
C CULES), WIDTH2(COLLISIONS WITH ALL OTHER), AND WIDTH3(NATURAL).
C AND WIDTH4(STARK)
  WIDTH1=1.33E-29*SQRT(2.0/AMOLEC(3,JSPEC2))*ORIGIN**2*SQRT(TEMP)
  1*PARTCC
  WIDTH2=5.85E-30*SQRT(1.0/AMOLEC(3,JSPEC2)+1./AMREST)*ORIGIN**2
  1*SQRT(TEMP)*ANREST
  WIDTH1=WIDTH1*WIDTHF
  WIDTH2=WIDTH2*WIDTHF
  WIDTH3=1.18E-4
  IF(ANE.LT.1.0) ANE=1.0
  WIDTH4=1.0E-8*STARK*(1.0E-16*ANE)**0.6*ORIGIN**2
  WIDTHL=WIDTH1+WIDTH2+WIDTH3+WIDTH4
C
C FIND THE VOIGT LINE WIDTH AT HALF-HEIGHT
  WIDTHV=WIDTHL/2.0+SQRT(WIDTHL**2/4.0+WIDTHG**2)
  IF(INDEX.EQ.1) CALL ZERO(WAVEL,EMIS,ABSB,NARRAY,NFOUT,
  > NPRT,NFERR,NMETH)
  IF(INDEX.EQ.2) CALL ONE(WAVEL,EMIS,ABSB,NARRAY,NFOUT,
  > NPRT,NFERR,NMETH)
  IF(INDEX.EQ.3) CALL S2P12(WAVEL,EMIS,ABSB,NARRAY,NFOUT,
  > NPRT,NFERR,NMETH)
  IF(NPRT.GT.1) WRITE(NFOUT,2) (AMOLEC(I,JSPEC2),I=1,2)
  1 ,UL,VL,ORIGIN,WIDTHG,WIDTHL,SUMRE2,FRANCK,KMAX
  2 FORMAT(1X,2A3,2X,6HVL=,2F4.0,2X,7HORIGIN=,F9.2,2X,
  1 9HWIDTHG=,1P2E10.3,2X,7HSUMRE2=,E10.3,2X,7HFRANCK=,
  2 E10.3,2X,5HKMAX=,I3)
  1 CONTINUE
  IF(NMETH.GT.1) RETURN
  IF(NPRT.GT.1) WRITE(NFOUT,4)(AMOLEC(I,JSPEC2),I=1,2),
  1 PWR1,PWR2,PWR3
  4 FORMAT(1X,2A3,1X,16H PWR1,PWR2,PWR3= ,1P3E10.3)
  TOTPWR(1)=TOTPWR(1)+PWR1
  IF(1.E8/NUBAR0.GT.2500.) TOTPWR(2)=TOTPWR(2)+PWR2
  IF(1.E8/NUBAR0.GT.3500.) TOTPWR(3)=TOTPWR(3)+PWR3
  RETURN
  END
*DECK ZERO
  SUBROUTINE ZERO(WAVEL,EMIS,ABSB,NARRAY,NFOUT,NPRT,NFERR,NMETH)
C SUBROUTINE ZERO COMPUTES PARALLEL TRANSITIONS FOR DIATOMIC MOLECULES.
C INPUT PARAMETERS
C WAVEL=WAVELENGTHS, A
C NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
C NFOUT=FILE NUMBER OF OUTPUT PRINTS
C NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C NFERR=FILE NUMBER OF ERROR MESSAGES
C NMETH=1,EMITTED POWER ONLY. =2,SPECTRAL CALCULATION
C OUTPUT PARAMETERS
C EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
C ABSB=ABSORPTION+STIMULATED EMISSION COEFFICIENT, CM-1
  REAL KU,KL,LAMCL,MU, LAMMIN,NUBAR,NUBAR0,NUSPIN
  COMMON/CBAND1/ALPHAU,BEU,BETAU,CAPAU,CAPLU,DEU,DZEROU,REU,TERMU,
  1 ALPHAL,BEL,BETAL,CAPAL,CAPLL,DEL,DZEROL,REL,TERML
  COMMON/CBAND2/WEU,WEXEU,WEYEU,WEZEU,BVU,DVU,DEGENU,MU,ALTNAT,

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1          WEL, WEXEL, WEYEL, WEZEL, BVL, DVL,          NUSPIN
COMMON/CTEMP/TELECT, TVIB, TROT
COMMON/CWIDTH/WIDTHL, WIDTHV, RANGE, DELLAM, LAMMIN
COMMON/CTRAN/PARTCC, NUBAR0, Q, AOE, CINT1, CINT2, KMIN, KMAX, R1
1, PWR1, PWR2, PWR3
COMMON/CEXTRA/INDEX,          SYSTEM, TOTAL
COMMON /CFAST/SPEED, NSPEED, LINE1, NSTART, NEND, LAMCL, E, CSPRD1, CSPRD2
COMMON/CFST1/Y1(4000), NJM, NJ
DIMENSION WAVEL(1)
DIMENSION EMIS(1)
DIMENSION ABSB(1)
LOGICAL LINE1

C
C CALCULATE TOTAL POWER FOR NMETH=1
IF(NMETH.GT.1) GO TO 1
A=AOE**2*CINT2*EXP(-1.43877*CINT1)
TBYB=TROT/(1.43877*BVU)
SUME=A*(0.5*NUBAR0**4*TBYB+2.*NUBAR0**3*(BVU-BVL)*TBYB**2+
1 2.*NUBAR0**2*(3.*(BVU-BVL)**2-2.*NUBAR0*(DVU-DVL))*TBYB**3
2 +12.*NUBAR0*(BVU-BVL)*((BVU-BVL)**2-4.*NUBAR0*(DVU-DVL)
3 )*TBYB**4)
SUME=SUME*2.*12.57
IF(1.0E8/NUBAR0.GT.WAVEL(1)) PWR1=PWR1+SUME
IF(1.E8/NUBAR0.GT.2500.) PWR2=PWR2+SUME
IF(1.E8/NUBAR0.GT.3500.) PWR3=PWR3+SUME
RETURN
1 CONTINUE

C
C FIND THE NUMBER OF ENTRIES IN THE INTENSITY ARRAY, FROM THE LINE CENT
C AT WHICH EACH LINE IS ASSUMED TO HAVE A CONTRIBUTION.
C SET CONSTANTS WHICH DETERMINE THE LINE SHAPE.
CSPRD2=WIDTHL/WIDTHV
CSPRD3=(1.065+0.447*CSPRD2+0.058*CSPRD2**2)*WIDTHV*1.0E-4
CSPRD1=(1.0-CSPRD2)/CSPRD3
CSPRD2=CSPRD2/CSPRD3
C SET CONSTANTS WHICH DETERMINE THE WAVELENGTH OF THE LINE CENTER FOR
C TRIPLETS. SEE HERZBERG PAGE 235.
YU=CAPAU/BVU
YL=CAPAL/BVL
DIVISR=2.0
IF (CAPLU .EQ. 0.0) DIVISR=1.0
C SET CONSTANTS FOR THE P BRANCH AND INITIALIZE THE RUNNING SUMS.
CSTR=1.0
KU=KMIN
KL=KU+1.0
10 CONTINUE
C COMPUTE AND DISTRIBUTE THE INTEGRATED INTENSITY DUE TO SPONTANEOUS
C EMISSION OF ALL SPECIFIED ROTATIONAL LINES FOR THE APPROPRIATE BRANCH
DO 60 M=KMIN, KMAX
Z2U=0.0
Z2L=0.0

C FOR A DESCRIPTION OF THESE EQUATIONS SEE HERZBERG PAGE 235.
IF (DEGENU/DIVISR .NE. 3.0) GO TO 20
Z1U=CAPLU**2*YU*(YU-4.0)+(4.0/3.0)+4.0*KU*(KU+1.0)

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Z1L=CAPLL**2*YL*(YL-4.0)+(4.0/3.0)+4.0*KL*(KL+1.0)
Z2U=(CAPLU**2*YU*(YU-1.0)-(4.0/9.0)-2.0*KU*(KU+1.0))/(3.0*Z1U)
Z2L=(CAPLL**2*YL*(YL-1.0)-(4.0/9.0)-2.0*KL*(KL+1.0))/(3.0*Z1L)
C COMPUTE THE WAVELENGTH OF THE LINE CENTER IN ANGSTROMS.
20 FPU=BVU*(KU*(KU+1.))+4.0*Z2U-DVU*(KU+0.5)**4
FPL=BVL*(KL*(KL+1.))+4.0*Z2L-DVL*(KL+0.5)**4
NUBAR=NUBAR0+FPU-FPL
R2=R1*EXP(1.43877*(FPU-FPL)/TROT)
LAMCL=1.0E+8/NUBAR
DELLOC=LAMCL**2*DELLAM
NSPRED=1.1+RANGE*WIDTH/DELLOC
C FIND THE STRENGTH FACTOR.
S=KU+DSTR
C DETERMINE IF LINES ALTERNATE IN INTENSITY.
FACTOR=1.0
IF (ALTNAT .EQ. 0.0) GO TO 30
C EVALUATE THE ALTERNATION FACTOR FOR HOMONUCLEAR MOLECULES. THE
C EXPONENT IN THE ALTERNATING FUNCTION IS FOUND SEPARATELY TO ENSURE
C THAT IT IS AN INTEGER BEFORE RAISING(-1.0) TO A POWER.
KEXP= KL + ALTNAT + 0.1
FACTOR=1.0 +(-1.0)**KEXP/(2.0*NUSPIN+1.0)
C FIND THE INTEGRATED LINE INTENSITY DUE TO SPONTANEOUS EMISSION E
C AND SUM OF ABSORPTION AND STIMULATED EMISSION AK1
30 E=FACTOR*S*(NUBAR**2*A0E)**2*CINT2*EXP(-1.43879*(CINT1
1 +(BVU*KU*(KU+1.0))/TROT))
ALAM=1.0E-8*LAMCL
AK=8.493E15*(ALAM**5)*R2*E
AK1=AK*(1.-1.0/R2)
C SET CONSTANTS USED TO DISTRIBUTE THE ROTATIONAL LINE.
NCENTR=(LAMMIN-1.0/LAMCL)/DELLAM+1
NSTART=NCENTR-NSPRED
NEND=NCENTR+NSPRED
IF((NSTART.LT.1).OR.(NEND.GE.NARRAY)) GO TO 50
C DISTRIBUTE THE ROTATIONAL LINE.
IF (E.LT.1.0E-25) GO TO 50
IF (.NOT.LINE1) GO TO 300
C GENERATE LINESHAPE TEMPLATE
200 CALL FAST
201 LINE1=.FALSE.
C COPY LINESHAPE USING TEMPLATE
300 XAMCL1=1.0/(LAMMIN-(NCENTR-1)*DELLAM)
DM=XAMCL1-LAMCL
K=NSPEED*DM/DELLOC
M3=NUM+K-NSPEED*NCENTR
IF(K.LT.(-0.5*FLOAT(NSPEED))) M3=M3+NSPEED
M1=NSTART
M2=NEND
309 IF((M3+NSPEED*M1).GE.1) GO TO 308
M1=M1+1
GO TO 309
309 IF((M3+NSPEED*M2).LE.NJ) GO TO 310
M2=M2-1
GO TO 309

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310 CONTINUE
      IF(M1.GT.M2) GO TO 50
      CALL SAXPY(M2-M1+1,E,Y1(M3+NSPEED*M1),NSPEED,EMIS(M1),1)
      CALL SAXPY(M2-M1+1,A,K1,Y1(M3+NSPEED*M1),NSPEED,ABSB(M1),1)
C
50      KU=KU+1.0
60      KL=KL+1.0
C HAVE BOTH BRANCHES BEEN COMPLETED.
      IF (KL .EQ. KU-1.0) GO TO 70
C SET CONSTANTS FOR THE R BRANCH.
      CSTR=0.0
      KU=KMIN
      KL=KU-1.0
      GO TO 10
70 CONTINUE
      RETURN
      END
*DECK ONE
      SUBROUTINE ONE(WAVEL,EMIS,ABSB,NARRAY,NFOUT,NPRT,NFERR,NMETH)
C SUBROUTINE ONE COMPUTES PERPENDICULAR TRANSITIONS FOR DIATOMIC
C MOLECULES.
C INPUT PARAMETERS
C   WAVEL=WAVELENGTH, A
C   NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
C   NFOUT=FILE NUMBER OF OUTPUT PRINTS
C   NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C   NFERR=FILE NUMBER OF ERROR MESSAGES
C   NMETH=1,EMITTED POWER ONLY. =2,SPECTRAL CALCULATION
C OUTPUT PARAMETERS
C   EMIS=EMISSION COEFFICIENT
C   ABSB=ABSORPTION COEFFICIENT
      REAL      KU,KL,LAMCL,MU,          LAMMIN,NUBAR,NUBARO,NUSPIN
      DIMENSION WAVEL(1)
      DIMENSION EMIS(1)
      DIMENSION ABSB(1)
      COMMON /CFAST/SPEED,NSPEED,LINE1,NSTART,NEND,LAMCL,E,CSPRD1,CSPRD2
      COMMON/CFST1/Y1(4000),NJM,NJ
      COMMON/CBAND1/ALPHAU,BEU,BETAU,CAPAU,CAPLU,DEU,DZEROU,REU,TERMU,
1          ALPHA,BEL,BETAL,CAPAL,CAPLL,DEL,DZEROL,REL,TERML
      COMMON/CBAND2/WEU,WEXEU,WEYEU,WEZEU,BVU,DVU,DEGENU,MU,ALTNAT,
1          WEL,WEXEL,WEYEL,WEZEL,BVL,DVL,          NUSPIN
      COMMON/CTEMP/TELECT,TVIB,TROT
      COMMON/CWIDTH/WIDTHL,WIDTHV,RANGE,DELLAM,LAMMIN
      COMMON/CTRAN/PARTCC,NUBARO,Q,AOE,CINT1,CINT2,KMIN,KMAX,R1
1,PWR1,PWR2,PWR3
      COMMON/CEXTRA/INDEX,          SYSTEM,TOTAL
      INTEGER SWITCH
      LOGICAL LINE1
C FIND THE NUMBER OF ENTRIES IN THE INTENSITY ARRAY, FROM THE LINE CENT
C AT WHICH EACH LINE IS ASSUMED TO HAVE A CONTRIBUTION.
C SET CONSTANTS WHICH DETERMINE THE LINE SHAPE.
      CSPRD2=WIDTHL/WIDTHV
      CSPRD3=(1.065+0.447*CSPRD2+0.058*CSPRD2**2)*WIDTHV*1.0E-4
      CSPRD1=(1.0-CSPRD2)/CSPRD3
      CSPRD2=CSPRD2/CSPRD3

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C SET THE SIGN OF CAPLU, USED IN STRENGTH EQUATIONS, APPROPRIATE TO THE
C SIGN OF DELTA LAMBDA.  SEE JOHNSON PAGE 150.
  SIGN=1.0
  IF (CAPLU .LT. CAPLL) SIGN=-1.0
  IF(CAPLU.LT.0.5) GO TO 5
C ADJUST FACTOR USED IN INTENSITY EQUATION TO CORRECT
C PARTCO FOR LAMBDA DOUBLING.
  CINT2=CINT2/2.0
  5 SWITCH=1
C
C CALCULATE EMITTED POWER FOR NMETH=1
  IF(NMETH.GT.1) GO TO 1
  A=A0E**2*CINT2*EXP(-1.43877*CINT1)
  TBYB=TR0T/(1.43877*BVU)
  SUME=A*(0.5*NUBAR0**4*TBYB+2.*NUBAR0**3*(BVU-BVL)*TBYB**2+
1 2*NUBAR0**2*(3*(BVU-BVL)**2-2*NUBAR0*(DVU-DVL))*TBYB**3
2 +12*NUBAR0*(BVU-BVL)*((BVU-BVL)**2-4*NUBAR0*(DVU-DVL))
3 *TBYB**4)
  SUME=SUME*4.*12.57
  IF(1.E8/NUBAR0.GT.WAVEL(1)) PWR1=PWR1+SUME
  IF(1.E8/NUBAR0.GT.2500.) PWR2=PWR2+SUME
  IF(1.E8/NUBAR0.GT.3500.) PWR3=PWR3+SUME
  RETURN
1 CONTINUE
C
C
  KU=KMIN
  KL=KU+1.0
  DEL1=1./DELLAM
10 CONTINUE
C COMPUTE AND DISTRIBUTE THE INTEGRATED INTENSITY DUE TO SPONTANEOUS
C EMISSION OF ALL SPECIFIED ROTATIONAL LINES.
  DO 90 M=KMIN,KMAX
C COMPUTE THE WAVELENGTH OF THE LINE CENTER IN ANGSTROMS.
  FPU=BVU*(KU*(KU+1.0))-DVL*(KU+0.5)**4
  FPL=BVL*(KL*(KL+1.0))-DVL*(KL+0.5)**4
  NUBAR=NUBAR0+FPU-FPL
  R2=R1*EXP(1.43877*(FPU-FPL)/TR0T)
  LAMCL=1.0E+8/NUBAR
  DELLOC=LAMCL**2*DELLAM
  NSPREO=1.1+RANGE*WIDTH/DELLOC
C FIND THE STRENGTH FACTOR.
  GO TO (20,30,40), SWITCH
C P BRANCH STRENGTH FACTOR
20  S=(KU+1.0-SIGN*CAPLU)*(KU+2.0-SIGN*CAPLU)/(KU+1.0)
C Q BRANCH STRENGTH FACTOR.
  GO TO 50
30  S=(KU-SIGN*CAPLU)*(2.0*KU+1.0)*(KU+1.0-SIGN*CAPLU)/
1 (KU*(KU+1.0))
  GO TO 50
C R BRANCH STRENGTH FACTOR.
40  S=(KU-SIGN*CAPLU)*(KU-1.0+SIGN*CAPLU)/KU
C DETERMINE IF LINES ALTERNATE IN INTENSITY.
50  FACTOR=1.0
  IF (ALTNAT .EQ. 0.0) GO TO 60

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C EVALUATE THE ALTERNATION FACTOR FOR HOMONUCLEAR MOLECULES. THE
C EXPONENT IN THE ALTERNATING FUNCTION IS FOUND SEPARATELY TO ENSURE
C THAT IT IS AN INTEGER BEFORE RAISING (-1.0) TO A POWER.
      KEXP= KL + ALTNAT + 0.1
      FACTOR=1.0 +(-1.0)**KEXP/(2.0*NUSPIN+1.0)
C FIND THE INTEGRATED LINE INTENSITY DUE TO SPONTANEOUS EMISSION E,
C AND SUM OF ABSORPTION AND STIMULATED EMISSION AK1
      60   E=FACTOR*S*(NUBAR**2*AOE)**2*CINT2*EXP(-1.43879*(CINT1
          1   +(BUU*KU*(KU+1.0))/TROT))
          ALAM=1.0E-8*LAMCL
          AK=0.403E15*(ALAM**5)*R2*E
          AK1=AK*(1.0-1.0/R2)
C SET CONSTANTS USED TO DISTRIBUTE THE ROTATIONAL LINE.
      NCENTR=(LAMMIN-1.0/LAMCL)/DELLAM+1
      NSTART=NCENTR-NSPRED
      NEND=NCENTR +NSPRED
      IF((NSTART.LE.1).OR.(NEND.GE.NARRAY)) GO TO 80
C DISTRIBUTE THE ROTATIONAL LINE.
      IF (E.LT.1.0E-25) GO TO 80
      IF(.NOT.LINE1) GO TO 300
C GENERATE LINESHAPE TEMPLATE
      200 CALL FAST
      201 LINE1=.FALSE.
C COPY LINESHAPE USING TEMPLATE
      300 XAMCL1=1.0/(LAMMIN-(NCENTR-1)*DELLAM)
          DM=XAMCL1-LAMCL
          K=NSPEED*DM/DELLOC
          M3=NJM+K-NSPEED*NCENTR
          IF(K.LT.(-0.5*FLOAT(NSPEED))) M3=M3+NSPEED
          M1=NSTART
          M2=NEND
      309 IF((M3+NSPEED*M1).GE.1) GO TO 308
          M1=M1+1
          GO TO 309
      308 IF((M3+NSPEED*M2).LE.NJ) GO TO 310
          M2=M2-1
          GO TO 308
      310 CONTINUE
          IF(M1.GT.M2) GO TO 80
          CALL SAXPY(M2-M1+1,E,Y1(M3+NSPEED*M1),NSPEED,EMIS(M1),1)
          CALL SAXPY(M2-M1+1,AK1,Y1(M3+NSPEED*M1),NSPEED,ABSE,M1),1)
C
      80   KU=KU+1.0
      90   KL=KL+1.0
          GO TO (100,110,120),SWITCH
      100 CONTINUE
C SET CONSTANTS FOR Q BRANCH.
          SWITCH= 2
          KU=KMIN
          KL=KU
          GO TO 10
      110 CONTINUE
C SET CONSTANTS FOR R BRANCH.
          SWITCH= 3
          KU=KMIN

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KL=KU-1.0
GO TO 10
120 CONTINUE
RETURN
END
*DECK S2PI2
SUBROUTINE S2PI2(WAVEL,EMIS,ABSB,NARRAY,NFOUT,NPRT,NFERR,NMETH)
C CALCULATES S2-PI2 TRANSITIONS
C INPUT PARAMETERS
C WAVEL=WAVELENGTH, A
C NARRAY=LENGTH OF WAVEL, EMIS, ABSB ARRAYS
C NFOUT=FILE NUMBER OF OUTPUT PRINTS
C NPRT=PRINT OUT INDEX. 0=NO PRINT. 1=SMALL PRINT. 2=LARGE PRINT
C NFERR=FILE NUMBER OF ERROR MESSAGES
C NMETH=1,EMITTED POWER ONLY. =2,SPECTRAL CALCULATION
C OUTPUT PARAMETERS
C EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
C ABSB=ABSORPTION+STIMULATED EMISSION COEFFICIENT, CM-1
REAL JU,JL,LAMCL,MU, LAMMIN,NUBAR,NUBARO,NUSPIN
DIMENSION WAVEL(1)
DIMENSION EMIS(1)
DIMENSION ABSB(1)
COMMON /CFAST/SPEED,NSPEED,LINE1,NSTART,NEND,LAMCL,E,CSPRD1,CSPRD2
COMMON/CFST1/Y1(4000),NJM,NJ
COMMON/CBAND1/ALPHAU,BEU,BETAU,CAPAU,CAPLU,DEU,DZEROU,REU,TERMU,
1 C ALPHA,BEL,BETAL,CAPAL,CAPLL,DEL,DZEROL,REL,TERML
COMMON/CBAND2/WEU,WEXEU,WEYEU,WEZEU,BVU,DXU,DEGENU,MU,ALTRAT,
1 WEL,WEXEL,WEYEL,WEZEL,BVL,DXL, NUSPIN
COMMON/CTEMP/TELECT,TVIB,TROT
COMMON/CWIDTH/WIDTHL,WIDTHU,RANGE,DELLAM,LAMMIN
COMMON/CTRAN/PARTCC,NUBARO,Q,AOE,CINT1,CINT2,KMIN,KMAX,R1
1,PWR1,PWR2,PWR3
COMMON/CEXTRA/INDEX, SYSTEM,TOTAL
INTEGER SWITCH
LOGICAL LINE1
LOGICAL FROMPI,DBLBRN
C PI TO SIGMA TRANSITIONS. SIGMA TO PI TRANSITIONS.
C DBLBRN IS TRUE WHEN COMPUTING TWO BRANCHES WHOSE LINES ARE ASSUMED TO
C HAVE THE SAME WAVELENGTHS.
DBLBRN=.FALSE.
CINT2=CINT2/2.0
C SET CONSTANTS APPROPRIATE TO THE ELECTRONIC TRANSITION. FROMPI IS TR
C IF THE UPPER STATE IS DOUBLET PI.
FROMPI=.FALSE.
IF (CAPLU.GT.CAPLL) FROMPI=.TRUE.
C ADJUST FACTOR USED IN INTENSITY EQUATION TO CORRECT PARTCC
C FOR SPIN SPLITTING AND LAMBDA DOUBLING
IF(FROMPI) CINT2=CINT2/2.0
C
C CALCULATE EMITTED POWER FOR NMETH=1
IF(NMETH.GT.1) GO TO 1
A=AOE**2*CINT2*EXP(-1.43877*CINT1)
TBYB=TROT/(1.43877*BVU)
SUME=A*(0.5*NUBARO**4+2*NUBARO**3*(BVU-BVL)*TBYB**2+

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1 2*NUBAR0**2*(3*(BVU-BVL)**2-4*NUBAR0*(DVU-DVL))*TBYB**3
2 +12*NUBAR0*(BVU-BVL)*((BVU-BVL)**2-2*NUBAR0*(DVU-DVL))
3 *TBYB**4)
SUME=SUME*0.12.57
IF(1.E8/NUBAR0.GT.WAVEL(1)) PWR1=PWR1+SUME
IF(1.E8/NUBAR0.GT.2500.) PWR2=PWR2+SUME
IF(1.E8/NUBAR0.GT.3500.) PWR3=PWR3+SUME
RETURN
1 CONTINUE
C
C SET COUPLING CONSTANT.
YU=CAPAU/BVU
YL=CAPAL/BVL
Y=YL
IF(FROMPI) Y=YU
C SET POSITN, THE BRANCH IDENTIFIER, AND IPRINT, THE INDEX ON NAME WHIC
C IDENTIFIES THE BRANCH OUTPUT.
SWITCH= 0
IPRINT=0
IF (FROMPI) IPRINT=-1
C SET CONSTANTS WHICH DETERMINE THE LINE SHAPE.
CSPRD2=WIDTHL/WIDTHV
CSPRD3=(1.065+0.447*CSPRD2+0.058*CSPRD2**2)*WIDTHW*1.0E-4
CSPRD1=(1.0-CSPRD2)/CSPRD3
CSPRD2=CSPRD2/CSPRD3
C SET CONSTANTS FOR THE P2 BRANCH (PI TO SIGMA TRANSITION) OR
C R2 BRANCH (SIGMA TO PI TRANSITION).
BAND=0.0
K=KMIN
JU=K-0.5
JL=JU-1.0
IF (FROMPI) JL=JU+1.0
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
SIGNU1=1.0
SIGNU2=1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
SIGNS1=1.0
SIGNS2=-1.0
CONST1=1.0
CONST2=1.0
GO TO 80
C SET CONSTANTS FOR THE R1 BRANCH (PI TO SIGMA TRANSITION) OR
C PI BRANCH (SIGMA TO PI TRANSITION)
10 CONTINUE
JU=K+0.5
JL=JU+1.0
IF (FROMPI) JL=JU-1.0
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
SIGNU1=-1.0
SIGNU2=-1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
SIGNS1=1.0
SIGNS2=-1.0
CONST1=1.0

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```
CONST2=0.0
GO TO 80
C SET CONSTANTS FOR THE SR21 BRANCH (EITHER TRANSITION).
20 CONTINUE
JU=K-0.5
JL=JU-1.0
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
SIGNU1=1.0
SIGNU2=-1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
SIGNS1=-1.0
SIGNS2=-1.0
CONST1=1.0
CONST2=1.0
IF (FROMPI) CONST2=0.0
GO TO 80
C SET CONSTANTS FOR THE OP12 BRANCH (EITHER TRANSITION).

30 CONTINUE
JU=K+0.5
JL=JU+1.0
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
SIGNU1=-1.0
SIGNU2=1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
SIGNS1=-1.0
SIGNS2=-1.0
CONST1=1.0
CONST2=0.0
IF (FROMPI) CONST2=1.0
GO TO 80
C SET CONSTANTS FOR THE Q2 AND QP21 BRANCHES (PI TO SIGMA TRANSITION) 0
C Q2 AND QR12 BRANCHES (SIGMA TO PI TRANSITION).
40 CONTINUE
DSLBRN=.TRUE.
JU=K-0.5
JL=JU
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
SIGNU1=1.0
SIGNU2=1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
SIGNS1=-1.0
SIGNS2=1.0
SIGNS3=-1.0
CONST1=-7.0
CONST2=1.0
CONST3=1.0
GO TO 80
C SET CONSTANTS FOR THE Q1 AND QR12 BRANCHES (PI TO SIGMA TRANSITION) 0
C Q1 AND QP21 BRANCHES (SIGMA TO PI TRANSITION)
50 CONTINUE
JU=K+0.5
JL=JU
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```
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
  SIGNU1=-1.0
  SIGNU2=-1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
  SIGNS1=-1.0
  SIGNS2=1.0
  SIGNS3=1.0
  CONST1=-7.0
  CONST2=0.0
  CONST3=-7.0
  GO TO 80
C SET CONSTANTS FOR THE R2 AND RQ21 BRANCHES (PI TO SIGMA TRANSITION) 0
C   P2 AND PQ12 BRANCHES (SIGMA TO PI TRANSITION)
  60 CONTINUE
  JU=K-0.5
  JL=JU+1.0
  IF (FROMPI) JL=JU-1.0
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
  SIGNU1=1.0
  SIGNU2=1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
  SIGNS1=1.0
  SIGNS2= 1.0
  SIGNS3= 1.0
  CONST1=-7.0
  CONST2=0.0
  CONST3=-7.0
  GO TO 80
C SET CONSTANTS FOR THE P1 AND PQ12 BRANCHES (PI TO SIGMA TRANSITION) 0
C   R1 AND RQ21 BRANCHES (SIGMA TO PI TRANSITION)
  70 CONTINUE
  JU=K+0.5
  JL=JU-1.0
  IF (FROMPI) JL=JU+1.0
C SET CONSTANTS FOR THE WAVELENGTH EQUATION.
  SIGNU1=-1.0
  SIGNU2=-1.0
C SET CONSTANTS FOR THE STRENGTH EQUATION.
  SIGNS1=1.0
  SIGNS2=1.0
  SIGNS3=-1.0
  CONST1=-7.0
  CONST2=1.0
  CONST3=1.0
C COMPUTE AND DISTRIBUTE THE INTEGRATED INTENSITY DUE TO SPONTANEOUS
C EMISSION OF ALL SPECIFIED ROTATIONAL LINES FOR THE APPROPRIATE BRANCH.
C J IS THE ROTATIONAL QUANTUM NUMBER OF THE PI STATE. SEE REFERENCE BY
C EARLS.
  80  BRANCH=0.0
      J=JL
      IF (FROMPI) J=JU
      DO 120 M=KMIN,KMAX
C COMPUTE THE WAVELENGTH OF THE LINE CENTER IN ANGSTROMS.
      FPU=EVU*((JU+0.5)**2-CAPLU**2+SIGNU1/2.0 *SQRT(4.0*(JU+0.5)
1**2-4.0*YU*CAPLU**2+(YU*CAPLU)**2))
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FPL=BUL*((JL+0.5)**2-CAPLL**2+SIGNU2/2.0 *SQRT(4.0*(JL+0.5)
1**2-4.0*YL*CAPLL**2+(YL*CAPLL)**2))
NUBAR=NUBAR0+FPU-FPL
R2=R1*EXP(1.43877*(FPU-FPL)/TROT)
LAMCL=1.0E+8/NUBAR
DELLOC=LAMCL**2*DELLAM
NSPRED=1.1+RANGE*WIDTHV/DELLOC
C FIND STRENGTH FACTOR FOR SINGLE BRANCHES.
  U=1.0/SQRT(Y**2-4.0*Y+(2.0*J+1.0)**2)
  S=((2.0*J+1.0)**2 +SIGN51*(2.0*J+1.0)*U*(4.0*J**2 +4.0*J +CONST1
1 +SIGN52*2.0*Y))/(8.0*(J+CONST2))
  IF (.NOT.DBLBRN) GO TO 90
C FIND STRENGTH FACTOR FOR DOUBLE BRANCHES.
  S=S +(2.0*J+1.0)*((4.0*J**2+4.0*J-1.0) -SIGN51*U*(8.0*J**3+12.0
1 *J**2-2.0*J+CONST3+SIGN53*2.0*Y))/(8.0*J*(J+1.0))
C FIND THE INTEGRATED LINE INTENSITY DUE TO SPONTANEOUS EMISSION E,
C AND SUM OF ABSORPTION AND STIMULATED EMISSION AK1
90   E=S*(NUBAR**2*AOE)**2*CINT2*EXP(-1.43879*(CINT1
1   +(BUU*JU*(JU+1.0))/TROT))
  ALAM=1.0E-8*LAMCL
  AK=8.403E15*(ALAM**5)*R2*E
  AK1=AK*(1.-1./R2)
C SET CONSTANTS USED TO DISTRIBUTE THE ROTATIONAL LINE.
  NCENTR=(LAMMIN-1.0/LAMCL)/DELLAM+1
  NSTART=NCENTR-NSPRED
  NEND=NCENTR +NSPRED
  IF((NSTART.LE.1).OR.(NEND.GE.NARRAY)) GO TO 110
C DISTRIBUTE THE ROTATIONAL LINE.
  IF (E.LT.1.0E-25) GO TO 110
  IF(.NOT.LINE1) GO TO 300
C GENERATE LINESHAPE TEMPLATE
  CALL FAST
201 LINE1=.FALSE.
C COPY LINESHAPE USING TEMPLATE
300 XAMCL1=1.0/(LAMMIN-(NCENTR-1)*DELLAM)
  DM=XAMCL1-LAMCL
  K=NSPEED*DM/DELLOC
  M2=NJM+K-NSPEED*NCENTR
  IF(K.LT.(-0.5*FLOAT(NSPEED))) M3=M3+NSPEED
  M1=NSTART
  M2=NEND
305 IF((M3+NSPEED*M1).GE.1) GO TO 308
  M1=M1+1
  GO TO 309
308 IF((M3+NSPEED*M2).LE.NJ) GO TO 310
  M2=M2-1
  GO TO 309
310 CONTINUE
  IF(M1.GT.M2) GO TO 110
  CALL SAXPY(M2-M1+1,E,Y1(M3+NSPEED*M1),NSPEED,EMIS(M1),1)
  CALL SAXPY(M2-M1+1,AK1,Y1(M3+NSPEED*M1),NSPEED,ABSB(M1),1)
110   JU=JU+1.0
      JL=JL+1.0
      K=K+1.0
120   J=J+1.0

```

```

C SET FACTORS IN PREPARATION FOR THE NEXT BRANCH.
  K=XMIN
  SWITCH= SWITCH+ 1
C GO TO THE APPROPRIATE BRANCH.
  GO TO (10,20,30,40,50,60,70,130), SWITCH
130 CONTINUE
  RETURN
  END
*DECK FAST
  SUBROUTINE FAST
C FAST CALCULATION OF ROTATIONAL LINES
  REAL LAMMIN, LAMCL, LAM
  COMMON /CFAST/SPEED, NSPEED, LINE1, NSTART, NEND, LAMCL, E, CSPRD1, CSPRD2
  COMMON /CWIDTH/WIDTHL, WIDTHU, RANGE, DELLAM, LAMMIN
  COMMON /CFST1/Y(4000), NJM, NJ
  LOGICAL LINE1
  DATA Y/4000*0./

C COMPUTE FIRST LINE
C DETERMIN NSPEED
  DELLOC=DELLAM*LAMCL**2
  WD1=1.0/WIDTHU
  NSPEED=DELLOC*WD1*10.+1
C CONSTRUCT LINE TEMPLATE
  NJM=NSPEED*(RANGE*WIDTHU/DELLOC+1.)+1
  IF(NJM.GT.1999) NJM=1999
  NJ=2*NJM-1
  AN=NSPEED
  AM=1.0/AN
C DISTRIBUTE LINE TEMPLATE
C TEST IF LINE IS NEARLY DISPERSIVE
  IF((WIDTHL/WIDTHU).LT.0.90) GO TO 6
C LINE IS NEARLY DISPERSIVE
  WD2=2.0*WD1
  DO 7 I=1, NJ
    LAM=LAMCL*(1.0+LAMCL*(I-NJM)*DELLAM*AM)
    DELL=ABS(LAM-LAMCL)
    Y(I)=0.3183E4*WD2/(1.0+(DELL*WD2)**2)
  7 CONTINUE
  RETURN
  6 CONTINUE
C LINE IS VOIGT
  DO 1 I=1, NJ
    LAM=LAMCL*(1.0+LAMCL*(I-NJM)*DELLAM*AM)
    CSPRD3=ABS(LAM-LAMCL)*WD1
    CSP2=CSPRD3**2
    CSP3=CSP2*SQRT(SQRT(CSPRD3))
    Y(I)=CSPRD1*EXP(-2.772*CSP2)+CSPRD2/(1.0+4.0*CSP2)+0.016*CSPRD2
    >*(1.0-WIDTHL*WD1)*(EXP(-0.4*CSP3)-10./(10.+CSP3))
  1 CONTINUE
  RETURN
  END
  SUBROUTINE SAXPY(N, SA, SX, INCX, SY, INCY)

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C LINEAR COMBINATION ROUTINE TO SUBSTITUTE FOR THE BUILT-IN
C SUBROUTINE IN CRAY
C TAKE OUT IF IN CRAY
  DIMENSION SX(1),SY(1)
  IX=1-INCX
  IY=1-INCY
  DO 1 I=1,N
  IX=IX+INCX
  IY=IY+INCY
  1 SY(IY)=SA*SX(IX)+SY(IY)
  RETURN
  END
*DECK GLBPWR
  SUBROUTINE GLBPWR(WAVEL,EMIS,NARRAY,PWR1,PWR2,PWR3)
C CALCULATES GLOBAL EMISSION POWER
C INPUT PARAMETERS
C WAVEL=WAVELENGTH, A
C EMIS=EMISSION COEFFICIENT, W/(MICRON-CM2-SR)
C NARRAY=LENGTH OF WAVEL, EMIS ARRAYS
C PWR1=TOTAL EMITTED POWER
C PWR2=POWER EMITTED ABOVE 2500 A
C PWR3=POWER EMITTED ABOVE 3500 A
  DIMENSION WAVEL(1)
  DIMENSION EMIS(1)
  PWR1=0.
  PWR2=0.
  PWR3=0.
  DELLOC=(1./WAVEL(1)-1./WAVEL(NARRAY))/(NARRAY-1)
  DO 1 M=1,NARRAY
  DELLOC=WAVEL(M)**2*DELLOC
  PWR1=PWR1+EMIS(M)*DELLOC*1.0E-4*.3.142
  IF(WAVEL(M).GT.2500.) PWR2=PWR2+EMIS(M)*DELLOC*1.0E-4
  >*4.*3.142
  IF(WAVEL(M).GT.3500.) PWR3=PWR3+EMIS(M)*DELLOC*1.0E-4
  >*4.*3.142
  1 CONTINUE
  RETURN
  END

```

ORIGINAL PAGE IS
OF POOR QUALITY

17 6.553E-15 -1.149
 18 0.000E+00 0.000
 19 0.000E+00 0.000
 20 0.000E+00 0.000
 21 0.000E+00 0.000
 22 0.000E+00 0.000

ORIGINAL PAGE NO.
 OF POOR QUALITY

1	2	1.1E-08	0.20	1	3	3.5E-09	0.21	1	4	7.1E-06	-1.87	1	5	1.0E-30	0.00	1
1	6	4.0E-09	0.82	1	7	1.0E-30	0.00	1	8	1.5E-05	-1.93	1	9	1.3E-05	-2.06	2
1	10	1.0E-30	0.00	1	11	5.9E-09	0.82	1	12	2.9E-05	-1.93	1	13	2.5E-05	-2.04	3
1	14	1.0E-30	0.00	1	15	1.0E-30	0.00	1	16	4.7E-05	-2.04	1	17	1.0E-30	0.00	4
1	18	1.7E-05	-2.09	1	19	1.9E-05	-2.09	1	20	2.1E-05	-2.09	1	21	2.2E-05	-2.09	5
2	3	5.4E-09	0.27	2	4	1.0E-30	0.00	2	5	5.3E-06	-1.86	2	6	1.0E-30	0.00	6
2	7	6.8E-09	0.62	2	8	4.5E-06	-1.87	2	9	1.0E-30	0.00	2	10	8.0E-06	-2.06	7
2	11	3.3E-09	0.79	2	12	9.3E-06	-1.88	2	13	8.1E-06	-2.04	2	14	1.0E-30	0.00	8
2	15	1.0E-30	0.00	2	16	1.6E-05	-2.03	2	17	1.0E-30	0.00	2	18	5.7E-06	-2.07	9
2	19	6.3E-06	-2.07	2	20	7.0E-06	-2.07	2	21	7.6E-06	-2.07	2	22	8.1E-06	-2.07	10
3	4	1.0E-30	0.00	3	5	3.5E-06	-1.85	3	6	1.0E-30	0.00	3	7	7.1E-09	0.59	11
3	8	3.4E-06	-1.87	3	9	1.0E-30	0.00	3	10	6.0E-06	-2.06	3	11	3.6E-09	0.76	12
3	12	7.3E-06	-1.88	3	13	6.3E-06	-2.04	3	14	1.0E-30	0.00	3	15	1.0E-30	0.00	13
3	16	1.2E-05	-2.03	3	17	1.0E-30	0.00	3	18	4.5E-06	-2.06	3	19	5.1E-06	-2.07	14
3	20	5.6E-06	-2.07	3	21	6.1E-06	-2.07	3	22	6.6E-06	-2.07	3	23	1.0E-30	0.00	15
4	5	7.3E-12	-0.43	4	6	3.1E-08	-0.05	4	7	2.3E-09	-0.85	4	8	6.6E-08	-0.12	16
4	9	1.1E-07	-0.16	4	10	3.5E-09	-0.72	4	11	8.2E-08	-0.25	4	12	1.8E-07	-0.11	17
4	13	1.2E-07	-0.22	4	14	4.2E-08	-0.23	4	15	7.8E-08	-0.30	4	16	1.7E-07	-0.26	18
4	17	1.1E-07	-0.28	4	18	2.1E-07	-0.32	4	19	2.5E-07	-0.33	4	20	2.9E-07	-0.33	19
4	21	3.2E-07	-0.33	4	22	3.6E-07	-0.33	4	23	1.0E-30	0.00	4	24	1.0E-30	0.00	20
5	6	4.8E-10	-0.88	5	7	7.1E-08	-0.11	5	8	7.2E-08	-0.14	5	9	8.0E-09	-0.71	21
5	10	2.3E-07	-0.18	5	11	6.2E-08	-0.23	5	12	1.4E-07	-0.10	5	13	1.4E-07	-0.25	22
5	14	4.8E-08	-0.28	5	15	1.8E-07	-0.29	5	16	2.1E-07	-0.27	5	17	1.3E-07	-0.32	23
5	18	2.7E-07	-0.35	5	19	3.3E-07	-0.35	5	20	5.7E-07	-0.36	5	21	4.2E-07	-0.36	24
5	22	4.7E-07	-0.36	5	23	1.0E-30	0.00	5	24	1.0E-30	0.00	5	25	1.0E-30	0.00	25
6	7	2.2E-12	-1.09	6	8	8.9E-09	0.20	6	9	4.1E-08	0.04	6	10	9.0E-10	-0.91	26
6	11	1.4E-08	-0.17	6	12	3.0E-08	0.15	6	13	3.9E-08	-0.18	6	14	1.9E-08	-0.44	27
6	15	1.3E-08	-0.27	6	16	4.7E-08	-0.23	6	17	5.4E-08	-0.43	6	18	5.9E-08	-0.32	28
6	19	7.2E-08	-0.33	6	20	8.4E-08	-0.34	6	21	9.7E-08	-0.35	6	22	1.1E-07	-0.35	29
7	8	1.1E-08	0.16	7	9	2.2E-09	-1.03	7	10	8.6E-08	-0.04	7	11	1.9E-08	-0.25	30
7	12	2.9E-08	0.13	7	13	4.5E-08	-0.28	7	14	1.4E-08	-0.52	7	15	1.0E-07	-0.25	31
7	16	6.9E-08	-0.28	7	17	2.1E-08	-0.46	7	18	1.0E-07	-0.37	7	19	1.3E-07	-0.39	32
7	20	1.5E-07	-0.40	7	21	1.7E-07	-0.40	7	22	2.0E-07	-0.41	7	23	1.0E-30	0.00	33
8	9	4.5E-11	-0.44	8	10	4.4E-11	-0.49	8	11	6.0E-08	-0.04	8	12	1.8E-07	-0.05	34
8	13	6.5E-08	0.07	8	14	1.8E-08	0.13	8	15	1.9E-07	0.00	8	16	1.5E-07	-0.05	35
8	17	6.8E-08	-0.01	8	18	4.5E-07	-0.37	8	19	5.9E-07	-0.43	8	20	7.2E-07	-0.46	36
8	21	8.5E-07	-0.48	8	22	9.8E-07	-0.49	8	23	1.0E-30	0.00	8	24	1.0E-30	0.00	37
9	10	6.5E-18	-0.96	9	11	9.5E-10	-0.13	9	12	2.7E-09	0.07	9	13	1.9E-08	-0.10	38
9	14	1.1E-07	0.08	9	15	8.2E-09	-0.32	9	16	4.6E-08	-0.20	9	17	1.4E-07	0.04	39
9	18	1.3E-07	-0.20	9	19	1.7E-07	-0.27	9	20	2.1E-07	-0.31	9	21	2.5E-07	-0.33	40
9	22	2.8E-07	-0.35	9	23	1.0E-30	0.00	9	24	1.0E-30	0.00	9	25	1.0E-30	0.00	41
10	11	6.1E-10	-0.05	10	12	2.5E-09	-0.39	10	13	1.6E-08	-0.07	10	14	1.2E-07	0.04	42
10	15	3.4E-08	-0.17	10	16	4.5E-08	-0.19	10	17	1.6E-07	0.00	10	18	1.6E-07	-0.27	43
10	19	2.1E-07	-0.34	10	20	2.6E-07	-0.38	10	21	3.1E-07	-0.40	10	22	3.6E-07	-0.42	44
11	12	2.3E-08	0.39	11	13	4.3E-08	0.23	11	14	1.8E-08	-0.37	11	15	5.0E-08	-0.17	45
11	16	7.8E-08	0.00	11	17	4.5E-08	-0.46	11	18	2.1E-07	-0.41	11	19	2.9E-07	-0.52	46
11	20	3.5E-07	-0.59	11	21	4.2E-07	-0.63	11	22	4.9E-07	-0.65	11	23	1.0E-30	0.00	47

12 13 5.4E-11-0.51 12 14 5.4E-11-0.49 12 15 1.8E-07 0.22 12 16 9.8E-08 0.33 48
 12 17 4.9E-08 0.30 12 18 1.3E-08 0.26 12 19 9.1E-09-0.05 12 20 8.5E-09-0.22 49
 12 21 8.6E-09-0.38 12 22 9.2E-09-0.49 12 23 1.0E-30 0.00 12 24 1.0E-30 0.00 50
 13 14 1.1E-11-0.33 13 15 5.2E-09-0.15 13 16 2.5E-08 0.31 13 17 1.2E-07 0.30 51
 13 18 2.1E-07-0.63 13 19 2.9E-07-0.82 13 20 3.8E-07-0.97 13 21 4.6E-07-1.05 52
 13 22 5.5E-07-1.11 13 23 1.0E-30 0.00 13 24 1.0E-30 0.00 13 25 1.0E-30 0.00 53
 14 15 2.1E-10-0.50 14 16 4.7E-09-0.38 14 17 3.4E-08 0.28 14 18 3.2E-08-0.49 54
 14 19 4.5E-08-0.70 14 20 5.9E-08-0.84 14 21 7.3E-08-0.94 14 22 8.7E-08-1.00 55
 15 16 7.1E-08 0.45 15 17 3.0E-08-0.31 15 18 8.7E-09 0.17 15 19 7.8E-09-0.15 56
 15 20 8.4E-09-0.32 15 21 9.1E-09-0.47 15 22 1.0E-08-0.58 15 23 1.0E-30 0.00 57
 16 17 1.2E-11-0.38 16 18 1.6E-08-0.05 16 19 3.2E-08-0.37 16 20 4.7E-08-0.54 58
 16 21 6.0E-08-0.69 16 22 7.3E-08-0.80 16 23 1.0E-30 0.00 16 24 1.0E-30 0.00 59
 17 18 2.7E-09 0.08 17 19 5.8E-09-0.23 17 20 8.8E-09-0.40 17 21 1.1E-08-0.56 60
 17 22 1.4E-08-0.67 17 23 1.0E-30 0.00 17 24 1.0E-30 0.00 17 25 1.0E-30 0.00 61
 18 19 3.1E-08 0.18 18 20 5.3E-08-0.16 18 21 7.2E-08-0.31 18 22 8.2E-08-0.45 62
 19 20 3.2E-08 0.24 19 21 5.6E-08-0.12 19 22 7.7E-08-0.25 19 23 1.0E-30 0.00 63
 20 21 3.3E-08 0.28 20 22 6.0E-08-0.10 20 23 1.0E-30 0.00 20 24 1.0E-30 0.00 64
 21 22 3.4E-08 0.30 21 23 1.0E-30 0.00 21 24 1.0E-30 0.00 21 25 1.0E-30 0.00 65

OXYGEN 109837.

4. 10. 6. 12. 0. 26810. 40467. 120000.

1 2 78. 9. 2P4 3P
 2 2 15868. 5. 2P4 1D
 3 2 33792. 1. 2P4 1S
 4 3 73768. 5. 3S 5S
 5 3 76795. 3. 3S 3S
 6 3 86629. 15. 3P 5P
 7 3 88631. 9. 3P 3P
 8 4 95757. 8. 4S 5S 4S 3S
 9 3 97445. 40. 3D 5D 3D 3D
 10 4 99313. 24. 4P 5P 4P 3P
 11 5 102227. 8. 5S 5S 5S 3S
 12 4 102881. 96. 4D 5D 4F 5F 4D 3D 4F 3F
 13 5 103869. 24. 5P 5P 5P 3P
 14 5 105394. 168. 5D 5D 5F 5F 5G 5G 5D 3D 5F 3F 5G 3F
 15 6 106639. 298. 6
 16 7 107583. 392. 7
 17 8 108117. 512. 8
 18 9 108478. 648. 9
 19 10 108734. 800. 10

1 5 3.810E+08
 4 6 3.400E+07
 4 10 2.038E+05
 5 7 2.800E+07
 6 8 1.700E+07
 6 9 2.623E+07
 6 11 4.438E+06
 6 12 1.827E+06
 6 14 2.927E+05

1 1.056E-13 -0.286
 2 0.000E+00 0.000
 3 0.000E+00 0.000
 4 1.016E-16 0.558

5	1.664E-16	0.867
6	8.357E-15	-0.779
7	2.393E-15	-0.186
8	0.000E+00	0.000
9	2.196E-14	-0.873
10	5.143E-15	-0.805
11	0.000E+00	0.000
12	1.788E-14	-0.952
13	1.672E-15	-0.609
14	1.392E-14	-1.001
15	0.000E+00	0.000
16	0.000E+00	0.000
17	0.000E+00	0.000
18	0.000E+00	0.000
19	0.000E+00	0.000

ORIGINAL PAGE IS
OF POOR QUALITY

1	2	2.3E-09	0.47	1	3	3.8E-10	0.24	1	4	1.8E-09	0.03	1	5	7.3E-06	-1.80	1
1	6	5.7E-09	0.07	1	7	3.4E-09	0.91	1	8	7.7E-06	-1.91	1	9	4.4E-06	-1.99	2
1	10	2.7E-08	0.17	1	11	1.6E-05	-1.85	1	12	5.2E-06	-1.99	1	13	1.0E-30	0.00	3
1	14	5.8E-06	-1.99	1	15	8.9E-06	-2.05	1	16	1.1E-05	-2.05	1	17	1.2E-05	-2.05	4
1	18	1.3E-05	-2.05	1	19	1.3E-05	-2.05	1	20	1.0E-30	0.00	1	21	1.0E-30	0.00	5
2	3	1.3E-09	-0.03	2	4	1.0E-30	0.00	2	5	1.0E-30	0.00	2	6	1.0E-30	0.00	6
2	7	1.0E-30	0.00	2	8	1.0E-30	0.00	2	9	1.0E-30	0.00	2	10	1.0E-30	0.00	7
2	11	1.0E-30	0.00	2	12	1.0E-30	0.00	2	13	1.0E-30	0.00	2	14	1.0E-30	0.00	8
2	15	0.0E+00	0.00	2	16	0.0E+00	0.00	2	17	0.0E+00	0.00	2	18	0.0E+00	0.00	9
2	19	0.0E+00	0.00	2	20	1.0E-30	0.00	2	21	1.0E-30	0.00	2	22	1.0E-30	0.00	10
3	4	1.0E-30	0.00	3	5	1.0E-30	0.00	3	6	1.0E-30	0.00	3	7	1.0E-30	0.00	11
3	8	1.0E-30	0.00	3	9	1.0E-30	0.00	3	10	1.0E-30	0.00	3	11	1.0E-30	0.00	12
3	12	1.3E-30	0.00	3	13	1.0E-30	0.00	3	14	1.0E-30	0.00	3	15	0.0E+00	0.00	13
3	16	0.0E+00	0.00	3	17	0.0E+00	0.00	3	18	0.0E+00	0.00	3	19	0.0E+00	0.00	14
4	5	1.0E-30	0.00	4	6	1.0E-30	0.00	4	7	1.0E-30	0.00	4	8	1.0E-30	0.00	15
4	9	1.0E-30	0.00	4	10	1.0E-30	0.00	4	11	1.0E-30	0.00	4	12	1.0E-30	0.00	16
4	13	1.0E-30	0.00	4	14	1.0E-30	0.00	4	15	0.0E+00	0.00	4	16	0.0E+00	0.00	17
4	17	0.0E+00	0.00	4	18	0.0E+00	0.00	4	19	0.0E+00	0.00	4	20	1.0E-30	0.00	18
5	6	1.0E-30	0.00	5	7	1.0E-30	0.00	5	8	1.0E-30	0.00	5	9	1.0E-30	0.00	19
5	10	1.0E-30	0.00	5	11	1.0E-30	0.00	5	12	1.0E-30	0.00	5	13	1.0E-30	0.00	20
5	14	1.0E-30	0.00	5	15	0.0E+00	0.00	5	16	0.0E+00	0.00	5	17	0.0E+00	0.00	21
5	18	0.0E+00	0.00	5	19	0.0E+00	0.00	5	20	1.0E-30	0.00	5	21	1.0E-30	0.00	22
6	7	4.6E-11	-1.19	6	8	1.0E-30	0.00	6	9	4.4E-08	0.00	6	10	2.5E-08	-0.19	23
6	11	1.0E-30	0.00	6	12	6.6E-08	-0.39	6	13	1.6E-08	-0.05	6	14	1.0E-07	-0.48	24
6	15	1.0E-07	-0.46	6	16	1.3E-07	-0.47	6	17	1.5E-07	-0.48	6	18	1.8E-07	-0.48	25
6	19	2.0E-07	-0.49	6	20	1.0E-30	0.00	6	21	1.0E-30	0.00	6	22	1.0E-30	0.00	26
7	8	1.0E-30	0.00	7	9	4.4E-08	-0.11	7	10	7.9E-08	-0.54	7	11	1.0E-30	0.00	27
7	12	7.7E-08	-0.53	7	13	8.6E-08	-0.26	7	14	9.2E-08	-0.52	7	15	1.2E-07	-0.49	28
7	16	1.6E-07	-0.51	7	17	2.0E-07	-0.52	7	18	2.2E-07	-0.53	7	19	2.5E-07	-0.53	29
8	9	1.0E-30	0.00	8	10	1.0E-30	0.00	8	11	1.0E-30	0.00	8	12	1.0E-30	0.00	30
8	13	1.0E-30	0.00	8	14	1.0E-30	0.00	8	15	2.9E-30	-0.31	8	16	0.0E+00	0.00	31
8	17	0.0E+00	0.00	8	18	0.0E+00	0.00	8	19	0.0E+00	0.00	8	20	1.0E-30	0.00	32
9	10	8.2E-10	-0.51	9	11	1.0E-30	0.00	9	12	1.7E-07	-0.11	9	13	3.3E-08	-0.31	33
9	14	2.9E-07	-0.13	9	15	2.9E-07	-0.34	9	16	4.2E-07	-0.42	9	17	5.2E-07	-0.46	34
9	18	6.1E-07	-0.49	9	19	7.0E-07	-0.50	9	20	1.0E-30	0.00	9	21	1.0E-30	0.00	35
10	11	1.0E-30	0.00	10	12	4.1E-08	-0.01	10	13	8.2E-08	-0.15	10	14	9.0E-08	-0.40	36
10	15	1.7E-07	-0.60	10	16	2.5E-07	-0.74	10	17	3.1E-07	-0.80	10	18	3.7E-07	-0.83	37
10	19	4.3E-07	-0.85	10	20	1.0E-30	0.00	10	21	1.0E-30	0.00	10	22	1.0E-30	0.00	38

11 12 1.0E-30 0.00 11 13 1.0E-30 0.00 11 14 1.0E-30 0.00 11 15 3.2E-31 0.39 39
 11 16 1.9E-31 0.01 11 17 1.7E-31-0.16 11 18 1.7E-31-0.31 11 19 1.8E-31-0.42 40
 12 13 4.1E-09-0.21 12 14 1.3E-07 0.10 12 15 1.4E-07-0.47 12 16 2.2E-07-0.71 41
 12 17 2.9E-07-0.86 12 18 3.5E-07-0.95 12 19 4.2E-07-1.00 12 20 1.0E-30 0.00 42
 13 14 4.8E-08 0.06 13 15 2.2E-08 0.02 13 16 1.9E-08-0.36 13 17 2.0E-08-0.53 43
 13 18 2.2E-08-0.69 13 19 2.5E-08-0.80 13 20 1.0E-30 0.00 13 21 1.0E-30 0.00 44
 14 15 3.2E-08 0.12 14 16 8.1E-08-0.26 14 17 1.2E-07-0.43 14 18 1.6E-07-0.58 45
 14 19 1.9E-07-0.69 14 20 1.0E-30 0.00 14 21 1.0E-30 0.00 14 22 1.0E-30 0.00 46
 15 16 7.3E-08 0.16 15 17 1.2E-07-0.16 15 18 1.7E-07-0.31 15 19 1.9E-07-0.45 47
 16 17 7.2E-08 0.26 16 18 1.3E-07-0.09 16 19 1.7E-07-0.23 16 20 1.0E-30 0.00 48
 17 18 7.4E-08 0.30 17 19 1.4E-07-0.08 17 20 1.0E-30 0.00 17 21 1.0E-30 0.00 49
 18 19 7.6E-08 0.32 18 20 1.0E-30 0.00 18 21 1.0E-30 0.00 18 22 1.0E-30 0.00 50
 -1 0 0.

N2+ 28.010 4 6 5 4 0
 2.000 0.000 2207.190 16.136 -0.040 0.000 1.93220 2.020E-02
 4.000 9168.400 1902.840 14.910 0.000 0.000 1.72200 1.900E-02
 2.000 25461.500 2419.840 23.190 -0.538 0.000 2.08300 1.950E-02
 4.000 51663.2 907.71 11.91 0.016 0. 1.113 0.020
 2.000 64622.199 2050.000 0.000 0.000 0.000 1.65000 5.000E-02

N 4S 1.401E+01 7.040E+04 4.000E+00 1.500E+00 0.000E+00

N+ 3P 1.401E+01 7.040E+04 9.000E+00 1.000E+00 1.000E+00

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ET AL

8.727 11.01 16.52 22.03 27.54 41.30 55.07 82.61
 2.950E-16 2.830E-16 2.380E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ET AL

7.610 9.604 14.41 19.21 24.01 36.01 48.02 72.03
 2.950E-16 2.830E-16 2.380E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ET AL

5.558 7.014 10.52 14.03 17.54 26.30 35.07 52.61
 2.950E-16 2.830E-16 2.380E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ET AL

2.323 2.931 4.397 5.863 7.328 10.99 14.66 21.98
 2.950E-16 2.830E-16 2.380E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16

N2+MEI 1 2 10

0 0 4.751E-01 0 1 3.798E-01 0 2 1.226E-01 0 3 2.055E-02 0 4 1.914E-03
 0 5 9.822E-05 1 0 3.255E-01 1 1 3.115E-01 1 2 3.358E-01 1 3 2.368E-01
 1 4 6.236E-02 1 5 7.946E-03 1 6 5.163E-04 2 0 1.360E-01 2 1 2.245E-01
 2 2 2.137E-02 2 3 1.851E-01 2 4 2.946E-01 2 5 1.171E-03 2 6 1.972E-03
 2 7 1.581E-03 3 0 4.526E-02 3 1 1.990E-01 3 2 7.974E-01 3 3 1.049E-01
 3 4 6.274E-02 3 5 2.929E-01 3 6 1.738E-01 3 7 3.793E-02 3 8 3.685E-03
 4 0 1.329E-02 4 1 1.032E-01 4 2 1.745E-01 4 3 7.195E-03 4 4 1.553E-01
 4 5 5.868E-03 4 6 2.479E-01 4 7 2.230E-01 4 8 6.228E-02 4 9 7.238E-03
 5 0 3.624E-03 5 1 4.145E-02 5 2 1.395E-01 5 3 1.078E-01 5 4 6.918E-03
 5 5 1.509E-01 5 6 5.609E-03 5 7 1.816E-01 5 8 2.578E-01 5 9 9.165E-02

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ET AL

1.118 1.411 2.116 2.821 3.527 5.289 7.053 10.58
 2.950E-16 2.830E-16 2.380E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16

0.

N2+ 1- 1 3 36

0 0 6.509E-01 1 0 3.014E-01 2 0 4.537E-02 3 0 2.248E-03 4 0 1.452E-05
 0 1 2.588E-01 1 1 2.226E-01 2 1 4.060E-01 3 1 1.056E-01 4 1 6.935E-03
 5 1 3.986E-05 0 2 7.016E-02 1 2 2.860E-01 2 2 5.065E-02 3 2 4.137E-01
 4 2 1.660E-01 5 2 1.340E-02 6 2 5.729E-05 7 2 1.132E-05 0 3 1.600E-02
 1 3 1.324E-01 2 3 2.290E-01 3 3 2.101E-03 4 3 3.792E-01 5 3 2.205E-01
 6 3 2.063E-02 7 3 4.930E-05 8 3 3.006E-05 0 4 3.297E-03 1 4 4.273E-02

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2 4 1.654E-01 3 4 1.557E-01 4 4 6.726E-03 5 4 3.310E-01 6 4 2.673E-01
7 4 2.789E-02 8 4 1.807E-05 9 4 6.420E-05 0 5 6.342E-04 1 5 1.140E-02
2 5 7.113E-02 3 5 1.706E-01 4 5 9.290E-02 5 5 2.925E-02 6 5 2.830E-01
7 5 3.068E-01 8 5 3.419E-02 10 5 1.161E-04 0 6 1.155E-04 1 6 2.700E-03
2 6 2.362E-02 3 6 9.451E-02 4 6 1.569E-01 5 6 4.815E-02 6 6 5.331E-02
7 6 2.415E-01 8 6 3.401E-01 9 6 3.890E-02 10 6 8.094E-05 11 6 1.823E-04
0 7 2.000E-05 1 7 5.861E-04 2 7 6.691E-03 3 7 3.801E-02 4 7 1.096E-01
5 7 1.333E-01 6 7 2.044E-02 7 7 7.236E-02 8 7 2.083E-01 9 7 3.686E-01
10 7 4.153E-02 11 7 3.873E-04 12 7 2.509E-04 13 7 1.172E-05 1 8 1.185E-04
2 8 1.695E-03 3 8 1.261E-02 4 8 5.236E-02 5 8 1.161E-01 6 8 1.065E-01
7 8 5.939E-03 8 8 8.468E-02 9 8 1.837E-01 10 8 3.933E-01 11 8 4.170E-02
12 8 1.087E-03 13 8 3.010E-04 14 8 3.005E-05 1 9 2.239E-05 2 9 3.934E-04
8 9 4.743E-04 9 9 9.065E-02 10 9 1.672E-01 11 9 4.149E-01 12 9 3.928E-02
13 9 2.361E-03 14 9 3.071E-04 15 9 6.400E-05 2 10 8.445E-05 3 10 9.639E-04
4 10 6.599E-03 5 10 2.826E-02 6 10 7.442E-02 7 10 1.084E-01 8 10 5.865E-02
9 10 5.552E-04 10 10 9.141E-02 11 10 1.579E-01 12 10 4.338E-01 13 10 3.432E-02
14 10 4.364E-03 15 10 2.499E-04 16 10 1.171E-04 2 11 1.675E-05 3 11 2.324E-04
4 11 1.942E-03 5 11 1.043E-02 6 11 3.652E-02 7 11 8.051E-02 8 11 9.821E-02
9 11 4.075E-02 10 11 3.604E-03 11 11 8.818E-02 12 11 1.554E-01 13 11 4.496E-01
14 11 2.722E-02 15 11 7.165E-03 16 11 1.355E-04 17 11 1.867E-04 3 12 5.156E-05
4 12 5.207E-04 5 12 3.406E-03 6 12 1.496E-02 7 12 4.411E-02 8 12 8.319E-02
9 12 8.628E-02 10 12 2.710E-02 11 12 7.896E-03 12 12 8.205E-02 13 12 1.593E-01
14 12 4.615E-01 15 12 1.876E-02 16 12 1.068E-02 17 12 2.033E-05 18 12 2.587E-04
19 12 2.439E-05 3 13 1.044E-05 4 13 1.281E-04 5 13 1.007E-03 6 13 5.378E-03
7 13 1.991E-02 8 13 5.053E-02 9 13 8.288E-02 10 13 7.393E-02 11 13 1.720E-02
12 13 1.238E-02 13 13 7.384E-02 14 13 1.697E-01 15 13 4.681E-01 16 13 1.018E-02
17 13 1.459E-02 18 13 3.550E-05 19 13 3.056E-04 4 14 2.877E-05 5 14 2.724E-04
6 14 1.741E-03 7 14 7.823E-03 8 14 2.495E-02 9 14 5.544E-02 10 14 8.018E-02
11 14 6.208E-02 12 14 1.034E-02 13 14 1.651E-02 14 14 6.418E-02 15 14 1.866E-01
16 14 4.676E-01 17 14 3.207E-03 18 14 1.831E-02 19 14 3.955E-04 5 15 6.737E-05

CROSS-SECTIONS MEASURED BY CRANDALL ET AL

3.17 4.00 5.0 6.0 8.0 10. 15. 20.
2.950E-16 2.830E-16 2.390E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16
1.520E+07

N2+ DX 1 4 54
0 4 1.579E-04 0 5 6.941E-04 0 6 2.501E-03 0 7 7.498E-03 0 8 1.688E-02
0 9 4.020E-02 0 10 1.119E-01 0 11 1.469E-01 0 12 1.642E-01 0 13 1.556E-01
0 14 8.237E-02 0 15 4.467E-02 0 16 6.454E-03 0 17 1.574E-03 1 3 2.379E-04
1 4 1.105E-03 1 5 4.051E-03 1 6 1.193E-02 1 7 2.838E-02 1 8 5.433E-02
1 9 8.246E-02 1 10 7.993E-02 1 11 3.886E-02 1 12 3.775E-03 1 13 9.785E-03
1 14 1.231E-01 1 15 1.498E-01 1 16 7.868E-02 1 17 3.522E-02 1 18 2.220E-03
2 2 2.055E-04 2 3 1.061E-03 2 4 4.119E-03 2 5 1.243E-02 2 6 2.937E-02
2 7 5.383E-02 2 8 7.418E-02 2 9 7.166E-02 2 10 5.664E-03 2 11 6.219E-03
2 12 4.435E-02 2 13 7.148E-02 2 14 5.578E-03 2 15 1.365E-02 2 16 1.467E-01
2 17 1.458E-01 2 18 3.852E-02 2 19 1.260E-03 3 1 1.266E-04 3 2 7.873E-04
3 3 3.383E-03 3 4 1.083E-02 3 5 2.642E-02 3 6 4.873E-02 3 7 6.544E-02
3 8 5.822E-02 3 9 2.601E-02 3 10 1.461E-02 3 11 4.747E-02 3 12 4.558E-02
3 13 9.981E-03 3 14 4.763E-02 3 15 6.338E-02 3 16 3.506E-03 3 17 7.154E-02
3 18 1.543E-01 3 19 2.868E-02 3 20 2.104E-04 4 1 4.776E-04 4 2 2.441E-03
4 3 8.604E-03 4 4 2.231E-02 4 5 4.286E-02 4 6 5.903E-02 4 7 5.284E-02
4 8 2.278E-02 4 9 3.107E-04 4 10 4.162E-02 4 11 3.102E-02 4 12 2.057E-03
4 13 1.384E-02 4 14 2.859E-02 4 16 6.297E-02 4 17 2.450E-02 4 18 8.839E-02
4 19 1.494E-01 4 20 1.189E-02 5 0 2.140E-04 5 1 1.563E-03 5 2 6.463E-03
5 3 1.834E-02 5 4 3.756E-02 5 5 5.462E-02 5 6 5.185E-02 5 7 2.462E-02

5 8 8.863E-04 5 9 1.169E-02 5 10 2.555E-02 5 11 9.533E-04 5 12 1.462E-02
5 13 3.651E-02 5 14 1.906E-03 5 15 3.396E-02 5 16 8.541E-04 5 17 2.805E-02
5 18 1.584E-02 5 19 1.384E-01 5 20 1.102E-01 5 21 1.694E-03 6 0 8.007E-04
6 1 4.533E-03 6 2 1.487E-02 6 3 3.315E-02 6 4 5.168E-02 6 5 5.310E-02
6 6 2.909E-02 6 7 2.669E-03 6 8 7.266E-03 6 9 2.986E-02 6 10 1.364E-03
6 11 1.171E-02 6 12 3.032E-02 6 13 1.091E-02 6 14 2.913E-02 6 15 2.045E-02
6 16 2.965E-02 6 17 3.096E-02 6 18 3.761E-02 6 19 1.295E-03 6 20 2.057E-01
6 21 4.502E-02 7 0 2.732E-03 7 1 1.163E-02 7 2 2.957E-02 7 3 4.991E-02
7 4 5.571E-02 7 5 3.501E-02 7 6 5.910E-03 7 7 3.508E-03 7 8 2.451E-02
7 9 2.438E-02 7 10 7.875E-03 7 11 2.579E-02 7 12 1.041E-02 7 13 1.982E-03
7 14 1.547E-02 7 15 6.758E-04 7 16 1.859E-02 7 17 8.836E-04 7 18 2.156E-02
7 19 5.653E-02 7 20 2.086E-02 7 21 2.030E-01 7 22 6.649E-03 8 0 2.272E-02
8 1 4.752E-02 8 2 6.504E-02 8 3 4.986E-02 8 4 1.606E-02 8 6 1.551E-02
8 7 2.468E-02 8 8 7.102E-03 8 9 2.077E-03 8 10 1.226E-02 8 11 1.357E-04
8 12 1.509E-02 8 13 1.338E-02 8 14 1.572E-02 8 15 1.224E-02 8 16 1.958E-02
8 17 8.542E-03 8 18 2.511E-02 8 19 2.164E-02 8 20 5.973E-03 8 21 5.069E-03
8 22 2.433E-01 9 0 1.599E-02 9 1 6.827E-02 9 2 6.214E-02 9 7 9.697E-03
9 3 2.240E-02 9 4 1.873E-04 9 5 1.256E-02 9 6 2.450E-02 9 7 9.697E-03
9 8 6.955E-04 9 9 1.524E-02 9 11 1.157E-02 9 12 1.326E-02 9 14 1.165E-02
9 15 2.491E-04 9 16 7.723E-03 9 17 3.467E-03 9 18 1.668E-03 9 19 1.614E-02
9 20 3.486E-02 9 21 5.754E-02 9 22 6.642E-02 9 23 1.387E-01 9 24 1.769E-04
10 0 1.015E-01 10 1 6.956E-02 10 2 3.610E-02 10 3 9.781E-04 10 4 9.260E-03
10 5 2.566E-02 10 6 1.193E-02 10 8 1.277E-02 10 9 1.389E-02 10 10 8.671E-03
10 11 1.308E-02 10 12 4.079E-04 10 13 9.081E-03 10 15 1.218E-02 10 16 1.937E-03
10 17 1.562E-02 10 18 1.041E-02 10 19 2.075E-03 10 20 2.150E-04 10 21 5.829E-03
10 22 3.749E-02 10 23 2.378E-01 10 24 2.930E-03 11 0 2.010E-01 11 1 4.128E-03
11 2 9.081E-04 11 3 3.431E-02 11 4 1.479E-02 11 5 1.310E-03 11 6 1.013E-02
11 7 1.366E-02 11 8 2.956E-03 11 9 4.710E-03 11 10 2.317E-03 11 11 4.536E-03
11 12 1.066E-02 11 13 6.973E-04 11 14 8.468E-03 11 15 1.368E-04 11 16 3.669E-03
11 17 4.138E-03 11 19 2.462E-03 11 20 7.770E-03 11 21 1.372E-02 11 22 2.433E-02
11 23 6.579E-02 11 24 1.756E-01 12 0 1.293E-01 12 1 8.939E-02 12 2 5.961E-03
12 3 1.924E-02 12 4 1.544E-02 12 5 7.623E-03 12 6 1.198E-02 12 7 4.165E-03
12 8 7.042E-03 12 9 7.446E-03 12 10 7.521E-03 12 11 3.516E-03 12 12 3.584E-03
12 13 7.830E-03 12 14 6.465E-03 12 15 5.513E-03 12 16 9.053E-03 12 17 8.782E-04
12 18 5.483E-03 12 19 9.831E-03 12 20 1.299E-02 12 21 1.678E-02 12 22 2.334E-02

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR B-X OF CRANDALL ET AL
6.405 8.083 12.12 16.17 20.21 30.31 40.42 60.62
2.950E-16 2.830E-16 2.380E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16
0.

N24MEI 2 3 61
0 0 9.858E-02 0 1 2.010E-01 0 2 2.274E-01 0 3 1.887E-01 0 4 1.304E-01
0 5 7.827E-02 0 6 4.202E-02 0 7 2.023E-02 0 8 8.537E-03 0 9 2.978E-03
1 0 2.331E-01 1 1 1.645E-01 1 2 2.267E-02 1 3 1.090E-02 1 4 7.699E-02
1 5 1.276E-01 1 6 1.324E-01 1 7 1.054E-01 1 8 6.863E-02 1 9 3.678E-02
1 10 4.559E-03 1 11 6.144E-04 1 13 1.757E-04 2 0 2.739E-01 2 1 1.263E-02
2 2 6.140E-02 2 3 1.150E-01 2 4 4.835E-02 2 5 3.454E-04 2 6 2.816E-02
2 7 8.558E-02 2 8 1.196E-01 2 9 1.136E-01 2 10 4.217E-02 2 11 1.476E-02
2 12 2.383E-03 2 14 7.023E-04 2 15 2.225E-04 3 0 2.110E-01 3 1 4.466E-02
3 2 1.213E-01 3 3 9.749E-03 3 4 3.071E-02 3 5 8.135E-02 3 6 4.921E-02
3 7 3.362E-03 3 8 1.564E-02 3 9 7.232E-02 3 10 1.179E-01 3 11 7.927E-02
3 12 3.386E-02 3 13 6.730E-03 3 14 1.545E-03 3 15 1.969E-03 3 17 2.360E-04
4 0 1.175E-01 4 1 1.690E-01 4 2 1.948E-02 4 3 5.468E-02 4 4 7.808E-02
4 5 6.532E-03 4 6 2.003E-02 4 7 5.997E-02 4 8 3.954E-02 4 9 2.300E-03
4 10 8.239E-02 4 11 1.290E-01 4 12 1.155E-01 4 13 6.142E-02 4 14 1.524E-04

ORIGINAL PAGE IS
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4 15	2.870E-03	4 16	1.669E-03	4 17	4.403E-04	4 18	1.643E-04	4 19	1.416E-04
5 0	4.856E-02	5 1	2.020E-01	5 2	3.091E-02	5 3	9.172E-02	5 4	1.427E-04
5 5	5.362E-02	5 6	5.327E-02	5 7	3.333E-03	5 8	1.674E-02	5 9	4.537E-02
5 11	3.722E-02	5 12	1.109E-01	5 13	1.385E-01	5 14	2.914E-02	5 15	8.684E-04
5 16	8.187E-03	5 18	1.376E-03	6 0	1.438E-02	6 1	1.359E-01	6 2	1.596E-01
6 3	5.523E-03	6 4	6.783E-02	6 5	3.898E-02	6 6	3.357E-03	6 7	4.840E-02
6 8	3.482E-02	6 9	6.546E-04	6 10	3.239E-02	6 11	8.087E-03	6 12	8.612E-03
6 13	7.689E-02	6 14	1.222E-01	6 15	4.813E-02	6 16	5.028E-03	6 17	6.864E-03
6 18	1.326E-03	6 19	9.596E-04	7 0	2.712E-03	7 1	5.621E-02	7 2	1.997E-01
7 3	6.253E-02	7 4	5.351E-02	7 5	1.062E-02	7 6	5.970E-02	7 7	1.205E-02
7 8	1.061E-02	7 9	4.128E-02	7 10	2.364E-04	7 11	1.802E-02	7 12	1.626E-02
7 13	1.344E-04	7 14	1.267E-01	7 15	1.416E-01	7 16	7.417E-03	7 17	1.839E-02
7 18	8.947E-04	7 19	4.369E-03	8 0	2.265E-04	8 1	1.307E-02	8 2	1.197E-01
8 3	2.014E-01	8 4	5.484E-03	8 5	7.101E-02	8 6	3.963E-03	8 7	3.053E-02
8 8	3.781E-02	8 9	1.110E-03	8 10	3.166E-02	8 11	6.858E-03	8 12	3.060E-03
8 13	1.345E-02	8 14	2.037E-02	8 15	1.016E-01	8 16	9.138E-02	8 17	3.263E-03
8 18	1.800E-02	8 19	1.632E-03	9 2	2.899E-03	9 3	6.683E-02	9 4	2.357E-01
9 5	9.423E-02	9 6	2.519E-02	9 7	1.073E-02	9 8	4.088E-02	9 9	3.076E-03
9 10	2.651E-02	9 11	2.462E-03	9 12	9.289E-03	9 13	2.262E-02	9 14	3.273E-04
9 15	1.999E-03	9 16	5.189E-02	9 17	1.177E-01	9 19	3.142E-02	10 3	5.339E-03
10 4	1.066E-01	10 5	2.639E-01	10 6	4.767E-02	10 7	3.430E-02	10 9	3.080E-02
10 10	1.842E-03	10 11	2.221E-02	10 12	1.092E-02	10 13	9.910E-04	10 14	1.444E-02
10 15	1.188E-03	10 16	1.529E-03	10 17	1.059E-01	10 18	4.941E-02	10 19	1.990E-02
11 2	2.245E-04	11 3	5.422E-04	11 4	7.679E-03	11 5	1.488E-01	11 6	2.729E-01
11 7	2.125E-02	11 8	2.682E-02	11 9	7.366E-03	11 10	2.274E-02	11 11	7.674E-04
11 12	1.179E-02	11 13	1.601E-02	11 14	9.282E-03	11 15	1.739E-02	11 16	2.068E-04
11 17	2.478E-02	11 18	1.150E-01	11 19	3.166E-03	12 4	1.740E-03	12 5	6.393E-03
12 6	8.011E-03	12 7	2.178E-01	12 8	2.616E-01	12 9	6.698E-03	12 10	2.786E-02
12 12	1.370E-02	12 13	1.038E-02	12 14	1.144E-02	12 15	7.056E-03	12 16	1.222E-02
12 17	5.755E-03	12 18	1.538E-02	12 19	9.503E-02	13 5	3.214E-03	13 6	1.501E-02
13 7	4.955E-03	13 8	2.330E-01	13 9	2.522E-01	13 10	6.575E-04	13 11	3.209E-02
13 12	6.402E-04	13 13	7.041E-03	13 14	2.754E-04	13 15	7.066E-03	13 17	1.549E-02
13 18	5.836E-03	13 19	4.587E-02	14 5	5.767E-04	14 6	1.754E-03	14 7	4.791E-03
14 8	4.951E-02	14 9	3.759E-04	14 10	2.299E-01	14 11	2.551E-02	14 12	2.676E-02
14 13	3.778E-02	14 14	4.100E-04	14 15	1.029E-02	14 16	1.588E-03	14 17	1.967E-03
14 18	1.280E-02	14 19	1.100E-02	15 6	9.381E-04	15 7	5.386E-03	15 9	3.030E-03
15 9	7.132E-02	15 10	1.560E-01	15 11	2.100E-01	15 12	4.166E-02	15 13	5.199E-02
15 14	7.912E-04	15 16	3.713E-03	15 17	6.440E-03	15 18	8.720E-04	15 19	1.529E-02
16 6	1.202E-04	16 7	1.720E-03	16 8	3.403E-04	16 9	2.191E-02	16 10	8.807E-02
16 11	6.016E-02	16 12	4.443E-02	16 13	1.331E-01	16 14	1.157E-01	16 15	7.365E-02
16 16	3.836E-03	16 17	3.492E-03	16 18	4.125E-03	17 7	6.160E-01	17 9	6.856E-03
17 10	2.998E-02	17 11	3.679E-02	17 12	3.610E-02	17 13	1.144E-01	17 14	3.202E-02
17 15	5.362E-02	17 16	1.268E-01	17 17	1.735E-02	17 18	1.586E-03	17 19	2.835E-03
18 7	1.227E-04	18 8	4.722E-04	18 9	1.124E-03	18 10	4.144E-03	18 11	3.253E-02
18 12	3.762E-03	18 13	8.621E-02	18 14	6.917E-02	18 15	3.329E-02	18 16	4.071E-03
18 17	1.678E-01	18 18	5.230E-02	19 8	3.651E-04	19 10	7.526E-04	19 11	1.653E-02
19 12	6.207E-03	19 13	3.946E-02	19 14	3.596E-02	19 15	4.942E-02	19 16	1.820E-02
CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ETAL									
2.052	2.589	3.884	5.179	6.473	9.709	12.95	19.42		
2.950E-16	2.830E-16	2.380E-16	1.900E-16	1.550E-16	1.100E-16	0.890E-16	0.680E-16		
0.									
N2+JD:	2	4	14						
0 0	2.625E-06	0 2	3.782E-04	0 3	1.929E-03	0 4	7.451E-03	0 5	2.116E-02
1 1	3.153E-04	1 2	2.208E-03	1 3	9.528E-03	1 4	2.820E-02	1 5	6.006E-02
2 1	1.156E-03	2 2	6.808E-03	2 3	2.286E-02	2 4	5.450E-02	2 5	8.260E-02

3	0	2.676E-04	3	1	2.992E-03	3	2	1.475E-02	3	3	4.141E-02	3	4	6.928E-02
4	0	6.370E-04	4	1	6.138E-03	4	2	2.518E-02	4	3	5.561E-02	4	4	6.688E-02
4	5	3.501E-02	5	0	1.282E-03	5	1	1.063E-02	5	2	3.603E-02	5	3	6.105E-02
5	4	4.737E-02	5	5	7.281E-03	6	0	2.267E-03	6	1	1.617E-02	6	2	4.487E-02
6	3	5.632E-02	6	4	2.363E-02	6	5	2.567E-04	7	0	3.621E-03	7	1	2.217E-02
7	2	4.982E-02	7	3	4.401E-02	7	4	6.369E-03	7	5	9.586E-03	8	0	5.322E-03
8	1	2.793E-02	8	2	5.016E-02	8	3	2.875E-02	8	4	5.422E-02	8	5	2.267E-02
9	0	7.306E-03	9	1	3.282E-02	9	2	4.629E-02	9	3	1.493E-03	9	4	3.046E-03
9	5	2.972E-02	10	0	9.470E-03	10	1	3.634E-02	10	2	3.939E-02	10	3	5.296E-03
10	4	1.062E-02	10	5	2.806E-02	11	0	1.169E-02	11	1	3.827E-02	11	2	3.098E-02
11	3	6.495E-04	11	4	1.808E-02	11	5	2.041E-02	0	1	4.563E-05	1	0	2.100E-05

CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ETAL

5.287	6.673	10.01	13.35	16.68	25.02	33.36	50.04
2.950E-16	2.830E-16	2.380E-16	1.900E-16	1.550E-16	1.100E-16	0.890E-16	0.680E-16

N2+JD1		3	4	43													
0	7	1.400E-04	0	8	6.043E-04	0	9	7.837E-03	0	10	2.271E-02	0	11	5.541E-02			
0	12	1.799E-01	0	13	2.263E-01	0	14	1.314E-01	0	15	4.570E-02	1	6	2.347E-04			
1	7	9.487E-04	1	8	3.397E-03	1	9	2.759E-02	1	10	5.842E-02	1	11	9.454E-02			
1	12	6.349E-02	1	13	4.704E-03	1	14	1.817E-01	1	15	2.540E-01	1	16	1.953E-02			
1	17	4.728E-04	2	5	2.643E-04	2	6	1.016E-03	2	7	3.458E-03	2	8	1.021E-02			
2	9	5.059E-02	2	10	7.533E-02	2	11	7.295E-02	2	13	4.086E-02	2	14	1.873E-02			
2	15	4.644E-02	2	16	2.376E-01	2	17	1.340E-03	2	18	1.174E-03	3	4	2.611E-04			
3	5	9.672E-04	3	6	3.154E-03	3	7	8.963E-03	3	8	2.160E-02	3	9	6.202E-02			
3	10	5.959E-02	3	11	2.542E-02	3	12	2.943E-02	3	13	5.398E-02	3	14	2.494E-02			
3	15	7.028E-02	3	16	2.159E-01	3	17	4.280E-02	3	18	6.927E-03	3	19	1.089E-03			
4	3	2.491E-04	4	4	9.037E-04	4	5	2.846E-03	4	6	7.804E-03	4	7	1.832E-02			
4	8	3.544E-02	4	9	5.343E-02	4	10	2.664E-02	4	11	5.688E-04	4	12	4.220E-02			
4	13	1.237E-02	4	14	4.757E-02	4	15	2.575E-03	4	16	1.230E-02	4	17	3.780E-01			
4	18	3.457E-02	4	19	2.702E-04	5	2	2.367E-04	5	3	8.676E-04	5	4	2.671E-03			
5	5	7.086E-03	5	6	1.615E-02	5	7	3.080E-02	5	8	4.649E-02	5	9	2.979E-02			
5	10	3.001E-03	5	11	8.579E-03	5	12	1.775E-02	5	13	1.744E-03	5	14	1.063E-02			
5	15	1.880E-02	5	16	1.431E-02	5	17	1.539E-01	5	18	4.112E-01	5	19	3.821E-02			
6	1	2.178E-04	6	2	8.595E-04	6	3	2.654E-03	6	4	6.865E-03	6	5	1.516E-02			
6	6	2.822E-02	6	7	4.257E-02	6	8	4.771E-02	6	9	6.853E-03	6	10	2.823E-03			
6	11	2.488E-02	6	12	1.644E-04	6	13	1.976E-02	6	14	2.658E-03	6	15	3.042E-02			
6	16	3.599E-02	6	17	1.765E-02	6	18	1.712E-01	7	0	1.727E-04	7	1	8.435E-04			
7	2	2.765E-03	7	3	7.111E-03	7	4	1.526E-02	7	5	2.754E-02	7	6	4.079E-02			
7	7	4.643E-02	7	8	3.489E-02	7	9	3.820E-04	7	10	1.705E-02	7	11	2.399E-02			
7	12	8.803E-03	7	13	2.183E-02	7	14	1.994E-02	7	15	6.925E-03	7	16	7.100E-03			
7	17	9.588E-04	7	18	6.941E-03	7	19	3.421E-01	8	0	2.867E-03	8	1	8.360E-03			
8	2	1.925E-02	8	3	3.094E-02	8	4	4.274E-02	8	5	4.639E-02	8	6	3.593E-02			
8	7	1.472E-02	8	8	3.228E-04	8	9	2.106E-02	8	10	1.145E-02	8	11	1.462E-04			
8	12	1.049E-02	8	13	1.107E-03	8	14	9.045E-04	8	15	1.466E-02	8	16	1.706E-02			
8	17	1.621E-02	8	18	1.177E-02	8	19	7.529E-03	9	0	9.386E-03	9	1	2.003E-02			
9	2	3.486E-02	9	3	4.571E-02	9	4	4.740E-02	9	5	3.492E-02	9	6	1.414E-02			
9	7	4.308E-04	9	8	6.394E-03	9	9	1.362E-02	9	10	2.217E-04	9	11	9.246E-03			
9	12	1.145E-04	9	13	1.121E-02	9	14	5.186E-03	9	15	9.625E-03	9	16	7.202E-03			
9	17	3.854E-04	9	18	1.447E-02	9	19	1.089E-02	10	0	2.588E-02	10	1	3.808E-02			
10	2	5.164E-02	10	3	4.874E-02	10	4	3.393E-02	10	5	1.229E-02	10	6	2.351E-04			
10	7	6.373E-03	10	8	1.858E-02	10	9	1.047E-03	10	10	5.866E-03	10	11	1.372E-02			
10	12	5.994E-03	10	13	9.979E-03	10	14	1.182E-02	10	16	4.727E-04	10	17	7.276E-03			
10	18	7.282E-04	10	19	1.407E-02	11	0	1.113E-01	11	1	5.352E-02	11	2	3.960E-02			
11	3	7.436E-03	11	5	9.672E-03	11	6	1.900E-02	11	7	1.508E-02	11	8	1.939E-03			

ORIGINAL PAGE IS
OF POOR QUALITY

11 9 1.243E-02 11 10 5.944E-03 11 11 6.697E-04 11 12 2.967E-03 11 13 3.581E-03
11 14 8.869E-04 11 15 8.174E-03 11 16 6.102E-03 11 17 5.154E-04 11 18 8.523E-03
12 0 1.993E-01 12 1 1.168E-03 12 2 4.138E-04 12 3 2.162E-02 12 4 1.619E-02
12 5 1.654E-02 12 6 6.967E-04 12 7 2.334E-03 12 8 1.279E-02 12 10 6.565E-03
12 11 6.843E-03 12 12 6.989E-03 12 13 2.334E-03 12 14 4.345E-03 12 15 2.758E-03
CROSS-SECTIONS ASSUMED TO BE THE SAME AS FOR X-B OF CRANDALL ET AL
3.235 4.083 6.125 8.166 10.21 15.31 20.42 30.62
2.950E-16 2.930E-16 2.280E-16 1.900E-16 1.550E-16 1.100E-16 0.890E-16 0.680E-16
0.
N2 28.010 4 6 5 4
1.0 0. 2358.027 14.1351 -1.751E-02-1.144E-04 1.9980 1.772E-02
3.0 49754.8 1460.518 13.8313 5.999E-03 1.853E-03 1.45455 1.801E-02
6.0 59306.8 1733.391 14.1221 -5.688E-02-3.612E-03 1.6374 1.791E-02
2.0 68951.2 1694.208 13.9491 7.935E-03-2.911E-04 1.61698 1.793E-02
6.0 88977.9 2047.178 28.4450 2.08833 0.5350 1.82473 1.868E-02
N 4S 1.401E+01 7.872E+04 4.000E+00 1.500E+00 0.000E+00
N 4S 1.401E+01 7.872E+04 4.000E+00 1.500E+00 0.000E+00
CROSS-SECTIONS ASSUMED SAME AS FOR N2 1-3 OF CARTWRIGHT ET AL
9.7594 10.618 13.27 15.93 19.91 26.55 34.51 47.78
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
CROSS-SECTIONS ASSUMED SAME AS FOR N2 1-3 OF CARTWRIGHT ET AL
3.5909 3.907 4.884 5.860 7.325 9.767 12.70 17.58
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
CROSS-SECTIONS ASSUMED SAME AS FOR N2 1-3 OF CARTWRIGHT ET AL
2.4066 2.618 3.273 3.928 4.910 6.546 8.510 11.78
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
CROSS-SECTIONS ASSUMED SAME AS FOR N2 1-3 OF CARTWRIGHT ET AL
1.2110 1.318 1.647 1.976 2.470 3.294 4.282 5.929
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
N2 VK 1 2 72
0 0 5.900E-04 0 1 5.337E-03 0 2 2.296E-02 0 3 6.167E-02 0 4 1.176E-01
0 5 1.688E-01 0 6 1.894E-01 0 7 1.704E-02 0 8 1.250E-01 0 9 7.578E-02
0 10 3.828E-02 0 11 1.621E-02 0 12 5.780E-02 0 13 1.738E-03 0 14 4.411E-04
1 0 3.219E-03 1 1 2.278E-02 1 2 6.919E-02 1 3 1.193E-01 1 4 1.216E-01
1 5 6.383E-02 1 6 6.256E-03 1 7 1.395E-02 1 8 7.866E-02 1 9 1.370E-01
1 10 1.450E-01 1 11 1.100E-01 1 12 6.404E-02 1 13 2.963E-02 1 14 1.110E-02
2 0 9.975E-03 2 1 5.085E-02 2 2 1.035E-01 2 3 9.732E-02 2 4 2.922E-02
2 5 2.161E-03 2 6 5.473E-02 2 7 8.924E-02 2 8 4.616E-02 2 9 8.840E-04
2 10 2.955E-02 2 11 1.301E-01 2 12 1.378E-01 2 13 1.196E-01 2 14 7.472E-02
3 0 2.133E-02 3 1 7.850E-02 3 2 9.768E-02 3 3 3.326E-02 3 4 2.539E-03
3 5 5.617E-02 3 6 6.391E-02 3 7 8.564E-02 3 8 1.697E-02 3 9 7.218E-02
3 10 6.181E-02 3 11 7.600E-03 3 12 1.520E-02 3 13 8.383E-02 3 14 1.315E-01
4 0 3.642E-02 4 1 9.328E-02 4 2 5.998E-02 4 3 3.714E-04 4 4 4.107E-02
4 5 5.758E-02 4 6 4.625E-03 4 7 2.554E-02 4 8 6.331E-02 4 9 1.916E-02
4 10 7.127E-03 4 11 6.276E-02 4 12 6.314E-02 4 13 9.393E-03 4 14 1.379E-02
5 0 5.290E-02 5 1 8.962E-02 5 2 2.011E-02 5 3 1.465E-02 5 4 5.968E-02
5 5 1.223E-02 5 6 1.688E-02 5 7 5.462E-02 5 8 1.065E-02 5 9 1.643E-02
5 10 5.871E-02 5 11 2.016E-02 5 12 6.585E-03 5 13 6.143E-02 5 14 5.832E-02
6 0 6.799E-02 6 1 7.082E-02 6 2 8.381E-04 6 3 4.233E-02 6 4 3.400E-02
6 5 2.630E-03 6 6 4.768E-02 6 7 1.641E-02 6 8 1.163E-02 6 9 5.008E-02
6 10 9.734E-03 6 11 1.729E-02 6 12 5.579E-02 6 13 1.457E-02 6 14 1.131E-02
7 0 7.939E-02 7 1 4.539E-02 7 2 5.264E-03 7 3 5.154E-02 7 4 5.402E-03
7 5 2.905E-02 7 6 3.237E-02 7 7 1.710E-03 7 8 4.308E-02 7 9 1.308E-02
7 10 1.469E-02 7 11 4.635E-02 7 12 4.785E-02 7 13 2.447E-02 7 14 5.170E-02

8 0 8.588E-02 8 1 2.205E-02 8 2 2.231E-02 8 3 3.803E-02 8 4 1.933E-03
 8 5 4.203E-02 8 6 4.185E-03 8 7 2.701E-02 8 8 2.572E-02 8 9 4.073E-03
 8 10 4.148E-02 8 11 6.297E-03 8 12 2.185E-02 8 13 4.002E-02 8 14 3.600E-04
 9 0 8.730E-02 9 1 6.435E-03 9 2 3.838E-02 9 3 1.651E-02 9 4 1.815E-02
 9 5 2.890E-02 9 6 3.763E-03 9 7 3.696E-02 9 8 8.855E-04 9 9 3.109E-02
 9 10 1.592E-02 9 11 1.083E-02 9 12 3.765E-02 9 13 6.326E-04 9 14 3.284E-02
 10 0 8.434E-02 10 1 2.053E-04 10 2 4.527E-02 10 3 2.254E-03 10 4 3.349E-02
 10 5 8.054E-03 10 6 2.242E-02 10 7 1.837E-02 10 8 9.744E-03 10 9 3.026E-02
 10 10 5.291E-04 10 11 3.475E-02 10 12 5.380E-03 10 13 2.218E-02 10 14 2.757E-02
 11 0 7.812E-02 11 1 2.015E-03 11 2 4.180E-02 11 3 9.890E-04 11 4 3.530E-02
 11 5 1.684E-05 11 6 3.257E-02 11 7 1.243E-03 11 8 2.835E-02 11 9 7.166E-02
 11 10 1.963E-02 11 11 1.892E-02 11 12 7.224E-03 11 13 3.197E-02 11 14 5.829E-06
 12 0 6.988E-02 12 1 9.015E-03 12 2 3.141E-02 12 3 9.423E-03 12 4 2.493E-02
 12 5 7.426E-03 12 6 2.478E-02 12 7 4.205E-03 12 8 2.719E-02 12 9 9.855E-04
 12 10 2.962E-02 12 11 2.597E-04 12 12 2.853E-02 12 13 5.872E-03 12 14 2.016E-02
 13 0 6.071E-02 13 1 1.817E-02 13 2 1.899E-02 13 3 2.061E-02 13 4 1.116E-02
 13 5 2.003E-02 13 6 9.630E-03 13 7 1.809E-02 13 8 1.114E-02 13 9 1.477E-02
 13 10 1.519E-02 13 11 9.782E-03 13 12 2.152E-02 13 13 3.791E-03 13 14 2.831E-04
 14 0 5.149E-02 14 1 2.707E-02 14 2 8.494E-03 14 3 2.870E-02 14 4 1.925E-03
 14 5 2.732E-02 14 6 5.698E-04 14 7 2.605E-02 14 8 4.334E-04 14 9 2.527E-02
 14 10 9.608E-04 14 11 2.437E-02 14 12 2.827E-03 14 13 2.209E-02 14 14 7.438E-03
 15 0 4.280E-02 15 1 3.418E-02 15 2 2.038E-03 15 3 3.106E-02 15 4 2.871E-04
 15 5 2.560E-02 15 6 2.212E-03 15 7 2.191E-02 15 8 3.623E-03 15 9 2.041E-02
 15 10 3.825E-03 15 11 2.086E-02 15 12 2.852E-03 15 13 2.288E-02 15 14 1.148E-03
 2 15 3.567E-02 2 16 1.342E-02 2 17 4.046E-03 3 15 1.197E-01 3 16 7.543E-02
 3 17 3.543E-02 3 18 1.287E-02 3 19 3.690E-03 4 15 8.294E-02 4 16 1.299E-01
 4 17 1.152E-01 4 18 6.961E-02 4 19 3.095E-02 5 15 5.905E-03 5 16 1.982E-02
 5 17 9.210E-02 5 18 1.304E-01 5 19 1.066E-01 6 15 6.531E-02 6 16 4.826E-02
 6 17 1.141E-03 6 18 3.366E-02 6 19 1.068E-01 6 20 1.289E-01 5 20 5.938E-02
 6 21 9.341E-02 6 22 4.662E-02 6 23 1.704E-02 6 24 4.706E-03 7 20 5.591E-02
 7 15 6.143E-03 7 16 2.227E-02 7 17 6.887E-02 7 18 3.475E-02 7 21 1.216E-01
 7 22 1.217E-01 7 23 7.625E-02 7 24 3.334E-02 7 25 1.070E-02 8 15 3.610E-03
 8 16 4.227E-02 8 18 3.936E-02 8 19 6.567E-02 8 20 1.463E-02 8 21 1.114E-02
 8 22 8.420E-02 8 23 1.305E-01 8 24 1.069E-01 8 25 5.701E-02 8 26 2.147E-02
 9 15 2.810E-02 9 16 2.261E-03 9 17 4.748E-02 9 18 2.603E-02 9 19 3.787E-03
 9 20 5.775E-02 9 21 5.110E-02 9 22 1.516E-03 9 23 3.563E-02 9 24 1.120E-01
 9 25 1.284E-01 9 26 8.575E-02 9 27 3.813E-02 10 15 1.944E-03 10 16 4.137E-02
 10 17 1.221E-02 10 18 1.464E-02 10 19 5.044E-02 10 21 2.086E-02 10 22 6.749E-02
 10 23 2.717E-02 10 25 7.141E-02 10 26 1.302E-01 10 27 1.136E-01 11 15 3.333E-02
 11 16 1.235E-02 11 17 1.382E-02 11 18 3.941E-02 11 20 3.440E-02 11 21 3.862E-02
 11 23 4.661E-02 11 24 5.915E-02 11 26 2.730E-02 11 27 1.032E-01 12 15 1.998E-02
 12 16 6.000E-03 12 17 3.526E-02 12 19 3.137E-02 12 20 2.398E-02 12 22 4.881E-02
 12 23 1.619E-02 12 24 1.223E-02 12 25 6.568E-02 12 26 3.347E-02 13 16 3.060E-02
 13 18 2.180E-02 13 19 2.293E-02 13 21 4.054E-02 13 23 2.521E-02 13 24 4.374E-02
 13 26 4.106E-02 13 27 6.174E-02 14 15 1.686E-02 14 16 1.609E-02 14 18 2.250E-02
 14 20 3.395E-02 14 22 2.305E-02 14 23 3.004E-02 14 25 4.613E-02 14 26 2.015E-02
 15 15 2.563E-02 15 17 2.719E-02 15 19 2.415E-02 15 20 1.140E-02 15 21 1.370E-02
 15 22 2.799E-02 15 24 3.891E-02 15 26 2.121E-02 15 27 4.501E-02 16 21 2.925E-02

CROSS-SECTIONS FROM CARTWRIGHT

6.1693 7. 9. 11. 14. 17. 20. 26.
 0. 0.030E-16 0.094E-16 0.148E-16 0.204E-16 0.225E-16 0.183E-16 0.113E-16
 0.
 N2 BX 1 3 28
 0 0 6.117E-02 0 1 1.909E-01 0 2 2.753E-01 0 3 2.416E-01 0 4 1.442E-01
 0 5 6.185E-02 0 6 1.953E-02 0 7 4.555E-03 0 8 7.694E-04 1 0 1.487E-01

ORIGINAL PAGE IS
OF POOR QUALITY

1	1	1.921E-01	1	2	4.450E-02	1	3	1.658E-02	1	4	1.444E-01	1	5	2.072E-01
1	6	1.509E-01	1	7	6.917E-02	1	8	2.138E-02	1	9	4.492E-03	1	10	6.123E-04
2	0	1.999E-01	2	1	6.307E-02	2	2	2.445E-02	2	3	1.293E-01	2	4	4.565E-02
2	5	1.167E-02	2	6	1.314E-01	2	7	1.908E-01	2	8	1.322E-01	2	9	5.475E-02
2	10	1.434E-02	2	11	1.996E-04	2	0	1.969E-01	3	1	1.978E-04	3	2	1.039E-01
3	3	3.337E-02	3	4	3.276E-02	3	5	1.086E-01	3	6	2.046E-02	3	7	3.142E-02
3	8	1.547E-01	3	9	1.769E-01	3	10	1.006E-01	3	11	6.368E-03	3	12	6.241E-04
4	0	1.585E-01	4	1	3.398E-02	4	2	7.628E-02	4	3	9.215E-03	4	4	8.940E-02
4	5	4.742E-03	4	6	6.269E-02	4	7	8.009E-02	4	8	5.373E-04	4	9	7.885E-02
4	10	1.807E-01	4	11	6.192E-02	4	12	1.426E-02	4	13	1.602E-03	5	0	1.099E-01
5	1	9.570E-02	5	2	1.173E-02	5	3	6.681E-02	5	4	1.986E-02	5	5	4.484E-02
5	6	5.414E-02	5	7	5.903E-03	5	8	8.773E-02	5	9	3.286E-02	5	10	1.764E-02
5	11	1.796E-01	5	12	9.843E-02	5	13	2.745E-02	5	14	3.571E-03	6	0	6.681E-02
6	1	1.298E-01	6	2	7.534E-03	6	3	6.134E-02	6	4	8.044E-03	6	5	6.331E-02
6	6	1.317E-03	6	7	6.981E-02	6	8	9.108E-03	6	9	4.561E-02	6	10	7.154E-02
6	11	8.608E-02	6	12	1.876E-01	6	13	1.375E-01	6	14	4.692E-02	6	15	2.910E-04
7	0	3.542E-02	7	1	1.236E-01	7	2	6.025E-02	7	3	1.155E-02	7	4	5.031E-02
7	5	8.094E-03	7	6	5.130E-02	7	7	1.502E-02	7	8	3.624E-02	7	9	4.307E-02
7	10	7.110E-03	7	11	1.956E-02	7	12	3.391E-02	7	13	1.690E-01	7	14	1.718E-01
7	15	1.304E-02	7	16	6.258E-04	8	0	1.578E-02	8	1	9.080E-02	8	2	1.133E-01
8	3	7.048E-03	8	4	4.075E-02	8	5	1.139E-02	8	6	4.011E-02	8	7	1.422E-02
8	8	4.374E-02	8	9	4.418E-03	8	10	5.827E-02	8	11	5.267E-02	8	12	4.908E-02
8	13	4.720E-03	8	14	1.308E-01	8	15	1.030E-01	8	16	2.201E-02	8	17	1.265E-03
9	0	5.388E-03	9	1	5.162E-02	9	2	1.249E-01	9	3	6.428E-02	9	4	2.636E-03
9	5	3.857E-02	9	6	8.992E-04	9	7	5.011E-02	9	8	4.652E-02	9	9	3.142E-03
9	11	2.077E-02	9	12	2.099E-02	9	13	6.614E-02	9	14	1.418E-03	9	15	2.013E-01

CROSS-SECTIONS FROM CARTWRIGHT

7.3529	8.	10.	12.	15.	20.	26	36.
0.	0.054E-16	0.225E-16	0.299E-16	0.241E-16	0.156E-16	0.120E-16	0.076E-16
0.							

N2 LBH	1	4	38											
0	0	4.315E-02	1	0	1.162E-01	2	0	1.713E-01	3	0	1.835E-01	4	0	1.603E-01
5	0	1.214E-01	6	0	8.287E-02	7	0	5.230E-02	8	0	3.109E-02	9	0	1.764E-02
10	0	9.661E-03	11	0	5.146E-03	12	0	2.684E-03	13	0	1.378E-03	0	1	1.517E-01
1	1	1.932E-01	2	1	9.677E-02	3	1	1.212E-02	4	1	6.391E-03	5	1	4.706E-02
6	1	8.542E-02	7	1	9.971E-02	8	1	9.216E-02	9	1	7.346E-02	10	1	5.285E-02
11	1	3.530E-02	12	1	2.230E-02	13	1	1.350E-02	14	1	7.917E-03	0	2	2.477E-01
1	2	8.049E-02	2	2	3.276E-03	3	2	7.554E-02	4	2	9.661E-02	5	2	4.668E-02
6	2	4.538E-03	7	2	5.796E-03	8	2	3.372E-02	9	2	6.105E-02	10	2	7.378E-02
11	2	7.163E-02	12	2	6.044E-02	13	2	4.625E-02	14	2	3.296E-02	0	3	2.492E-01
2	3	1.074E-01	3	3	6.931E-02	4	3	5.812E-04	5	3	3.392E-02	6	3	7.289E-02
7	3	5.658E-02	8	3	1.826E-02	9	3	1.314E-04	10	3	9.747E-03	11	3	3.200E-02
12	3	5.101E-02	13	3	5.954E-02	14	3	5.797E-02	0	4	1.731E-01	1	4	8.732E-02
2	4	8.598E-02	3	4	3.606E-03	4	4	7.744E-02	5	4	5.670E-02	6	4	2.795E-03
7	4	1.717E-02	8	4	5.340E-02	9	4	5.485E-02	10	4	2.795E-02	11	4	4.549E-03
12	4	1.158E-03	13	4	1.398E-02	14	4	3.142E-02	0	5	8.808E-02	1	5	1.851E-01
3	5	9.511E-02	4	5	3.735E-02	5	5	8.364E-03	6	5	6.347E-02	7	5	4.694E-02
8	5	4.209E-03	9	5	9.234E-03	10	5	3.918E-02	11	5	4.918E-02	12	5	3.299E-02
13	5	1.091E-02	14	5	2.538E-04	0	6	3.399E-02	1	6	1.752E-01	2	6	6.451E-02
3	6	6.580E-02	4	6	1.689E-02	5	6	7.882E-02	6	6	1.485E-02	7	6	1.278E-02
11	6	4.904E-03	12	6	2.860E-02	13	6	4.237E-02	14	6	3.472E-02	0	7	1.017E-02
1	7	1.032E-01	2	7	1.640E-01	4	7	9.667E-02	5	7	7.912E-03	6	7	4.042E-02
7	7	5.731E-02	8	7	4.748E-03	9	7	1.587E-02	10	7	4.743E-02	11	7	3.446E-02
12	7	5.829E-03	13	7	2.321E-03	14	7	2.040E-02	0	8	2.392E-03	1	8	4.250E-02

ORIGINAL PAGE IS
OF POOR QUALITY

2 8 1.614E-01 3 8 7.840E-02 4 8 3.615E-02 5 8 4.675E-02 6 8 5.502E-02
7 8 1.040E-03 8 8 5.031E-02 9 8 3.869E-02 11 8 1.742E-02 12 8 4.169E-02
13 8 3.071E-02 14 8 6.695E-03 0 9 4.454E-04 1 9 1.289E-02 2 9 9.406E-02
3 9 1.632E-01 4 9 9.168E-03 5 9 8.536E-02 6 9 2.010E-03 7 9 6.755E-02
8 9 1.751E-02 9 9 1.174E-02 10 9 4.934E-02 11 9 2.518E-02 13 9 1.758E-02
14 9 3.680E-02 1 10 2.968E-03 2 10 3.718E-02 3 10 1.431E-01 4 10 1.085E-01
5 10 7.958E-03 6 10 7.874E-02 7 10 1.538E-02 8 10 3.144E-02 9 10 5.074E-02
10 10 1.843E-03 11 10 2.257E-02 12 10 4.332E-02 13 10 1.638E-02 1 11 5.266E-04
2 11 1.060E-02 3 11 7.518E-02 4 11 1.626E-01 5 11 3.911E-02 6 11 5.144E-02
7 11 3.210E-02 8 11 5.359E-02 9 11 1.246E-03 10 11 4.905E-02 11 11 2.698E-02
13 11 2.865E-02 14 11 3.626E-02 2 12 2.253E-03 3 12 2.675E-02 4 12 1.179E-01
5 12 1.402E-01 6 12 1.628E-03 7 12 8.354E-02 8 12 1.043E-03 9 12 6.308E-02
10 12 1.151E-02 11 12 1.839E-02 12 12 4.567E-02 13 12 1.068E-02 14 12 4.524E-03
3 13 6.824E-03 4 13 5.304E-02 5 13 1.499E-01 6 13 8.717E-02 7 13 1.195E-02
8 13 7.317E-02 9 13 1.239E-02 10 13 3.555E-02 11 13 4.096E-02 13 13 3.303E-02

CROSS-SECTIONS FROM CARTWRIGHT

8.5489 9. 11. 13. 15. 18. 22. 30.
0. 0.019E-16 0.099E-16 0.180E-16 0.256E-16 0.297E-16 0.258E-16 0.204E-16
5880.

N2 1+ 2 3 36
0 0 3.382E-01 1 0 4.065E-01 2 0 1.975E-01 3 0 5.014E-02 4 0 7.191E-03
5 0 5.871E-04 6 0 2.616E-05 0 1 3.248E-01 1 1 2.310E-03 2 1 2.120E-01
3 1 2.987E-01 4 1 1.318E-01 5 1 2.729E-02 6 1 2.925E-03 7 1 1.613E-04
0 2 1.909E-01 1 2 1.032E-01 2 2 1.132E-01 3 2 3.868E-02 4 2 2.738E-01
5 2 2.107E-01 6 2 6.148E-02 7 2 8.462E-03 8 2 5.675E-04 9 2 1.719E-05
0 3 8.857E-02 1 3 1.782E-01 2 3 1.205E-03 3 3 1.623E-01 4 3 1.807E-03
5 3 1.808E-01 6 3 2.605E-01 7 3 1.065E-01 8 3 1.857E-02 9 3 1.495E-03
10 3 5.241E-05 0 4 3.649E-02 1 4 1.450E-01 2 4 7.724E-02 3 4 3.227E-02
4 4 1.139E-01 5 4 4.780E-02 6 4 8.305E-02 7 4 2.706E-01 8 4 1.561E-01
9 4 3.420E-02 10 4 3.274E-03 11 4 1.318E-04 0 5 1.399E-02 1 5 8.647E-02
2 5 1.275E-01 3 5 9.050E-03 4 5 8.823E-02 5 5 4.262E-02 6 5 1.040E-01
7 5 1.916E-02 8 5 2.438E-01 9 5 2.029E-01 10 5 5.569E-02 11 5 6.299E-03
12 5 2.890E-04 0 6 5.147E-03 1 6 4.367E-02 2 6 1.127E-01 3 6 6.910E-02
4 6 5.227E-03 5 6 1.057E-01 6 6 3.171E-03 7 6 1.291E-01 8 6 2.766E-05
9 6 1.919E-01 10 6 2.402E-01 11 6 8.265E-02 12 6 1.099E-02 13 6 5.717E-04
0 7 1.851E-03 1 7 2.000E-02 2 7 7.496E-02 3 7 1.009E-01 4 7 1.798E-02
5 7 3.829E-02 6 7 8.078E-02 7 7 6.748E-03 8 7 1.159E-01 9 7 1.694E-02
10 7 1.299E-01 11 7 2.630E-01 12 7 1.140E-01 13 7 1.777E-02 14 7 1.044E-03
4 8 6.361E-02 6 8 6.967E-02 7 8 3.946E-02 8 8 3.633E-02 9 8 7.862E-02
10 8 5.219E-02 11 8 7.206E-02 12 8 2.688E-01 13 8 1.480E-01 14 8 2.702E-02
15 8 1.785E-03 16 8 3.480E-05 0 9 2.348E-04 1 9 3.509E-03 2 9 2.182E-02
3 9 6.406E-02 4 9 8.349E-02 5 9 2.454E-02 6 9 1.209E-02 7 9 7.733E-02
8 9 8.360E-03 9 9 6.773E-02 10 9 3.765E-02 11 9 8.779E-02 12 9 2.857E-02
13 9 2.575E-01 14 9 1.826E-01 15 9 3.902E-02 16 9 2.893E-03 17 9 6.131E-05
0 10 8.403E-05 1 10 1.463E-03 2 10 1.053E-02 3 10 3.917E-02 4 10 7.511E-02
5 10 5.820E-02 6 10 2.460E-03 7 10 3.933E-02 8 10 6.077E-02 9 10 3.194E-04
10 10 8.370E-02 11 10 9.012E-03 12 10 1.109E-01 13 10 4.687E-03 14 10 2.315E-01
15 10 2.154E-01 16 10 5.395E-02 17 10 4.480E-03 18 10 1.089E-04 0 11 3.038E-05
1 11 5.907E-04 2 11 4.885E-03 3 11 2.187E-02 4 11 5.510E-02 5 11 7.056E-02
6 11 2.810E-02 7 11 2.738E-03 8 11 5.721E-02 9 11 3.305E-02 10 11 1.307E-02
11 11 7.997E-02 12 11 2.617E-05 13 11 1.156E-01 14 11 7.733E-04 15 11 1.945E-01
16 11 2.443E-01 17 11 7.185E-02 18 11 6.675E-03 19 11 1.658E-04 0 12 1.114E-05
1 12 2.380E-04 2 12 2.212E-03 3 12 1.151E-02 4 12 3.567E-02 5 12 6.338E-02
6 12 5.261E-02 7 12 6.400E-03 8 12 1.852E-02 9 12 5.945E-02 10 12 9.576E-02
11 12 3.527E-02 12 12 5.846E-02 13 12 9.342E-03 14 12 1.029E-01 15 12 1.330E-02

ORIGINAL PAGE IS
OF POOR QUALITY

16 12 1.516E-01 17 12 2.672E-01 18 12 9.261E-02 19 12 9.615E-03 1 13 9.627E-05

CROSS-SECTIONS ASSUMED SAME AS B-X OF CARTWRIGHT

1.1942 1.288 1.611 1.933 2.416 3.221 4.187 5.798
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
9.000E+04

N2 A1A 2 4 24

0	0	7.827E-01	0	1	1.791E-01	0	2	3.059E-02	0	3	5.717E-03	0	4	5.717E-03
0	5	1.303E-03	0	6	3.656E-04	0	7	1.238E-04	1	0	7.827E-01	1	1	1.791E-01
1	2	3.059E-02	1	3	5.717E-03	1	4	5.717E-03	1	5	1.303E-03	1	6	3.656E-04
1	7	1.238E-04	2	0	2.095E-01	2	1	5.035E-01	2	2	2.184E-01	2	3	5.205E-02
2	4	5.205E-02	2	5	1.196E-02	2	6	3.080E-03	2	7	9.274E-04	2	8	3.263E-04
2	9	3.263E-04	2	10	1.320E-04	3	0	7.735E-03	3	1	3.024E-01	3	2	3.595E-01
3	3	2.312E-01	3	4	2.312E-01	3	5	7.099E-02	3	6	1.943E-02	3	7	5.626E-03
3	8	1.826E-03	3	9	1.826E-03	3	10	6.737E-04	3	11	2.808E-04	3	12	1.305E-04
4	0	7.735E-03	4	1	3.024E-01	4	2	3.595E-01	4	3	2.312E-01	4	4	2.312E-01
4	5	7.099E-02	4	6	1.943E-02	4	7	5.626E-03	4	8	1.826E-03	4	9	1.826E-03
4	10	6.737E-04	4	11	2.808E-04	4	12	1.305E-04	5	0	1.179E-04	5	1	1.479E-02
5	2	3.693E-01	5	3	2.594E-01	5	4	2.594E-01	5	5	2.275E-01	5	6	8.641E-02
5	7	2.778E-02	5	8	9.051E-03	5	9	9.051E-03	5	10	3.194E-03	5	11	1.248E-03
5	12	5.408E-04	5	13	2.581E-04	6	1	1.910E-04	6	2	2.198E-02	6	3	4.228E-01
6	4	4.228E-01	6	5	1.870E-01	6	6	2.121E-01	6	7	9.699E-02	6	8	3.623E-02
6	9	3.623E-02	6	10	1.328E-02	6	11	5.125E-03	6	12	2.139E-03	6	13	9.724E-04
6	14	2.558E-04	7	1	1.910E-04	7	2	2.198E-02	7	3	4.228E-01	7	4	4.228E-01
7	5	1.870E-01	7	6	2.121E-01	7	7	9.699E-02	7	8	3.623E-02	7	9	3.623E-02
7	10	1.328E-02	7	11	5.125E-03	7	12	2.139E-03	7	13	9.724E-04	7	14	2.558E-04
8	2	1.834E-04	8	3	2.866E-02	8	4	2.866E-02	8	5	4.674E-01	8	6	1.355E-01
8	7	1.896E-01	8	8	1.020E-01	8	9	1.020E-01	8	10	4.390E-02	8	11	1.903E-02
8	12	7.629E-03	8	13	3.421E-03	8	14	8.450E-04	9	3	1.027E-04	9	4	1.027E-04
9	5	3.385E-02	9	6	5.061E-01	9	7	9.970E-02	9	8	1.642E-01	9	9	1.642E-01
9	10	1.016E-01	9	11	4.959E-02	9	12	2.280E-02	9	13	1.058E-02	9	14	2.605E-03

CROSS-SECTIONS ASSUMED SAME AS B-X OF CARTWRIGHT

2.3799 2.589 3.237 3.884 4.885 6.473 8.415 11.65
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
0.0

N2 A1B 3 4 11

0	0	2.005E-03	0	1	9.979E-01	0	2	2.005E-03	1	0	2.005E-03	1	1	9.979E-01
1	2	2.005E-03	2	0	9.942E-01	2	1	1.966E-03	2	2	9.942E-01	2	3	3.781E-03
2	4	3.781E-03	3	0	3.652E-03	3	2	3.652E-03	3	3	9.907E-01	3	4	9.907E-01
3	5	5.449E-03	3	6	1.042E-04	3	7	1.042E-04	4	0	3.652E-03	4	2	3.652E-03
4	3	9.907E-01	4	4	9.907E-01	4	5	5.449E-03	4	6	1.042E-04	4	7	1.042E-04
5	0	1.335E-04	5	2	1.335E-04	5	3	5.189E-03	5	4	5.189E-03	5	5	9.875E-01
5	6	6.927E-03	5	7	6.927E-03	5	8	1.787E-04	6	3	2.431E-04	6	4	2.431E-04
6	5	6.497E-03	6	6	9.848E-01	6	7	9.848E-01	6	8	8.129E-03	6	9	2.877E-04
7	3	2.431E-04	7	4	2.431E-04	7	5	6.497E-03	7	6	9.848E-01	7	7	9.848E-01
7	8	8.129E-03	7	9	2.877E-04	8	5	3.900E-04	8	6	7.497E-03	8	7	7.497E-03
8	8	9.826E-01	8	9	9.985E-03	9	6	5.732E-04	9	7	5.732E-04	9	8	8.135E-03

CROSS-SECTION ASSUMED SAME AS B-X OF CARTWRIGHT

1.1956 1.301 1.626 1.951 2.439 3.252 4.228 5.854
0. 0.054E-16 0.225E-16 0.299E-16 0.241E-16 0.156E-16 0.120E-16 0.076E-16
0.

ND	30.010	3	3	6	3	0								
	4.000	69.550	1903.855	13.970	-0.001	0.000	1.70460	1.780E-02						
	2.000	43965.699	2371.300	14.480	-0.280	0.000	1.99520	1.640E-02						
	4.000	45932.398	1037.680	7.603	0.097	0.000	1.12790	1.525E-02						

	2.000	52148.000	2347.000	0.000	0.000	0.000	1.95500	0.000E+00	
	2.000	53083.000	2327.000	23.000	0.000	0.000	1.99170	0.000E+00	
	2.000	60628.500	2373.600	15.850	0.000	0.000	1.98630	1.820E-02	
N 4S	1.401E+01	5.249E+04	4.000E+00	1.500E+00	0.000E+00				
0 3P	1.600E+01	5.249E+04	9.000E+00	1.000E+00	1.000E+00				
CROSS-SECTIONS ASSUMED AS SAME FOR NO 1-2 OF IMAMI ET AL									
6.508	6.775	7.875	10.15	13.54	18.09	22.58	28.24		
0.000E 00	3.370E-18	1.540E-17	2.450E-17	2.980E-17	3.030E-17	2.870E-17	2.700E-17		
CROSS-SECTIONS ASSUMED AS SAME FOR NO 1-2 OF IMAMI ET AL									
1.058	1.1013	1.280	1.650	2.201	2.941	3.671	4.592		
0.000E 00	3.370E-18	1.540E-17	2.450E-17	2.980E-17	3.030E-17	2.870E-17	2.700E-17		
CROSS-SECTIONS ASSUMED AS SAME FOR NO 1-2 OF IMAMI ET AL									
0.8132	0.8465	0.9840	1.269	1.691	2.261	2.822	3.529		
0.000E 00	3.370E-18	1.540E-17	2.450E-17	2.980E-17	3.030E-17	2.870E-17	2.700E-17		
NO 8	1	3	46						
3 0	1.000E-03	4 0	3.000E-03	5 0	5.000E-03	6 0	1.100E-02	7 0	1.700E-02
8 0	2.200E-02	9 0	2.900E-02	10 0	3.200E-02	11 0	4.100E-02	12 0	5.100E-02
1 1	1.000E-03	2 1	4.000E-03	3 1	9.000E-03	4 1	1.700E-02	5 1	3.200E-02
6 1	4.400E-02	7 1	5.900E-02	8 1	5.800E-02	9 1	6.000E-02	10 1	5.700E-02
11 1	4.800E-02	12 1	3.400E-02	0 2	1.000E-03	1 2	6.000E-03	2 2	1.800E-02
3 2	3.800E-02	4 2	5.400E-02	5 2	6.900E-02	6 2	7.000E-02	7 2	5.300E-02
8 2	3.600E-02	9 2	1.900E-02	10 2	8.000E-03	11 2	1.000E-03	12 2	3.000E-03
0 3	5.000E-03	1 3	2.400E-02	2 3	4.800E-02	3 3	7.600E-02	4 3	7.600E-02
5 3	5.700E-02	6 3	3.200E-02	7 3	7.000E-03	8 3	1.400E-02	9 3	2.000E-02
11 3	3.100E-02	12 3	3.800E-02	0 4	1.700E-02	1 4	5.100E-02	2 4	8.500E-02
3 4	8.400E-02	4 4	4.300E-02	5 4	6.000E-03	6 4	1.000E-03	7 4	2.400E-02
8 4	3.400E-02	9 4	4.200E-02	10 4	3.400E-02	11 4	2.000E-02	12 4	1.000E-03
0 5	4.100E-02	1 5	9.700E-02	2 5	9.200E-02	3 5	3.800E-02	4 5	1.000E-03
5 5	1.200E-02	6 5	3.800E-02	7 5	4.600E-02	8 5	2.700E-02	9 5	6.000E-03
11 5	5.000E-03	12 5	2.600E-02	0 6	8.200E-02	1 6	1.179E-01	2 6	4.700E-02
4 6	3.000E-02	5 6	5.300E-02	6 6	3.500E-02	7 6	5.000E-03	8 6	2.000E-03
9 6	1.800E-02	10 6	3.200E-02	11 6	3.100E-02	12 6	1.100E-02	0 7	1.250E-01
1 7	8.800E-02	2 7	2.000E-03	3 7	3.300E-02	4 7	6.000E-02	5 7	2.400E-02
7 7	2.300E-02	8 7	3.800E-02	9 7	3.100E-02	10 7	1.000E-02	12 7	1.300E-02
1 8	2.900E-02	2 8	2.100E-02	3 8	6.800E-02	4 8	2.100E-02	5 8	4.000E-03
6 8	3.100E-02	7 8	3.600E-02	8 8	1.400E-02	10 8	1.400E-02	11 8	2.800E-02
12 8	2.000E-02	0 9	1.670E-01	2 9	7.300E-02	3 9	4.200E-02	4 9	3.000E-03
5 9	4.600E-02	6 9	3.400E-02	7 9	1.000E-03	8 9	1.300E-02	9 9	3.000E-02
10 9	2.700E-02	11 9	9.000E-03	12 9	3.000E-03	0 10	1.520E-01	1 10	2.100E-02
2 10	8.200E-02	3 10	1.000E-03	4 10	3.900E-02	5 10	3.700E-02	6 10	1.000E-03
7 10	2.200E-02	8 10	3.500E-02	9 10	1.800E-02	11 10	8.000E-03	12 10	2.600E-02
0 11	1.140E-01	1 11	7.400E-02	2 11	4.100E-02	3 11	2.400E-02	4 11	5.400E-02
5 11	1.800E-02	6 11	2.500E-02	7 11	4.000E-02	8 11	2.000E-03	9 11	8.000E-03
10 11	2.400E-02	11 11	2.600E-02	12 11	1.000E-03	0 12	7.600E-02	1 12	1.260E-01
3 12	7.200E-02	4 12	1.200E-02	5 12	2.500E-02	6 12	4.300E-02	7 12	2.000E-03
8 12	1.700E-02	9 12	3.400E-02	10 12	1.400E-02	12 12	1.200E-02	0 13	3.300E-02
1 13	1.390E-01	2 13	1.800E-02	3 13	5.400E-02	4 13	1.700E-02	5 13	5.200E-02
6 13	2.000E-03	7 13	2.800E-02	8 13	2.700E-02	9 13	2.000E-03	10 13	1.400E-02
11 13	3.200E-02	12 13	7.000E-03	0 14	1.600E-02	1 14	1.050E-01	2 14	8.200E-02
3 14	9.000E-03	4 14	6.600E-02	5 14	1.400E-02	6 14	1.800E-02	7 14	3.400E-02
9 14	2.100E-02	10 14	2.700E-02	11 14	8.000E-03	12 14	8.000E-03	0 15	7.000E-03
1 15	6.800E-02	2 15	1.260E-01	3 15	1.300E-02	4 15	5.600E-02	5 15	1.000E-02
0 16	2.000E-03	1 16	2.800E-02	2 16	1.240E-01	3 16	8.600E-02	4 16	5.000E-03
5 16	6.300E-02	6 16	6.000E-03	7 16	3.100E-02	8 16	2.200E-02	10 16	2.700E-02
11 16	2.200E-02	12 16	1.000E-03	1 17	1.200E-02	2 17	7.700E-02	3 17	1.340E-01

ORIGINAL PAGE IS
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4 17 2.900E-02 5 17 5.000E-02 6 17 1.800E-02 7 17 4.200E-02 9 17 3.200E-02
10 17 1.600E-02 11 17 2.000E-03 12 17 3.100E-02 1 18 4.000E-03 2 18 5.000E-02
3 18 1.150E-01 4 18 7.700E-02 5 18 3.000E-03 6 18 6.200E-02 7 18 1.000E-03
8 18 3.500E-02 9 18 2.200E-02 10 18 3.000E-03 11 18 2.900E-02 12 18 5.000E-03
1 19 1.000E-03 2 19 1.000E-02 3 19 6.900E-02 4 19 1.290E-01 5 19 3.000E-02
6 19 4.000E-02 7 19 3.800E-02 8 19 3.200E-02 9 19 8.000E-03 10 19 4.100E-02

CROSS-SECTIONS ASSUMED TO BE SAME AS FOR NO 1-2 OF IMAMI ET AL

5.687 6. 7. 9. 12. 16. 20. 25.
0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17
1.500E+06

NO 6 1 2 38
0 0 2.270E-01 1 0 3.670E-01 2 0 2.750E-01 3 0 9.900E-02 4 0 2.600E-02
5 0 5.000E-03 6 0 2.000E-03 0 1 3.050E-01 1 1 5.600E-02 2 1 8.700E-02
3 1 2.740E-01 4 1 1.930E-01 5 1 7.700E-02 6 1 1.000E-02 7 1 1.000E-03
0 2 2.180E-01 1 2 2.400E-02 2 2 1.690E-01 3 2 1.000E-03 4 2 1.740E-01
5 2 2.700E-01 6 2 1.050E-01 7 2 3.000E-02 8 2 3.000E-03 0 3 1.330E-01
1 3 1.330E-01 2 3 1.500E-02 3 3 1.120E-01 4 3 5.300E-02 5 3 4.800E-02
6 3 2.340E-01 7 3 1.920E-01 8 3 6.000E-02 9 3 1.600E-02 10 3 3.000E-03
0 4 6.500E-02 1 4 1.600E-01 2 4 2.000E-02 3 4 9.400E-02 4 4 2.000E-02
5 4 1.270E-01 6 4 6.000E-03 7 4 1.490E-01 8 4 2.210E-01 9 4 1.100E-01
10 4 2.400E-02 11 4 4.000E-03 12 4 1.000E-03 0 5 2.800E-02 1 5 1.260E-01
2 5 9.200E-02 4 5 1.090E-01 6 5 1.270E-01 7 5 1.800E-02 8 5 5.200E-02
9 5 2.300E-01 10 5 1.390E-01 11 5 6.100E-02 12 5 1.300E-02 0 6 1.000E-02
1 6 7.000E-02 2 6 1.250E-01 3 6 2.600E-02 4 6 5.600E-02 5 6 6.200E-02
6 6 2.200E-02 7 6 4.900E-02 8 6 9.300E-02 9 6 6.000E-03 10 6 1.790E-01
11 6 1.860E-01 12 6 9.300E-02 0 7 3.000E-03 1 7 3.400E-02 2 7 1.060E-01
3 7 6.500E-02 5 7 8.200E-02 6 7 2.600E-02 7 7 7.700E-03 8 7 2.500E-02
9 7 1.060E-01 10 7 2.000E-03 11 7 1.230E-01 12 7 2.040E-01 0 8 2.000E-03
1 8 1.300E-02 2 8 6.100E-02 3 8 1.010E-01 4 8 3.100E-02 5 8 2.100E-02
6 8 9.200E-02 7 8 5.000E-03 8 8 9.200E-02 9 8 3.000E-03 10 8 9.900E-02
2 9 2.800E-02 3 9 8.300E-02 4 9 8.300E-02 6 9 3.600E-02 7 9 5.500E-02
8 9 1.800E-02 9 9 7.500E-02 10 9 1.600E-02 11 9 8.000E-02 12 9 6.900E-02
1 10 3.000E-03 2 10 1.400E-02 3 10 6.000E-02 4 10 9.900E-02 5 10 2.500E-02
7 10 6.800E-02 8 10 1.100E-02 9 10 3.400E-02 10 10 5.300E-02 11 10 2.500E-02
12 10 4.500E-02 1 11 1.000E-03 2 11 7.000E-03 3 11 3.300E-02 4 11 6.700E-02
5 11 7.100E-02 6 11 1.700E-02 7 11 3.000E-02 8 11 5.900E-02 9 11 3.000E-03
10 11 6.300E-02 11 11 2.400E-02 12 11 5.500E-02 2 12 4.000E-03 3 12 1.400E-02
4 12 4.000E-02 5 12 7.500E-02 6 12 6.500E-02 8 12 1.700E-02 9 12 4.100E-02
10 12 2.900E-03 11 12 6.500E-02 12 12 2.000E-03 2 13 2.000E-03 3 13 7.000E-03
4 13 3.200E-02 5 13 5.900E-02 6 13 7.400E-02 7 13 2.000E-02 8 13 4.100E-02
9 13 5.300E-02 10 13 1.400E-02 11 13 3.200E-02 12 13 5.400E-02 2 14 1.000E-03
3 14 3.000E-03 4 14 1.400E-02 5 14 3.800E-02 6 14 6.500E-02 7 14 6.100E-02
8 14 2.100E-02 9 14 2.000E-02 10 14 5.000E-02 11 14 9.000E-03 12 14 2.900E-02
3 15 1.000E-03 4 15 7.000E-03 5 15 2.400E-02 6 15 5.600E-02 7 15 7.100E-02
8 15 1.300E-02 9 15 8.000E-03 10 15 3.400E-02 11 15 3.500E-02 12 15 3.000E-03
4 16 5.000E-03 5 16 1.100E-02 6 16 3.200E-02 7 16 5.400E-02 8 16 5.200E-02
9 16 4.000E-03 10 16 1.200E-02 11 16 4.800E-02 12 16 1.400E-02 4 17 1.900E-03
5 17 7.000E-03 6 17 1.800E-02 7 17 4.400E-02 8 17 6.200E-02 9 17 3.400E-02
11 17 1.700E-02 12 17 3.200E-02 5 18 1.000E-03 6 18 6.000E-03 7 18 2.900E-02

FROM IMAMI ET AL

5.443 5.666 5.686 6.490 11.32 15.13 18.89 23.62
0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17
8.620E+06

NO A-B 2 3 1

0 0 0.

CROSS-SECTIONS ASSUMED SAME AS AS FOR NO 1-2 OF IMAMI ET AL

0.2437 0.2537 0.2937 0.3802 0.5069 0.6775 0.8456 1.058
 0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17

9.

02 32.0 0 0 5 0
 3.000 0.000 1580.361 12.073 0.055 -0.001 1.44567 1.579E-02
 2.000 7918.100 1509.300 12.900 0.000 0.000 1.42640 1.710E-02
 1.000 13195.220 1432.687 13.950 -0.011 0.000 1.40042 1.817E-02
 3.000 36096.000 819.000 22.500 0.000 0.000 1.05000 0.000E+00
 3.000 49802.102 700.360 8.002 -0.375 0.000 0.81900 1.100E-02

0 3P 1.600E+01 4.126E+04 9.000E+00 1.000E+00 1.000E+00

0 3P 1.600E+01 4.126E+04 9.000E+00 1.000E+00 1.000E+00

CN 26.020 3 3 3 3 0
 2.000 0.000 2068.745 13.134 -0.006 0.000 1.89900 1.701E-02
 4.000 9245.344 1812.555 12.609 -0.012 0.000 1.71510 1.708E-02
 2.000 25751.801 2168.610 20.200 0.000 0.000 1.97010 2.215E-02

C 3P 1.201E+01 6.364E+04 9.000E+00 1.000E+00 1.000E+00

N 4S 1.401E+01 6.363E+04 4.000E+00 1.500E+00 0.000E+00

CROSS-SECTIONS ASSUMED AS SAME FOR NO 1-2 OF IMAMI ET AL

7.89 8.213 9.547 12.31 16.41 21.93 27.38 34.24
 0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17

CROSS-SECTIONS ASSUMED SAME AS SAME FOR NO 1-2 OF IMAMI ET AL

6.744 7.035 8.178 10.54 14.06 18.79 23.45 29.33
 0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17

CROSS-SECTIONS ASSUMED SAME AS SAME FOR NO 1-2 OF IMAMI ET AL

4.697 4.884 5.677 7.320 9.759 13.04 16.28 20.36
 0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17

CN VIO 1 3 13
 0 0 9.179E-01 1 0 8.090E-02 2 0 1.200E-03 0 1 7.600E-02 1 1 7.795E-01
 2 1 1.417E-01 3 1 2.800E-03 0 2 5.800E-03 1 2 1.240E-01 2 2 6.754E-01
 3 2 1.905E-01 4 2 4.300E-03 0 3 3.000E-04 1 3 1.430E-02 2 3 1.550E-01
 3 3 5.929E-01 4 3 2.318E-01 2 4 2.390E-02 3 4 1.745E-01 4 4 5.279E-01
 5 4 2.668E-01 3 5 3.420E-02 4 5 1.825E-01 5 5 4.824E-01 6 5 2.933E-01
 4 6 4.520E-02 5 6 1.781E-01 6 6 4.583E-01 7 6 3.095E-01 9 6 3.100E-03
 5 7 5.540E-02 6 7 1.640E-01 7 7 4.554E-01 8 7 3.122E-01 10 7 5.000E-03
 6 8 6.390E-02 8 8 4.750E-01 9 8 2.956E-01 11 8 6.700E-03 7 9 7.080E-02
 9 9 5.184E-01 10 9 2.537E-01 8 10 7.660E-02 10 10 5.801E-01 11 10 1.897E-01
 12 10 4.810E-02 14 10 3.400E-03 7 11 3.100E-03 9 11 8.280E-02 11 11 6.447E-01
 12 11 1.131E-01 13 11 8.540E-02 15 11 5.500E-03 8 12 3.700E-03 12 12 6.967E-01
 14 12 1.203E-01 9 13 4.100E-03 13 13 7.127E-01 15 13 1.380E-01 18 13 4.000E-03
 14 14 6.762E-01 16 14 1.234E-01 17 14 4.470E-02 15 15 5.736E-01 16 15 9.180E-02

CROSS-SECTIONS ASSUMED SAME AS FOR NO 1-2 OF IMAMI ET AL

3.193 3.329 3.870 4.989 6.652 8.890 11.10 13.88
 0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17
 1.180E+07

CN RED 1 2 50
 0 0 5.002E-01 1 0 3.179E-01 2 0 1.269E-01 3 0 4.020E-02 4 0 1.110E-02
 5 0 2.950E-03 6 0 7.500E-04 7 0 2.000E-04 8 0 5.000E-05 0 1 3.711E-01
 1 1 4.600E-02 2 1 2.409E-01 3 1 1.942E-01 4 1 9.410E-02 5 1 3.615E-02
 6 1 1.220E-02 7 1 3.800E-03 8 1 1.100E-03 9 1 3.500E-04 10 1 1.000E-04
 0 2 1.107E-01 1 2 3.528E-01 2 2 1.160E-02 3 2 9.950E-02 4 2 1.812E-01
 5 2 1.330E-01 6 2 6.755E-02 7 2 2.810E-02 8 2 1.040E-02 9 2 3.600E-03
 10 2 1.150E-03 11 2 3.500E-04 12 2 1.500E-04 13 2 5.000E-05 0 3 1.670E-02
 1 3 2.234E-01 2 3 2.136E-01 3 3 8.780E-02 4 3 1.615E-02 5 3 1.228E-01

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6 3 1.416E-01 7 3 9.500E-02 8 3 4.855E-02 9 3 2.125E-02 10 3 8.450E-03
 11 3 3.150E-03 12 3 1.100E-03 13 3 4.000E-04 14 3 1.500E-04 15 3 5.000E-05
 0 4 1.400E-03 1 4 5.355E-02 2 4 2.872E-01 3 4 8.785E-02 4 4 1.489E-01
 5 4 1.800E-03 6 4 5.870E-02 7 4 1.210E-01 8 4 1.088E-01 9 4 6.855E-02
 10 4 3.530E-02 11 4 1.600E-02 12 4 6.650E-03 13 4 2.650E-03 14 4 1.000E-03
 15 4 4.000E-04 16 4 1.500E-04 17 4 5.000E-05 0 5 1.000E-04 1 5 6.150E-03
 2 5 1.027E-01 3 5 2.994E-01 4 5 1.595E-02 5 5 1.591E-01 6 5 3.040E-02
 7 5 1.505E-02 8 5 8.440E-02 9 5 1.068E-01 10 5 8.305E-02 11 5 5.020E-02
 12 5 2.590E-02 13 5 1.210E-02 14 5 5.300E-03 15 5 2.150E-03 16 5 8.500E-04
 1 6 4.000E-04 2 6 1.590E-02 3 6 1.567E-01 4 6 2.669E-01 5 6 7.500E-04
 6 6 1.287E-01 7 6 6.960E-02 8 6 1.500E-04 9 6 4.555E-02 10 6 9.010E-02
 11 6 8.880E-02 12 6 6.315E-02 13 6 3.725E-02 14 6 1.940E-02 15 6 9.300E-03
 16 6 4.200E-03 17 6 1.950E-03 18 6 7.500E-04 2 7 1.250E-03 3 7 3.130E-02
 4 7 2.067E-01 5 7 2.069E-01 6 7 2.400E-02 7 7 8.095E-02 8 7 9.770E-02
 9 7 9.450E-03 10 7 1.610E-02 11 7 6.515E-02 12 7 8.440E-02 13 7 7.165E-02
 14 7 4.825E-02 15 7 2.805E-02 16 7 1.480E-02 17 7 7.300E-03 18 7 3.400E-03
 2 8 5.000E-05 3 8 2.350E-03 4 8 5.285E-02 5 8 2.455E-01 6 8 1.390E-01
 7 8 6.345E-02 8 8 3.650E-02 9 8 1.050E-01 10 8 3.190E-02 11 8 1.650E-03
 12 8 3.835E-02 13 8 7.115E-02 14 8 7.365E-02 15 8 5.700E-02 16 8 3.705E-02
 17 8 2.140E-02 18 8 1.145E-02 3 9 1.000E-04 4 9 6.000E-03 5 9 7.980E-02
 6 9 2.670E-01 7 9 7.770E-02 8 9 1.008E-01 9 9 8.250E-03 10 9 9.250E-02
 11 9 5.585E-02 12 9 2.400E-03 13 9 1.650E-02 14 9 5.265E-02 15 9 6.860E-02
 16 9 6.170E-02 17 9 4.505E-02 18 9 2.870E-02 4 10 3.500E-04 5 10 1.070E-02
 6 10 1.107E-01 7 10 2.728E-01 8 10 3.205E-02 9 10 1.242E-01 10 10 2.500E-04
 11 10 6.780E-02 12 10 7.205E-02 13 10 1.425E-02 14 10 3.500E-03 15 10 3.275E-02
 16 10 5.760E-02 17 10 6.145E-02 18 10 5.065E-02 5 11 6.500E-04 6 11 1.765E-02
 7 11 1.432E-01 8 11 2.606E-01 9 11 6.450E-03 10 11 1.297E-01 11 11 9.750E-03
 12 11 3.975E-02 13 11 7.685E-02 14 11 3.125E-02 15 11 7.500E-04 16 11 1.575E-02
 6 12 1.250E-03 7 12 2.700E-02 8 12 1.762E-01 9 12 2.346E-01 10 12 5.500E-04
 11 12 1.184E-01 12 12 2.990E-02 13 12 1.655E-02 14 12 6.985E-02 15 12 4.710E-02
 16 12 6.700E-03 17 12 4.609E-03 18 12 2.705E-02 7 13 2.150E-03 8 13 3.910E-02
 9 13 2.066E-01 10 13 1.985E-01 11 13 6.075E-02 12 13 9.515E-02 13 13 5.275E-02
 14 13 3.200E-03 15 13 5.435E-02 16 13 5.735E-02 17 13 1.930E-02 18 13 7.500E-04
 7 14 1.000E-04 8 14 3.550E-03 9 14 5.365E-02 10 14 2.326E-01 11 14 1.569E-01
 12 14 3.170E-02 13 14 6.660E-02 14 14 7.175E-02 15 14 9.500E-04 16 14 3.565E-02
 17 14 5.970E-02 18 14 3.145E-02 8 15 1.500E-04 9 15 5.500E-03 10 15 7.110E-02
 11 15 2.520E-01 12 15 1.146E-01 13 15 5.755E-02 14 15 3.885E-02 15 15 8.250E-02
 16 15 8.400E-02 17 15 1.815E-02 18 15 5.415E-02 9 16 2.500E-04 10 16 8.250E-03
 11 16 9.090E-02 12 16 2.647E-01 13 16 7.545E-02 14 16 8.245E-02 15 16 1.700E-02
 16 16 8.330E-02 17 16 2.195E-02 18 16 5.950E-03 10 17 3.500E-04 11 17 1.180E-02
 12 17 1.128E-01 13 17 2.693E-01 14 17 4.340E-02 15 17 1.020E-01 16 17 4.200E-03
 17 17 7.505E-02 18 17 3.715E-02 11 18 6.000E-04 12 18 1.635E-02 13 18 1.359E-01

CROSS-SECTIONS ASSUMED SAME AS NO 1-2 OF IMAMI ET AL

1.146 1.176 1.367 1.763 2.350 3.141 3.921 4.904
 0.000E 00 3.370E-18 1.540E-17 2.450E-17 2.980E-17 3.030E-17 2.870E-17 2.700E-17
 1.950E+05

CN AB 2 3 30
 1 0 2.248E-04 1 1 2.248E-04 1 2 1.833E-01 1 3 6.249E-01 1 4 6.249E-01
 1 5 1.442E-01 1 6 3.433E-02 1 7 8.821E-03 1 8 8.821E-03 1 9 2.609E-03
 1 10 8.926E-04 1 11 3.496E-04 1 12 3.496E-04 1 13 1.542E-04 2 0 8.909E-01
 2 1 8.909E-01 2 2 9.252E-02 2 3 1.300E-02 2 4 1.300E-02 2 5 2.521E-03
 2 6 8.437E-04 2 7 2.055E-04 2 8 2.055E-04 3 0 8.909E-01 3 1 8.909E-01
 3 2 9.252E-02 3 3 1.300E-02 3 4 1.300E-02 3 5 2.521E-03 3 6 6.437E-04
 3 7 2.055E-04 3 8 2.055E-04 4 0 1.088E-01 4 1 1.088E-01 4 2 7.239E-01
 4 3 1.339E-01 4 4 1.339E-01 4 5 2.530E-02 4 6 5.644E-03 4 7 1.530E-03

ORIGINAL PAGE IS
OF POOR QUALITY

4	9	1.530E-03	4	9	4.975E-04	4	10	1.894E-04	5	0	2.248E-04	5	1	2.248E-04
5	2	1.833E-01	5	3	6.249E-01	5	4	6.249E-01	5	5	1.442E-01	5	6	3.433E-02
5	7	8.821E-03	5	8	8.821E-03	5	9	2.609E-03	5	10	8.926E-04	5	11	3.496E-04
5	12	3.496E-04	5	13	1.542E-04	6	0	2.248E-04	6	1	2.248E-04	6	2	1.833E-01
6	3	6.249E-01	6	4	6.249E-01	6	5	1.442E-01	6	6	3.433E-02	6	7	8.821E-03
6	9	8.821E-03	6	9	2.609E-03	6	10	8.926E-04	6	11	3.496E-04	6	12	3.496E-04
6	13	1.542E-04	7	2	2.534E-04	7	3	2.281E-01	7	4	2.281E-01	7	5	5.936E-01
7	6	1.320E-01	7	7	3.861E-02	7	8	3.861E-02	7	9	1.127E-02	7	10	3.657E-03
7	11	1.335E-03	7	12	1.335E-03	7	13	5.469E-04	7	14	2.487E-04	8	2	2.534E-04
8	3	2.281E-01	8	4	2.281E-01	8	5	5.836E-01	8	6	1.320E-01	8	7	3.861E-02
8	9	3.861E-02	8	9	1.127E-02	8	10	3.657E-03	8	11	1.335E-03	8	12	1.335E-03
8	13	5.469E-04	8	14	2.487E-04	9	5	2.428E-01	9	6	5.930E-01	9	7	1.051E-01
9	8	1.051E-01	9	9	3.865E-02	9	10	1.255E-02	9	11	4.462E-03	9	12	4.462E-03
9	13	1.748E-03	9	14	7.549E-04	10	5	1.531E-03	10	6	2.259E-01	10	7	6.444E-01
10	8	6.444E-01	10	9	7.020E-02	10	10	3.617E-02	10	11	1.266E-02	10	12	1.266E-02
10	13	4.907E-03	10	14	2.062E-03	11	6	8.358E-03	11	7	1.780E-01	11	8	1.780E-01
11	9	7.241E-01	11	10	3.468E-02	11	11	3.320E-02	11	12	3.320E-02	11	13	1.185E-02
11	14	4.989E-03	12	6	8.358E-03	12	7	1.780E-01	12	8	1.780E-01	12	9	7.241E-01
12	10	3.468E-02	12	11	3.320E-02	12	12	3.320E-02	12	13	1.185E-02	12	14	4.989E-03
13	7	2.205E-02	13	8	2.205E-02	13	9	1.088E-01	13	10	8.092E-01	13	11	7.994E-03
13	12	7.994E-03	13	13	3.150E-02	13	14	1.046E-02	14	7	1.136E-03	14	8	1.136E-03
14	9	3.815E-02	14	10	4.041E-02	14	11	8.689E-01	14	12	8.689E-01	14	13	4.943E-04

CROSS-SECTIONS ASSUMED SAME AS FOR NO 1-2 OF IMAMI ET AL

2.046	2.153	2.502	3.226	4.301	5.749	7.176	8.975
0.000E 00	3.370E-13	1.540E-17	2.450E-17	2.980E-17	3.030E-17	2.870E-17	2.700E-17

0.

ORIGINAL PAGE IS
OF POOR QUALITY

0.000E+00	0.000	6.0	4.0	106998.0	1.670E+05	5292.90	2P4	4P	4P	4P	5.11.
0.000E+00	0.000	4.0	2.0	106983.0	2.730E+05	5309.20	2P4	4P	4P	4P	5.11.
0.000E+00	0.000	4.0	6.0	107039.0	1.130E+05	5293.50	2P4	4P	4P	4P	5.11.
0.000E+00	0.000	2.0	4.0	106998.0	1.370E+05	5310.60	2P4	4P	4P	4P	5.11.
0.000E+00	0.000	6.0	4.0	107447.0	2.090E+05	5170.00	2P4	4P	4P	4S	5.11.
0.000E+00	0.000	4.0	4.0	107447.0	1.440E+05	5181.50	2P4	4P	4P	4S	5.11.
4.410E-03	0.330	10.0	6.0	110082.0	3.300E+07	1100.70	2P3	2D	5S	2P	2.12.
2.120E-02	0.330	2.0	2.0	110029.0	2.200E+06	1231.70	2P3	2P	5S	2P	3.12.
2.120E-02	0.330	4.0	2.0	110029.0	1.100E+06	1231.70	2P3	2P	5S	2P	3.12.
4.510E-02	0.330	6.0	8.0	94883.0	1.910E+07	8680.27	3S	4P	3P	4D	4.6.
4.510E-02	0.330	4.0	6.0	94832.0	1.330E+07	8683.40	3S	4P	3P	4D	4.6.
4.510E-02	0.330	2.0	4.0	94795.0	7.900E+06	8686.16	3S	4P	3P	4D	4.6.
4.510E-02	0.330	6.0	6.0	94832.0	5.400E+06	8718.84	3S	4P	3P	4D	4.6.
4.510E-02	0.330	4.0	4.0	94795.0	1.010E+07	8711.71	3S	4P	3P	4D	4.6.
4.510E-02	0.330	2.0	2.0	94772.0	1.710E+07	8703.26	3S	4P	3P	4D	4.6.
4.510E-02	0.330	6.0	4.0	94795.0	7.900E+05	8747.36	3S	4P	3P	4D	4.6.
4.510E-02	0.330	4.0	2.0	94772.0	3.000E+05	8728.91	3S	4P	3P	4D	4.6.
4.460E-02	0.330	6.0	6.0	95533.0	1.600E+07	8216.32	3S	4P	3P	4P	4.6.
4.460E-02	0.330	4.0	4.0	95495.0	3.630E+06	8210.71	3S	4P	3P	4P	4.6.
4.460E-02	0.330	2.0	2.0	95477.0	3.640E+06	8200.36	3S	4P	3P	4P	4.6.
0.000E+00	0.000	6.0	4.0	95495.0	1.020E+07	8242.37	3S	4P	3P	4P	4.6.
4.460E-02	0.330	4.0	2.0	95477.0	2.020E+07	8223.12	3S	4P	3P	4P	4.6.
4.460E-02	0.330	4.0	6.0	95533.0	6.300E+06	8184.85	3S	4P	3P	4P	4.6.
4.460E-02	0.330	2.0	4.0	95495.0	9.200E+06	8188.01	3S	4P	3P	4P	4.6.
4.750E-02	0.330	6.0	4.0	96752.0	1.610E+07	7468.31	3S	4P	3P	4S	4.6.
4.750E-02	0.330	4.0	4.0	96752.0	1.060E+07	7442.30	3S	4P	3P	4S	4.6.
4.750E-02	0.330	2.0	4.0	96752.0	5.200E+06	7423.64	3S	4P	3P	4S	4.6.
7.460E-02	0.330	4.0	6.0	96854.0	2.180E+07	9392.79	3S	2P	3P	2D	5.7.
7.460E-02	0.330	2.0	4.0	96788.0	1.830E+07	9396.81	3S	2P	3P	2D	5.7.
7.460E-02	0.330	4.0	4.0	96788.0	3.340E+06	9460.68	3S	2P	3P	2D	5.7.
7.460E-02	0.330	4.0	4.0	97806.0	2.380E+07	8629.24	3S	2P	3P	2P	5.7.
7.460E-02	0.330	2.0	2.0	97770.0	1.900E+07	8590.01	3S	2P	3P	2P	5.7.
7.460E-02	0.330	4.0	2.0	97770.0	9.900E+06	8655.87	3S	2P	3P	2P	5.7.
7.460E-02	0.330	2.0	4.0	97806.0	4.590E+06	8567.74	3S	2P	3P	2P	5.7.
0.000E+00	0.000	4.0	6.0	110546.0	4.000E+06	4109.96	3S	2P	3P	2D	5.14.
0.000E+00	0.000	2.0	4.0	110522.0	3.400E+06	4099.95	3S	2P	3P	2D	5.14.
0.000E+00	0.000	4.0	4.0	110522.0	6.800E+05	4113.97	3S	2P	3P	2D	5.14.
1.670E-01	0.330	6.0	8.0	110715.0	2.690E+07	9045.88	3S	2D	3P	2F	7.14.
1.670E-01	0.330	4.0	6.0	110711.0	2.580E+07	9049.89	3S	2D	3P	2F	7.14.
1.670E-01	0.330	6.0	6.0	110711.0	1.800E+06	9049.47	3S	2D	3P	2F	7.14.
7.330E-02	0.330	6.0	8.0	106871.0	2.000E+06	4253.28	3S	4P	4P	4D	4.11.
7.330E-02	0.330	4.0	6.0	106816.0	1.400E+06	4254.70	3S	4P	4P	4D	4.11.
7.330E-02	0.330	2.0	4.0	106780.0	7.900E+05	4254.70	3S	4P	4P	4D	4.11.
7.680E-02	0.330	6.0	6.0	107039.0	5.100E+06	4223.04	3S	4P	4P	4P	4.11.
7.680E-02	0.330	4.0	4.0	106998.0	9.800E+05	4222.12	3S	4P	4P	4P	4.11.
7.680E-02	0.330	2.0	2.0	106983.0	1.200E+06	4218.87	3S	4P	4P	4P	4.11.
7.680E-02	0.330	6.0	4.0	106998.0	3.300E+06	4230.35	3S	4P	4P	4P	4.11.
7.680E-02	0.330	4.0	2.0	106983.0	6.100E+06	4224.74	3S	4P	4P	4P	4.11.
7.680E-02	0.330	4.0	6.0	107039.0	2.200E+06	4214.73	3S	4P	4P	4P	4.11.
7.680E-02	0.330	2.0	4.0	106998.0	3.100E+06	4215.92	3S	4P	4P	4P	4.11.
8.270E-02	0.330	6.0	4.0	107447.0	1.300E+06	4151.46	3S	4P	4P	4S	4.11.
8.270E-02	0.330	4.0	4.0	107447.0	7.800E+05	4143.42	3S	4P	4P	4S	4.11.
8.270E-02	0.330	2.0	4.0	107447.0	3.900E+05	4137.63	3S	4P	4P	4S	4.11.
1.060E-01	0.330	4.0	2.0	106479.0	1.590E+06	4935.02	3S	2P	4P	2S	5.11.
1.060E-01	0.330	2.0	2.0	106479.0	7.590E+05	4914.90	3S	2P	4P	2S	5.11.

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ORIGINAL PAGE IS
OF POOR QUALITY

1.670E-01	0.330	2.0	4.0	104615.0	2.570E+07	9060.72	3P	2S	3D	2P	7.10.
1.670E-01	0.330	2.0	2.0	104655.0	2.550E+07	9028.92	3P	2S	3D	2P	7.10.
2.510E-01	0.330	8.0	10.0	104767.0	3.740E+07	10114.60	3P	4D	3D	4F	6. 9.
0.000E+00	0.000	6.0	8.0	104718.0	3.210E+07	10112.50	3P	4D	3D	4F	6. 9.
0.000E+00	0.000	4.0	6.0	104684.0	2.810E+07	10108.90	3P	4D	3D	4F	6. 9.
0.000E+00	0.000	2.0	4.0	104665.0	2.620E+07	10105.10	3P	4D	3D	4F	6. 9.
0.000E+00	0.000	8.0	8.0	104718.0	5.230E+06	10164.80	3P	4D	3D	4F	6. 9.
0.000E+00	0.000	6.0	6.0	104684.0	8.980E+06	10147.30	3P	4D	3D	4F	6. 9.
0.000E+00	0.000	4.0	4.0	104665.0	1.040E+07	10128.30	3P	4D	3D	4F	6. 9.
1.460E-01	0.330	8.0	8.0	105020.0	1.010E+07	9863.33	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	6.0	6.0	105011.0	5.420E+06	9822.75	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	4.0	4.0	104998.0	3.460E+06	9798.57	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	2.0	2.0	104987.0	3.100E+06	9788.30	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	8.0	6.0	105011.0	2.220E+06	9872.16	3P	4D	3D	4D	6. 9.
1.460E-01	0.330	6.0	4.0	104998.0	4.610E+06	9834.62	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	4.0	2.0	104987.0	4.150E+06	9810.02	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	6.0	8.0	105020.0	1.180E+06	9814.03	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	4.0	6.0	105011.0	1.440E+06	9786.79	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	2.0	4.0	104998.0	1.770E+06	9776.90	3P	4D	3D	4D	6. 9.
0.000E+00	0.000	6.0	6.0	104825.0	8.690E+06	10757.90	3P	4P	3D	4P	6. 9.
0.000E+00	0.000	4.0	4.0	104860.0	1.690E+06	10675.00	3P	4P	3D	4P	6. 9.
0.000E+00	0.000	2.0	2.0	104886.0	2.150E+06	10623.20	3P	4P	3D	4P	6. 9.
0.000E+00	0.000	6.0	4.0	104860.0	5.640E+06	10718.00	3P	4P	3D	4P	6. 9.
0.000E+00	0.000	4.0	2.0	104886.0	1.070E+07	10644.00	3P	4P	3D	4P	6. 9.
0.000E+00	0.000	4.0	6.0	104825.0	3.760E+06	10713.60	3P	4P	3D	4P	6. 9.
2.790E-01	0.330	2.0	4.0	104860.0	5.320E+06	10653.00	3P	4P	3D	4P	6. 9.
0.000E+00	0.000	6.0	8.0	105020.0	2.420E+07	10539.60	3P	4P	3D	4D	6. 9.
0.000E+00	0.000	4.0	6.0	105011.0	1.320E+07	10507.00	3P	4P	3D	4D	6. 9.
0.000E+00	0.000	2.0	4.0	104998.0	6.520E+06	10500.30	3P	4P	3D	4D	6. 9.
1.670E-01	0.330	4.0	4.0	104998.0	1.620E+07	10520.60	3P	4P	3D	4D	6. 9.
1.670E-01	0.330	2.0	2.0	104987.0	1.740E+07	10513.40	3P	4P	3D	4D	6. 9.
0.000E+00	0.000	6.0	4.0	104998.0	3.690E+06	10563.30	3P	4P	3D	4D	6. 9.
0.000E+00	0.000	4.0	2.0	104987.0	4.050E+06	10533.80	3P	4P	3D	4D	6. 9.
3.880E-01	0.330	4.0	6.0	104825.0	1.230E+07	12384.00	3P	4S	3D	4P	6. 9.
3.580E-01	0.330	4.0	4.0	104860.0	1.240E+07	12330.00	3P	4S	3D	4P	6. 9.
3.580E-01	0.330	4.0	2.0	104886.0	1.250E+07	12291.00	3P	4S	3D	4P	6. 9.
4.910E+00	0.330	6.0	8.0	104883.0	2.170E+07	12467.80	3P	2D	3D	2F	7.10.
3.880E-01	0.330	4.0	6.0	104811.0	2.020E+07	12461.20	3P	2D	3D	2F	7.10.
4.910E+00	0.330	6.0	6.0	104811.0	1.410E+06	12582.30	3P	2D	3D	2F	7.10.
0.000E+00	0.000	4.0	2.0	120572.0	1.020E+06	4391.30	3P	2P	3D'	2S	7.22.
0.000E+00	0.000	2.0	2.0	120572.0	5.200E+05	4384.40	3P	2P	3D'	2S	7.22.
0.000E+00	0.000	8.0	10.0	120149.0	3.370E+07	10597.00	3P'	2F	3D'	2G14	2.22.
0.000E+00	0.000	6.0	8.0	120150.0	3.260E+07	10591.00	3P'	2F	3D'	2G14	2.22.
0.000E+00	0.000	8.0	8.0	120150.0	1.210E+06	10596.00	3P'	2F	3D'	2G14	2.22.
0.000E+00	0.000	8.0	6.0	103737.0	1.170E+07	11291.70	3P	4D	4S	4P	6. 8.
0.000E+00	0.000	6.0	4.0	103668.0	9.200E+06	11313.90	3P	4D	4S	4P	6. 8.
0.000E+00	0.000	4.0	2.0	103618.0	7.260E+06	11323.20	3P	4D	4S	4P	6. 8.
0.000E+00	0.000	6.0	6.0	103737.0	2.700E+06	11227.10	3P	4D	4S	4P	6. 8.
0.000E+00	0.000	4.0	4.0	103668.0	4.750E+07	11266.20	3P	4D	4S	4P	6. 8.
0.000E+00	0.000	2.0	2.0	103618.0	7.310E+06	11294.20	3P	4D	4S	4P	6. 8.
3.580E-01	0.330	6.0	6.0	103737.0	5.400E+06	12186.90	3P	4P	4S	4P	6. 8.
3.580E-01	0.330	4.0	4.0	103668.0	1.010E+06	12232.90	3P	4P	4S	4P	6. 8.
3.580E-01	0.330	2.0	2.0	103618.0	1.250E+06	12280.00	3P	4P	4S	4P	6. 8.
3.580E-01	0.330	6.0	4.0	103668.0	3.360E+06	12288.00	3P	4P	4S	4P	6. 8.
3.580E-01	0.330	4.0	2.0	103618.0	6.200E+06	12307.00	3P	4P	4S	4P	6. 8.

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0.000E+00	0.000	4.0	6.0	103737.0	2.330E+06	12128.60	3P	4P	4S	4P	6. 8.
3.580E-01	0.330	2.0	4.0	103668.0	3.180E+06	12203.40	3P	4P	4S	4P	6. 8.
0.000E+00	0.000	8.0	6.0	109928.0	3.110E+06	6644.96	3P	4D	5S	4P	6.12.
0.000E+00	0.000	6.0	4.0	109858.0	2.440E+06	6653.46	3P	4D	5S	4P	6.12.
0.000E+00	0.000	4.0	2.0	109814.0	1.930E+06	6656.51	3P	4D	5S	4P	6.12.
0.000E+00	0.000	4.0	4.0	109858.0	1.250E+06	6636.94	3P	4D	5S	4P	6.12.
0.000E+00	0.000	2.0	2.0	109814.0	1.940E+06	6646.51	3P	4D	5S	4P	6.12.
0.000E+00	0.000	6.0	6.0	109928.0	1.490E+06	6945.22	3P	4P	5S	4P	6.12.
0.000E+00	0.000	6.0	4.0	109858.0	9.400E+05	6979.10	3P	4P	5S	4P	6.12.
0.000E+00	0.000	4.0	2.0	109814.0	1.740E+06	6981.80	3P	4P	5S	4P	6.12.
0.000E+00	0.000	4.0	6.0	109928.0	6.400E+05	6926.90	3P	4P	5S	4P	6.12.
0.000E+00	0.000	2.0	4.0	109858.0	8.800E+05	6951.70	3P	4P	5S	4P	6.12.
0.000E+00	0.000	2.0	4.0	112801.0	2.300E+06	5201.80	3P	2S	5D	2D	7.16.
0.000E+00	0.000	2.0	2.0	112816.0	2.300E+06	5197.80	3P	2S	5D	2D	7.16.
0.000E+00	0.000	6.0	6.0	112623.0	6.400E+05	5829.53	3P	4P	6S	4P	6.16.
0.000E+00	0.000	4.0	4.0	112611.0	1.220E+05	5841.01	3P	4P	6S	4P	6.16.
0.000E+00	0.000	2.0	2.0	112566.0	1.520E+05	5850.10	3P	4P	6S	4P	6.16.
0.000E+00	0.000	6.0	4.0	112611.0	4.090E+05	5854.16	3P	4P	6S	4P	6.16.
0.000E+00	0.000	4.0	2.0	112566.0	7.600E+05	5856.30	3P	4P	6S	4P	6.16.
0.000E+00	0.000	4.0	6.0	112623.0	2.790E+05	5816.48	3P	4P	6S	4P	6.16.
0.000E+00	0.000	2.0	4.0	112611.0	3.830E+05	5834.70	3P	4P	6S	4P	6.16.
2P3 4P	4.0	0.0		1							
50.3450	60.4845	70.4147	80.4029	91.4802	102.6450	114.1854	126.5929	139.4852	152.4725		
2P3 2P	10.0	19223.0		2							
14.9889	17.4268	19.2955	22.3918	25.0733	27.7908	30.5854	33.5102	36.5328	39.6276		
2P3 2P	6.0	28840.0		3							
10.7361	13.7557	14.7642	16.8461	19.0311	21.2740	23.5879	25.9904	28.4602	31.0449		
3S 4P	12.0	83237.0		4							
0.10834	0.14782	0.23637	0.36552	0.48912	0.62636	0.76476	0.88044	0.97815	1.06603		
3S 2P	6.0	86192.6		5							
0.57251	0.62050	0.69837	0.80213	0.93876	1.09996	1.29427	1.53794	1.83747	2.19576		
3P 2S	2.0	93582.3		7							
1.56966	1.46777	1.15296	0.97645	0.82397	0.96123	1.06950	1.24009	1.46177	1.73434		
3P 4D	20.0	94829.1		6							
1.05955	0.77406	0.69970	0.77699	0.98798	1.23237	1.66601	2.10084	2.58564	3.12547		
3P 4P	12.0	95511.0		6							
0.73110	0.57524	0.64077	0.86056	1.21895	1.67044	2.19074	2.77694	3.41460	4.10620		
3P 4S	4.0	96751.0		6							
0.36200	0.42576	0.71686	1.15835	1.74058	2.41411	3.15551	3.96279	4.83496	5.74892		
3P 2D	10.0	96933.8		7							
0.41342	0.61759	1.04505	1.61261	2.31748	3.10171	3.94367	4.85405	5.81037	6.90454		
3P 2P	6.0	97793.0		7							
0.35486	0.70139	1.26041	1.94835	2.76504	3.65932	4.60798	5.62501	6.68812	7.79174		
3D 2P	6.0	104629.0		10							
1.22846	1.20799	1.19387	1.19268	1.19797	1.20949	1.23166	1.25979	1.29625	1.33541		
3D 4F	28.0	104720.0		9							
1.13041	1.08153	1.04285	1.01831	1.00160	0.99135	0.99132	0.99667	1.00953	1.02493		
3D 2F	14.0	104851.9		10							
1.03191	0.95755	0.89959	0.85923	0.82926	0.80733	0.79565	0.78849	0.78765	0.78916		
3D 4P	12.0	104919.2		9							
0.96095	0.86887	0.79641	0.74266	0.70077	0.66758	0.64483	0.62693	0.61542	0.60672		
3D 4S	20.0	105009.6		9							
0.87619	0.76617	0.68052	0.61569	0.56494	0.52410	0.49403	0.46905	0.45029	0.43456		
3D 2D	10.0	105134.9		10							
0.79730	0.67560	0.58413	0.51625	0.46330	0.42217	0.39032	0.36213	0.33855	0.31677		

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4P 4S	4.0	107448.2	11						
0.47355	0.35598	0.51316	0.83399	1.39825	2.06874	2.76359	3.49013	4.20755	4.95729
4P 2S	2.0	106478.6	11						
1.84682	1.52740	1.30801	1.19701	1.14072	1.19556	1.32739	1.50479	1.71191	1.95340
4P 4P	12.0	107016.1	11						
0.94679	0.69036	0.65501	0.77972	1.06562	1.47666	1.94898	2.45514	2.97381	3.52872
4P 2P	6.0	107500.0	11						
0.55142	0.48466	0.68694	1.04662	1.64936	2.35250	3.07920	3.92380	4.56096	5.32764
4P 4D	20.0	106825.2	11						
1.21816	0.91712	0.80209	0.83737	0.99659	1.28235	1.63961	2.03614	2.45246	2.90572
4P 2D	10.0	107400.0	11						
0.53485	0.49868	0.74309	1.14770	1.80771	2.56768	3.34904	4.14407	4.92810	5.74110
4D 4P	12.0	110372.7	13						
1.28551	1.45051	1.43460	1.37394	1.30755	1.24893	1.19657	1.14829	1.10732	1.06982
4D 2P	6.0	110229.3	13						
1.47525	1.80857	1.88780	1.89361	1.85258	1.82430	1.79653	1.76407	1.73464	1.70579
4D 4D	20.0	110299.1	13						
1.36906	1.61289	1.63972	1.60336	1.55181	1.50685	1.46644	1.42682	1.39332	1.36255
4D 2D	10.0	110461.6	13						
1.19683	1.29367	1.23193	1.15531	1.08135	1.01376	0.95158	0.89426	0.84299	0.79389
4D 4F	28.0	110253.3	13						
1.42140	1.71836	1.77635	1.75952	1.72129	1.68863	1.65912	1.62785	1.60149	1.57710
4D 2F	14.0	110346.4	13						
1.34562	1.55202	1.56158	1.51783	1.46295	1.41222	1.36419	1.31651	1.27330	1.23105
4F 4D	20.0	110486.0	14						
0.59599	0.34209	0.21550	0.14091	0.09787	0.07984	0.05778	0.04376	0.03591	0.03233
4F 2D	10.0	110486.0	14						
0.59599	0.34209	0.21550	0.14091	0.09787	0.07984	0.05778	0.04376	0.03591	0.03233
4F 4F	28.0	110486.0	14						
0.59599	0.34209	0.21550	0.14091	0.09787	0.07984	0.05778	0.04376	0.03591	0.03233
4F 2F	14.0	110486.0	14						
0.59599	0.34209	0.21550	0.14091	0.09787	0.07984	0.05778	0.04376	0.03591	0.03233
4F 4G	36.0	110486.0	14						
0.59599	0.34209	0.21550	0.14091	0.09787	0.07984	0.05778	0.04376	0.03591	0.03233
4F 2G	18.0	110486.0	14						
0.59599	0.34209	0.21550	0.14091	0.09787	0.07984	0.05778	0.04376	0.03591	0.03233
0.05	0.10	0.15	0.20	0.25	0.30				
10000.	-0.148	-0.202	-0.214	-0.197	-0.158	-0.087			
12000.	-0.141	-0.192	-0.201	-0.183	-0.142	-0.068			
14000.	-0.135	-0.182	-0.189	-0.168	-0.125	-0.051			
16000.	-0.128	-0.172	-0.177	-0.154	-0.110	-0.033			
18000.	-0.121	-0.162	-0.165	-0.141	-0.094	-0.017			
OXYGEN	16.0	109837.	109	15	5				
9.	78.	5.	15868.	1.	33792.	5.	73768.		
3.	76795.	15.	86629.	9.	98631.	5.	95476.		
4.	0.	10.	26820.	5.	40468.	12.	120000.		
10.	165990.								
7.840E-04	0.380	5.0	3.0	76795.0	2.100E+08	1302.17	2P4 3P 3S	3S 1. 5.	
7.840E-04	0.380	3.0	3.0	76795.0	1.300E+08	1304.87	2P4 3P 3S	3S 1. 5.	
7.840E-04	0.380	1.0	3.0	76795.0	4.100E+07	1306.04	2P4 3P 3S	3S 1. 5.	
4.990E-04	0.305	5.0	7.0	101135.0	2.300E+08	988.78	2P4 3P 3S'	3D 1.11.	
4.990E-04	0.305	3.0	5.0	101147.0	1.700E+08	990.21	2P4 3P 3S'	3D 1.11.	
4.990E-04	0.305	1.0	3.0	101155.0	1.200E+08	990.80	2P4 3P 3S'	3D 1.11.	
4.990E-04	0.305	5.0	5.0	101147.0	5.800E+07	988.66	2P4 3P 3S'	3D 1.11.	
4.990E-04	0.305	3.0	3.0	101155.0	9.500E+07	990.13	2P4 3P 3S'	3D 1.11.	

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4.990E-04	0.305	5.0	3.0	101155.0	6.600E+06	968.58	2P4	3P	3S'	3D	1.11.
6.990E-04	0.302	5.0	5.0	102662.0	4.500E+08	1152.16	2P4	3P	3S'	3D	1.12.
3.330E-04	0.305	5.0	5.0	113910.0	2.400E+08	877.89	2P4	3P	3S'	3D	1.13.
3.930E-04	0.305	3.0	3.0	113921.0	7.900E+07	879.03	2P4	3P	3S'	3D	1.13.
3.930E-04	0.305	5.0	3.0	113921.0	1.300E+08	877.80	2P4	3P	3S'	3D	1.13.
3.930E-04	0.305	3.0	1.0	113927.0	3.200E+08	878.93	2P4	3P	3S'	3D	1.13.
3.930E-04	0.305	3.0	5.0	113910.0	8.300E+07	879.11	2P4	3P	3S'	3D	1.13.
3.930E-04	0.305	1.0	3.0	113921.0	1.100E+08	879.55	2P4	3P	3S'	3D	1.13.
5.260E-04	0.302	5.0	3.0	115918.0	3.900E+08	999.49	2P4	1D	3S'	1P	2.13.
7.809E-04	0.302	1.0	3.0	115918.0	2.000E+08	1217.64	2P4	1S	3S'	1P	3.13.
1.880E-03	0.153	5.0	7.0	97488.0	3.900E+07	1025.77	2P4	3P	3D	3D	1. 9.
1.880E-03	0.153	3.0	5.0	97488.0	2.900E+07	1027.42	2P4	3P	3D	3D	1. 9.
1.880E-03	0.153	1.0	3.0	97488.0	2.000E+07	1028.16	2P4	3P	3D	3D	1. 9.
1.880E-03	0.153	5.0	5.0	97488.0	9.700E+06	1025.77	2P4	3P	3D	3D	1. 9.
1.880E-03	0.153	3.0	3.0	97488.0	1.600E+07	1027.42	2P4	3P	3D	3D	1. 9.
1.880E-03	0.153	5.0	3.0	97488.0	1.100E+06	1025.77	2P4	3P	3D	3D	1. 9.
1.455E-03	0.260	9.0	9.0	123326.0	7.800E+07	911.37	2P4	3P	3D'	3P	1.13.
1.610E-01	0.330	5.0	7.0	124326.0	9.300E+07	936.01	2P4	1D	3D'	1P	2.13.
3.270E-02	0.438	5.0	7.0	86631.0	3.400E+07	7771.96	3S	5S	3P	5P	4. 6.
3.270E-02	0.438	5.0	5.0	86627.0	3.400E+07	7774.18	3S	5S	3P	5P	4. 6.
3.270E-02	0.438	5.0	3.0	86625.0	3.400E+07	7775.40	3S	5S	3P	5P	4. 6.
5.290E-02	0.423	9.0	9.0	86631.0	2.800E+07	8446.50	3S	3S	3P	3P	5. 7.
4.720E-02	0.360	7.0	7.0	113294.0	2.920E+07	8221.84	3S'	3D	3P'	3D11	1.13.
4.720E-02	0.360	5.0	5.0	113295.0	2.110E+07	8230.01	3S'	3D	3P'	3D11	1.13.
4.720E-02	0.360	3.0	3.0	113298.0	2.610E+07	8232.99	3S'	3D	3P'	3D11	1.13.
4.720E-02	0.360	7.0	5.0	113295.0	6.630E+06	8221.84	3S'	3D	3P'	3D11	1.13.
4.720E-02	0.360	5.0	3.0	113298.0	9.340E+06	8227.64	3S'	3D	3P'	3D11	1.13.
4.720E-02	0.360	5.0	7.0	113294.0	2.610E+06	8230.01	3S'	3D	3P'	3D11	1.13.
4.720E-02	0.360	3.0	5.0	113295.0	4.320E+06	8235.31	3S'	3D	3P'	3D11	1.13.
7.390E-01	0.288	7.0	9.0	113714.0	3.730E+07	7947.56	3S'	3D	3P'	3F11	1.13.
7.390E-01	0.288	5.0	7.0	113721.0	3.310E+07	7950.83	3S'	3D	3P'	3F11	1.13.
7.390E-01	0.288	3.0	5.0	113727.0	3.130E+07	7952.13	3S'	3D	3P'	3F11	1.13.
7.390E-01	0.288	7.0	7.0	113721.0	4.170E+06	7943.15	3S'	3D	3P'	3F11	1.13.
7.390E-01	0.288	5.0	5.0	113727.0	5.800E+04	7947.20	3S'	3D	3P'	3F11	1.13.
7.390E-01	0.288	7.0	5.0	113727.0	1.650E+05	7939.49	3S'	3D	3P'	3F11	1.13.
4.150E-01	0.155	15.0	9.0	117158.0	7.300E+07	6242.50	3S'	3D	3P'	3P11	1.13.
5.430E-02	0.360	5.0	7.0	113996.0	2.610E+07	8820.45	3S'	3D	3P'	3P12	1.13.
5.450E-01	0.155	5.0	5.0	116631.0	4.730E+07	7156.80	3S'	3D	3P'	3P12	1.13.
2.430E-01	0.204	5.0	5.0	113370.0	2.150E+07	9391.20	3S'	1D	3P'	1P12	1.13.
0.000E+00	0.000	9.0	3.0	126298.0	3.390E+07	9073.70	3S'	3P	3P'	3S19	1.13.
6.540E-01	0.288	5.0	7.0	127292.0	4.080E+07	7476.45	3S'	3P	3P'	3D19	1.13.
6.540E-01	0.288	3.0	5.0	127298.0	3.060E+07	7479.06	3S'	3P	3P'	3D19	1.13.
6.540E-01	0.288	1.0	3.0	127291.0	2.260E+07	7480.66	3S'	3P	3P'	3D19	1.13.
6.540E-01	0.288	3.0	3.0	127291.0	1.700E+07	7477.21	3S'	3P	3P'	3D19	1.13.
6.540E-01	0.288	5.0	3.0	127291.0	1.140E+06	7471.36	3S'	3P	3P'	3D19	1.13.
5.610E-01	0.155	9.0	9.0	127811.0	4.780E+07	7194.60	3S'	3P	3P'	3P19	1.13.
3.100E+00	0.000	3.0	3.0	127668.0	2.890E+07	8508.63	3S'	1P	3P'	1P19	1.13.
3.100E+00	0.000	3.0	5.0	128595.0	3.700E+07	7886.31	3S'	1P	3P'	1D19	1.13.
3.100E+00	0.000	3.0	1.0	130943.0	6.000E+07	6653.78	3S'	1P	3P'	1S19	1.13.
5.700E-02	0.442	5.0	15.0	99095.0	3.260E+05	3947.29	3S	5S	4P	5P	4.10.
2.190E-02	0.464	3.0	9.0	99690.0	6.600E+05	4368.30	3S	2S	4P	3P	5.10.
0.000E+00	0.000	5.0	7.0	101135.0	2.900E+07	7995.12	3P	3P	3S'	3D	7.11.
0.000E+00	0.000	3.0	5.0	101147.0	2.100E+07	7987.00	3P	3P	3S'	3D	7.11.
0.000E+00	0.000	1.0	3.0	101155.0	1.600E+07	7982.41	3P	3P	3S'	3D	7.11.
0.000E+00	0.000	5.0	5.0	101147.0	7.200E+06	7987.34	3P	3P	3S'	3D	7.11.

0.000E+00	0.000	3.0	3.0	101155.0	1.200E+07	7981.97	3P	3P	3S'	3D	7.11.
0.000E+00	0.000	5.0	3.0	101155.0	8.000E+05	7982.30	3P	3P	3S'	3D	7.11.
2.140E-01	0.135	7.0	9.0	97420.0	4.190E+07	9265.99	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	5.0	7.0	97420.0	2.800E+07	9262.73	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	3.0	5.0	97420.0	1.470E+07	9260.88	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	7.0	7.0	97420.0	1.400E+07	9265.99	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	5.0	5.0	97420.0	2.450E+07	9262.73	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	3.0	3.0	97421.0	3.150E+07	9260.88	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	7.0	5.0	97420.0	2.790E+06	9265.99	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	5.0	3.0	97421.0	1.050E+07	9262.73	3P	5P	3D	5D	6. 9.
2.140E-01	0.135	3.0	1.0	97421.0	4.200E+07	9260.88	3P	5P	3D	5D	6. 9.
3.530E-01	0.225	9.0	15.0	97488.0	2.350E+07	11287.00	3P	3P	3D	3D	7. 9.
3.900E-01	0.370	7.0	5.0	95476.0	1.270E+07	11302.20	3P	5P	4S	5S	6. 8.
3.900E-01	0.370	5.0	5.0	95476.0	9.100E+06	11297.50	3P	5P	4S	5S	6. 8.
3.900E-01	0.370	3.0	5.0	95476.0	5.400E+06	11295.00	3P	5P	4S	5S	6. 8.
0.000E+00	0.000	9.0	3.0	96226.0	1.880E+07	13164.00	3P	3P	4S	3S	7. 8.
4.040E-01	0.155	7.0	9.0	102865.0	7.010E+06	6158.19	3P	5P	4D	5D	6.12.
4.040E-01	0.155	5.0	7.0	102865.0	4.680E+06	6156.78	3P	5P	4D	5D	6.12.
4.040E-01	0.155	3.0	5.0	102865.0	2.450E+06	6155.99	3P	5P	4D	5D	6.12.
4.040E-01	0.155	7.0	7.0	102865.0	2.340E+06	6158.19	3P	5P	4D	5D	6.12.
4.040E-01	0.155	5.0	5.0	102865.0	4.100E+06	6156.78	3P	5P	4D	5D	6.12.
4.040E-01	0.155	3.0	3.0	102865.0	5.270E+06	6155.99	3P	5P	4D	5D	6.12.
4.040E-01	0.155	7.0	5.0	102865.0	4.670E+05	6158.19	3P	5P	4D	5D	6.12.
4.040E-01	0.155	5.0	3.0	102865.0	1.750E+06	6156.78	3P	5P	4D	5D	6.12.
4.040E-01	0.155	3.0	1.0	102865.0	7.020E+06	6155.99	3P	5P	4D	5D	6.12.
0.000E+00	0.000	9.0	15.0	102908.0	3.250E+06	7002.10	3P	3P	4D	3D	7.12.
0.000E+00	0.000	15.0	21.0	129667.0	4.600E+06	6106.50	3P'	3D	4D'	3F	19.19.
0.000E+00	0.000	21.0	21.0	129667.0	1.980E+06	6269.40	3P'	3F	4D'	3F	19.19.
0.000E+00	0.000	21.0	27.0	129690.0	6.300E+06	6259.60	3P'	3F	4D'	3G	19.19.
5.430E-01	0.339	7.0	5.0	102116.0	3.310E+06	6456.01	3P	5P	5S	5S	6.11.
5.430E-01	0.339	5.0	5.0	102116.0	2.370E+06	6454.48	3P	5P	5S	5S	6.11.
5.430E-01	0.339	3.0	5.0	102116.0	1.420E+06	6453.64	3P	5P	5S	5S	6.11.
6.980E-01	0.349	9.0	3.0	102412.0	6.200E+06	7254.40	3P	3P	5S	3S	7.11.
1.258E+00	0.185	7.0	9.0	105385.0	1.960E+06	5330.66	3P	5P	5D	5D	6.14.
1.258E+00	0.185	5.0	7.0	105385.0	1.310E+06	5329.59	3P	5P	5D	5D	6.14.
1.258E+00	0.185	3.0	5.0	105385.0	6.900E+05	5328.98	3P	5P	5D	5D	6.14.
1.258E+00	0.185	7.0	7.0	105385.0	6.600E+05	5330.66	3P	5P	5D	5D	6.14.
1.258E+00	0.185	5.0	5.0	105385.0	1.150E+06	5329.59	3P	5P	5D	5D	6.14.
1.258E+00	0.185	3.0	3.0	105385.0	1.480E+06	5328.98	3P	5P	5D	5D	6.14.
1.258E+00	0.185	7.0	5.0	105385.0	1.310E+05	5330.66	3P	5P	5D	5D	6.14.
0.000E+00	0.000	5.0	3.0	105385.0	4.910E+05	5329.59	3P	5P	5D	5D	6.14.
0.000E+00	0.000	3.0	1.0	105385.0	1.970E+06	5328.98	3P	5P	5D	5D	6.14.
0.000E+00	0.000	7.0	5.0	105019.0	1.420E+06	5436.83	3P	5P	6S	5S	6.14.
0.000E+00	0.000	5.0	5.0	105019.0	1.020E+06	5435.76	3P	5P	6S	5S	6.14.
0.000E+00	0.000	3.0	5.0	105019.0	6.100E+05	5435.16	3P	5P	6S	5S	6.14.
1.420E+00	0.318	9.0	3.0	105165.0	2.340E+06	6046.40	3P	3P	6S	3S	7.14.
2P4 3P	9.0	78.0		1							
12.1196	14.9111	17.7888	20.7167	23.9167	27.1607	30.5087	34.0583	37.7269	41.4359		
2P4 1P	5.0	15867.7		2							
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
2P4 1P	1.0	33792.4		3							
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
3S 5S	5.0	73767.8		4							
0.00023	0.04397	0.13992	0.27262	0.40008	0.53951	0.67704	0.78756	0.87653	0.95347		
3S 3S	3.0	76794.7		5							

ORIGINAL PROBLEM
OF POOR QUALITY

0.00043	0.09373	0.33051	0.70181	1.14633	1.69498	2.32813	3.00308	3.72587	4.51091
3P	5P	15.0	86628.7	6					
1.85539	1.23680	0.96244	0.82291	0.86718	1.06703	1.39919	1.95119	2.41117	3.08249
3P	3P	9.0	88630.7	7					
0.82574	0.49531	0.62242	0.92971	1.40623	2.00315	2.69438	3.48024	4.34113	5.27262
3D	5D	35.0	97420.0	9					
0.84013	0.84301	0.76501	0.70766	0.66160	0.62430	0.59748	0.57576	0.56052	0.54919
3D	3D	15.0	97486.0	9					
0.89004	0.78152	0.69620	0.63089	0.57887	0.53611	0.50361	0.47561	0.45389	0.43461
4P	5P	15.0	99093.0	10					
1.81437	1.41945	1.13333	0.99490	0.97311	1.13373	1.43874	1.85301	2.35626	2.96197
4P	3P	9.0	99680.0	10					
0.89727	0.63452	0.61076	0.77093	1.13363	1.65109	2.25270	2.91352	3.60873	4.36480
4D	5D	35.0	102355.1	12					
1.85774	1.40953	1.38352	1.31451	1.24123	1.17820	1.12337	1.07406	1.03333	0.99714
4D	3D	15.0	102808.1	12					
1.21487	1.32490	1.27629	1.19361	1.11044	1.03682	0.97157	0.91303	0.86338	0.81863
4F	5F	35.0	102965.1	12					
0.59511	0.33542	0.21385	0.13979	0.09728	0.07930	0.05742	0.04354	0.03580	0.03229
4F	3F	21.0	102979.1	12					
0.59595	0.33382	0.21449	0.14016	0.09750	0.07951	0.05755	0.04363	0.03584	0.03230
0.35	0.10	0.15	0.20	0.25	0.30				
10000.	-0.169	-0.251	-0.298	-0.315	-0.308	-0.279			
12000.	-0.168	-0.240	-0.283	-0.296	-0.286	-0.243			
14000.	-0.157	-0.230	-0.268	-0.278	-0.263	-0.217			
16000.	-0.153	-0.218	-0.252	-0.259	-0.241	-0.191			
18000.	-0.143	-0.206	-0.236	-0.240	-0.218	-0.164			
224 1-	28.310	1	94	4					
4	1.00	0.000E+00	0.000E+00	1.075E-08	0.000	0.000	0.00		
7.000	1.00	0.000E+00	0.000E+00	1.116E-08	70330.000	0.000	0.00		
2.000	25461.500	3419.840	23.196	-0.538	0.000	2.08300	1.950E-02		
2.000	0.000	2207.190	16.136	-0.040	0.000	1.55220	2.920E-02		
2.000	64622.000	2050.000	0.000	0.000	0.000	1.65000	5.000E-02		
4.000	3159.400	1962.840	14.910	0.000	0.000	1.72200	1.830E-02		
0.0	0.0	4.500E-01	6.509E-01	1.0	0.0	4.500E-01	3.014E-01		
2.0	0.0	4.500E-01	4.537E-02	3.0	0.0	4.500E-01	2.242E-03		
4.0	0.0	4.500E-01	1.452E-05	0.0	1.0	4.500E-01	2.583E-01		
1.0	1.0	4.500E-01	2.226E-01	2.0	1.0	4.500E-01	4.060E-01		
3.0	1.0	4.500E-01	1.056E-01	4.0	1.0	4.500E-01	6.935E-03		
5.0	1.0	4.500E-01	3.996E-05	0.0	2.0	4.500E-01	7.016E-02		
1.0	2.0	4.500E-01	2.860E-01	2.0	2.0	4.500E-01	5.065E-02		
3.0	2.0	4.500E-01	4.137E-01	4.0	2.0	4.500E-01	1.660E-01		
5.0	2.0	4.500E-01	1.340E-02	6.0	2.0	4.500E-01	5.729E-05		
7.0	2.0	4.500E-01	1.132E-05	0.0	3.0	4.500E-01	1.600E-02		
1.0	3.0	4.500E-01	1.324E-01	2.0	3.0	4.500E-01	2.290E-01		
3.0	3.0	4.500E-01	2.101E-03	4.0	3.0	4.500E-01	3.792E-01		
5.0	3.0	4.500E-01	2.205E-01	6.0	3.0	4.500E-01	2.069E-02		
7.0	3.0	4.500E-01	4.930E-05	8.0	3.0	4.500E-01	3.006E-05		
0.0	4.0	4.500E-01	3.237E-03	1.0	4.0	4.500E-01	4.273E-02		
2.0	4.0	4.500E-01	1.654E-01	3.0	4.0	4.500E-01	1.557E-01		
4.0	4.0	4.500E-01	6.726E-03	5.0	4.0	4.500E-01	3.310E-01		
6.0	4.0	4.500E-01	3.673E-01	7.0	4.0	4.500E-01	2.789E-02		
8.0	4.0	4.500E-01	1.807E-05	9.0	4.0	4.500E-01	6.423E-05		
0.0	5.0	4.500E-01	5.342E-04	1.0	5.0	4.500E-01	1.140E-02		
2.0	5.0	4.500E-01	7.113E-02	3.0	5.0	4.500E-01	1.706E-01		

4.0	5.0	4.500E-01	9.290E-02	5.0	5.0	4.500E-01	2.925E-02		
6.0	5.0	4.500E-01	2.830E-01	7.0	5.0	4.500E-01	3.063E-01		
8.0	5.0	4.500E-01	3.419E-02	10.0	5.0	4.500E-01	1.161E-04		
0.0	6.0	4.500E-01	1.155E-04	1.0	6.0	4.500E-01	2.700E-03		
2.0	6.0	4.500E-01	2.362E-02	3.0	6.0	4.500E-01	9.451E-02		
4.0	6.0	4.500E-01	1.569E-01	5.0	6.0	4.500E-01	4.815E-02		
6.0	6.0	4.500E-01	5.331E-02	7.0	6.0	4.500E-01	2.415E-01		
8.0	6.0	4.500E-01	3.401E-01	9.0	6.0	4.500E-01	3.890E-02		
10.0	6.0	4.500E-01	8.094E-05	11.0	6.0	4.500E-01	1.823E-04		
0.0	7.0	4.500E-01	2.000E-05	1.0	7.0	4.500E-01	5.861E-04		
2.0	7.0	4.500E-01	6.691E-03	3.0	7.0	4.500E-01	3.801E-02		
4.0	7.0	4.500E-01	1.096E-01	5.0	7.0	4.500E-01	1.333E-01		
6.0	7.0	4.500E-01	2.044E-02	7.0	7.0	4.500E-01	7.236E-02		
8.0	7.0	4.500E-01	2.083E-01	9.0	7.0	4.500E-01	3.686E-01		
10.0	7.0	4.500E-01	4.153E-02	11.0	7.0	4.500E-01	3.873E-04		
12.0	7.0	4.500E-01	2.509E-04	13.0	7.0	4.500E-01	1.172E-05		
1.0	8.0	4.500E-01	1.185E-04	2.0	8.0	4.500E-01	1.695E-03		
3.0	8.0	4.500E-01	1.261E-02	4.0	8.0	4.500E-01	5.236E-02		
5.0	8.0	4.500E-01	1.161E-01	6.0	8.0	4.500E-01	1.065E-01		
7.0	8.0	4.500E-01	5.939E-03	8.0	8.0	4.500E-01	8.468E-02		
9.0	8.0	4.500E-01	1.837E-01	10.0	8.0	4.500E-01	3.933E-01		
11.0	8.0	4.500E-01	4.170E-02	12.0	8.0	4.500E-01	1.087E-03		
13.0	8.0	4.500E-01	3.010E-04	14.0	8.0	4.500E-01	3.005E-05		
1.0	9.0	4.500E-01	2.239E-05	2.0	9.0	4.500E-01	3.934E-04		
3.0	9.0	4.500E-01	3.668E-03	4.0	9.0	4.500E-01	2.003E-02		
5.0	9.0	4.500E-01	6.488E-02	6.0	9.0	4.500E-01	1.150E-01		
N2+	1-	28.010	1	94	4				
	4	1.00	0.000E+00	0.000E+00	1.075E-08	0.000	0.000	0.00	
	7.000	1.00	0.000E+00	0.000E+00	1.116E-08	70390.000	0.000	0.00	
	2.000	25461.500	2419.840	23.190	-0.538	0.000	2.08300	1.950E-02	
	2.000	0.000	2207.190	16.136	-0.040	0.000	1.93220	2.020E-02	
	2.000	64622.000	2050.000	0.000	0.000	0.000	1.65000	5.000E-02	
	4.000	9168.400	1902.840	14.910	0.000	0.000	1.72200	1.800E-02	
8.0	9.0	4.500E-01	4.743E-04	9.0	9.0	4.500E-01	9.065E-02		
10.0	9.0	4.500E-01	1.672E-01	11.0	9.0	4.500E-01	4.149E-01		
12.0	9.0	4.500E-01	3.928E-02	13.0	9.0	4.500E-01	2.361E-03		
14.0	9.0	4.500E-01	3.071E-04	15.0	9.0	4.500E-01	6.400E-05		
2.0	10.0	4.500E-01	8.445E-05	3.0	10.0	4.500E-01	9.639E-04		
4.0	10.0	4.500E-01	6.599E-03	5.0	10.0	4.500E-01	2.826E-02		
6.0	10.0	4.500E-01	7.442E-02	7.0	10.0	4.500E-01	1.084E-01		
8.0	10.0	4.500E-01	5.865E-02	9.0	10.0	4.500E-01	5.552E-04		
10.0	10.0	4.500E-01	9.141E-02	11.0	10.0	4.500E-01	1.579E-01		
12.0	10.0	4.500E-01	4.338E-01	13.0	10.0	4.500E-01	3.432E-02		
14.0	10.0	4.500E-01	4.364E-03	15.0	10.0	4.500E-01	2.499E-04		
16.0	10.0	4.500E-01	1.171E-04	2.0	11.0	4.500E-01	1.675E-05		
3.0	11.0	4.500E-01	2.324E-04	4.0	11.0	4.500E-01	1.942E-03		
5.0	11.0	4.500E-01	1.043E-02	6.0	11.0	4.500E-01	3.652E-02		
7.0	11.0	4.500E-01	8.051E-02	8.0	11.0	4.500E-01	9.821E-02		
9.0	11.0	4.500E-01	4.075E-02	10.0	11.0	4.500E-01	3.604E-03		
11.0	11.0	4.500E-01	8.818E-02	12.0	11.0	4.500E-01	1.554E-01		
13.0	11.0	4.500E-01	4.496E-01	14.0	11.0	4.500E-01	2.722E-02		
15.0	11.0	4.500E-01	7.165E-03	16.0	11.0	4.500E-01	1.355E-04		
17.0	11.0	4.500E-01	1.867E-04	3.0	12.0	4.500E-01	5.156E-05		
4.0	12.0	4.500E-01	5.207E-04	5.0	12.0	4.500E-01	3.406E-03		
6.0	12.0	4.500E-01	1.496E-02	7.0	12.0	4.500E-01	4.411E-02		

ORIGINAL PARTIAL
OF POOR QUALITY

8.0	12.0	4.500E-01	8.319E-02	9.0	12.0	4.500E-01	8.628E-02
10.0	12.0	4.500E-01	2.710E-02	11.0	12.0	4.500E-01	7.896E-02
12.0	12.0	4.500E-01	8.265E-02	13.0	12.0	4.500E-01	1.593E-01
14.0	12.0	4.500E-01	4.615E-01	15.0	12.0	4.500E-01	1.876E-02
16.0	12.0	4.500E-01	1.062E-02	17.0	12.0	4.500E-01	2.033E-05
18.0	12.0	4.500E-01	2.587E-04	19.0	12.0	4.500E-01	2.439E-05
3.0	13.0	4.500E-01	1.044E-05	4.0	13.0	4.500E-01	1.281E-04
5.0	13.0	4.500E-01	1.807E-03	6.0	13.0	4.500E-01	5.378E-03
7.0	13.0	4.500E-01	1.391E-02	8.0	13.0	4.500E-01	5.053E-02
9.0	13.0	4.500E-01	8.288E-02	10.0	13.0	4.500E-01	7.393E-02
11.0	13.0	4.500E-01	1.720E-02	12.0	13.0	4.500E-01	1.238E-02
13.0	13.0	4.500E-01	7.384E-02	14.0	13.0	4.500E-01	1.697E-01
15.0	13.0	4.500E-01	4.661E-01	16.0	13.0	4.500E-01	1.013E-02
17.0	13.0	4.500E-01	1.459E-02	18.0	13.0	4.500E-01	3.550E-05
19.0	13.0	4.500E-01	3.056E-04	4.0	14.0	4.500E-01	2.677E-05
5.0	14.0	4.500E-01	2.724E-04	6.0	14.0	4.500E-01	1.741E-03
7.0	14.0	4.500E-01	7.823E-03	8.0	14.0	4.500E-01	2.482E-02
9.0	14.0	4.500E-01	5.544E-02	10.0	14.0	4.500E-01	8.018E-02
11.0	14.0	4.500E-01	6.208E-02	12.0	14.0	4.500E-01	1.034E-02
13.0	14.0	4.500E-01	1.651E-02	14.0	14.0	4.500E-01	6.418E-02
15.0	14.0	4.500E-01	1.866E-01	16.0	14.0	4.500E-01	4.676E-01
17.0	14.0	4.500E-01	3.287E-03	18.0	14.0	4.500E-01	1.831E-02
19.0	14.0	4.500E-01	3.355E-04	5.0	15.0	4.500E-01	6.737E-05
6.0	15.0	4.500E-01	5.146E-04	7.0	15.0	4.500E-01	2.756E-03
8.0	15.0	4.500E-01	1.065E-02	9.0	15.0	4.500E-01	2.977E-02

N2 14	20.010	3	94	9				
	9	1.00	0.000E+00	0.000E+00	1.212E-09	0.000	0.000	1.00
	7.000	1.00	0.000E+00	0.000E+00	1.292E-08	0.000	0.000	0.00
6.0	58306.8	1733.391	14.1221	-0.05688	-3.612E-03	1.6374	0.01791	
8.0	19754.8	1460.518	13.8313	0.005999	1.853E-03	1.45455	0.018009	
1.0	101672.	746.0	0.	0.	0.	1.154	0.0048	
6.0	93277.3	2047.178	28.445	2.08833	0.535	1.82473	0.018683	
2.0	71698.8	1559.236	11.8874	0.003225	0.	1.458	0.0166	
2.0	63951.2	1694.208	13.9491	0.0079346	-2.911E-04	1.61688	0.017933	
1.0	67739.3	1530.254	12.0747	0.041292	2.896E-04	1.47988	0.016574	
6.0	65853.4	1516.823	12.181	0.041958	7.323E-04	1.47359	0.016861	
1.0	0.	2358.027	14.1351	-0.01751	-1.144E-04	1.8360	0.01772	
0.0	0.0	1.000E-00	3.382E-01	1.0	0.0	1.000E-00	4.065E-01	
2.0	0.0	1.000E-00	1.975E-01	3.0	0.0	1.000E-00	5.014E-02	
4.0	0.0	1.000E-00	7.191E-03	5.0	0.0	1.000E-00	5.871E-04	
6.0	0.0	1.000E-00	2.616E-05	0.0	1.0	1.000E-00	3.248E-01	
1.0	1.0	1.000E-00	3.310E-03	2.0	1.0	1.000E-00	2.120E-01	
3.0	1.0	1.000E-00	2.987E-01	4.0	1.0	1.000E-00	1.312E-01	
5.0	1.0	1.000E-00	2.729E-02	6.0	1.0	1.000E-00	2.925E-03	
7.0	1.0	1.000E-00	1.613E-04	0.0	2.0	1.000E-00	1.900E-01	
1.0	2.0	1.000E-00	1.032E-01	2.0	2.0	1.000E-00	1.132E-01	
3.0	2.0	1.000E-00	3.868E-02	4.0	2.0	1.000E-00	2.738E-01	
5.0	2.0	1.000E-00	2.107E-01	6.0	2.0	1.000E-00	6.148E-02	
7.0	2.0	1.000E-00	3.462E-03	8.0	2.0	1.000E-00	5.675E-04	
9.0	2.0	1.000E-00	1.719E-05	0.0	3.0	1.000E-00	8.857E-02	
1.0	3.0	1.000E-00	1.782E-01	2.0	3.0	1.000E-00	1.205E-03	
3.0	3.0	1.000E-00	1.623E-01	4.0	3.0	1.000E-00	1.807E-03	
5.0	3.0	1.000E-00	1.809E-01	6.0	3.0	1.000E-00	2.605E-01	
7.0	3.0	1.000E-00	1.065E-01	8.0	3.0	1.000E-00	1.957E-02	
9.0	3.0	1.000E-00	1.485E-03	10.0	3.0	1.000E-00	5.241E-05	

0.0	4.0	1.000E-00	3.649E-02	1.0	4.0	1.000E-00	1.450E-01	
2.0	4.0	1.000E-00	7.724E-02	3.0	4.0	1.000E-00	3.227E-02	
4.0	4.0	1.000E-00	1.139E-01	5.0	4.0	1.000E-00	4.780E-02	
6.0	4.0	1.000E-00	8.305E-02	7.0	4.0	1.000E-00	2.706E-01	
8.0	4.0	1.000E-00	1.561E-01	9.0	4.0	1.000E-00	3.420E-02	
10.0	4.0	1.000E-00	3.274E-03	11.0	4.0	1.000E-00	1.318E-04	
0.0	5.0	1.000E-00	1.399E-02	1.0	5.0	1.000E-00	8.647E-02	
2.0	5.0	1.000E-00	1.275E-01	3.0	5.0	1.000E-00	9.050E-03	
4.0	5.0	1.000E-00	8.823E-02	5.0	5.0	1.000E-00	4.262E-02	
6.0	5.0	1.000E-00	1.040E-01	7.0	5.0	1.000E-00	1.916E-02	
8.0	5.0	1.000E-00	2.438E-01	9.0	5.0	1.000E-00	2.029E-01	
10.0	5.0	1.000E-00	5.569E-02	11.0	5.0	1.000E-00	6.299E-03	
12.0	5.0	1.000E-00	2.290E-04	0.0	6.0	1.000E-00	5.147E-03	
1.0	6.0	1.000E-00	4.367E-02	2.0	6.0	1.000E-00	1.127E-01	
3.0	6.0	1.000E-00	6.910E-02	4.0	6.0	1.000E-00	5.227E-03	
5.0	6.0	1.000E-00	1.057E-01	6.0	6.0	1.000E-00	3.171E-03	
7.0	6.0	1.000E-00	1.291E-01	8.0	6.0	1.000E-00	2.766E-05	
9.0	6.0	1.000E-00	1.919E-01	10.0	6.0	1.000E-00	2.402E-01	
11.0	6.0	1.000E-00	8.265E-02	12.0	6.0	1.000E-00	1.099E-02	
13.0	6.0	1.000E-00	5.717E-04	0.0	7.0	1.000E-00	1.851E-03	
1.0	7.0	1.000E-00	2.900E-02	2.0	7.0	1.000E-00	7.496E-02	
3.0	7.0	1.000E-00	1.009E-01	4.0	7.0	1.000E-00	1.798E-02	
5.0	7.0	1.000E-00	3.829E-02	6.0	7.0	1.000E-00	3.078E-02	
7.0	7.0	1.000E-00	6.748E-03	8.0	7.0	1.000E-00	1.159E-01	
9.0	7.0	1.000E-00	1.684E-02	10.0	7.0	1.000E-00	1.299E-01	
11.0	7.0	1.000E-00	2.630E-01	12.0	7.0	1.000E-00	1.140E-01	
13.0	7.0	1.000E-00	1.777E-02	14.0	7.0	1.000E-00	1.044E-03	
15.0	7.0	1.000E-00	1.866E-05	0.0	8.0	1.000E-00	6.595E-04	
1.0	8.0	1.000E-00	8.626E-03	2.0	8.0	1.000E-00	4.247E-02	
N2 1+	28.010	2	94	9				
	9	1.00	0.000E+00	0.000E+00	1.212E-08	0.000	0.000	1.00
	7.000	1.00	0.000E+00	0.000E+00	1.293E-08	0.000	0.000	0.00
0.0	59306.8	1733.391	14.1221	-0.05689	-3.612E-03	1.6374	0.01791	
3.0	49754.8	1460.518	13.8313	0.005999	1.653E-03	1.45455	0.018009	
1.0	103672.	746.0	9.	0.	0.	1.154	0.0048	
6.0	88977.9	2047.178	28.445	2.08833	0.525	1.92473	0.013693	
2.0	71698.8	1559.236	11.8874	0.003225	0.	1.498	0.0166	
2.0	68951.2	1694.208	13.9491	0.0079346	-2.911E-04	1.61688	0.017933	
1.0	67739.3	1530.254	12.0747	0.041292	2.895E-04	1.47988	0.016574	
6.0	65952.4	1516.983	12.121	0.041858	7.323E-04	1.47359	0.016861	
1.0	0.	2258.027	14.1351	-0.01751	-1.144E-04	1.3960	0.01772	
4.0	8.0	1.000E+00	6.361E-02	6.0	8.0	1.000E+00	6.967E-02	
7.0	8.0	1.000E+00	3.946E-02	8.0	8.0	1.000E+00	3.633E-02	
9.0	8.0	1.000E+00	7.862E-02	10.0	8.0	1.000E+00	5.219E-02	
11.0	8.0	1.000E+00	7.206E-02	12.0	8.0	1.000E+00	2.688E-01	
13.0	8.0	1.000E+00	1.480E-01	14.0	8.0	1.000E+00	2.702E-02	
15.0	8.0	1.000E+00	1.785E-03	16.0	8.0	1.000E+00	3.480E-05	
0.0	9.0	1.000E+00	2.349E-04	1.0	9.0	1.000E+00	3.589E-03	
2.0	9.0	1.000E+00	2.182E-02	3.0	9.0	1.000E+00	6.406E-02	
4.0	9.0	1.000E+00	8.349E-02	5.0	9.0	1.000E+00	2.454E-02	
6.0	9.0	1.000E+00	1.289E-02	7.0	9.0	1.000E+00	7.733E-02	
8.0	9.0	1.000E+00	8.360E-03	9.0	9.0	1.000E+00	6.773E-02	
10.0	9.0	1.000E+00	3.765E-02	11.0	9.0	1.000E+00	8.779E-02	
12.0	9.0	1.000E+00	2.857E-02	13.0	9.0	1.000E+00	2.575E-01	
14.0	9.0	1.000E+00	1.326E-01	15.0	9.0	1.000E+00	3.902E-02	

ORIGINAL TABLE
OF POOR QUALITY

16.0	9.0	1.000E+00	2.893E-03	17.0	9.0	1.000E+00	6.131E-05	
9.0	10.0	1.000E+00	8.403E-05	1.0	10.0	1.000E+00	1.463E-03	
2.0	10.0	1.000E+00	1.053E-02	3.0	10.0	1.000E+00	3.917E-02	
4.0	10.0	1.000E+00	7.511E-02	5.0	10.0	1.000E+00	5.820E-02	
6.0	10.0	1.000E+00	2.469E-03	7.0	10.0	1.000E+00	3.833E-02	
8.0	10.0	1.000E+00	6.077E-02	9.0	10.0	1.000E+00	3.194E-04	
10.0	10.0	1.000E+00	8.370E-02	11.0	10.0	1.000E+00	9.012E-02	
12.0	10.0	1.000E+00	1.109E-01	13.0	10.0	1.000E+00	4.687E-03	
14.0	10.0	1.000E+00	2.315E-01	15.0	10.0	1.000E+00	2.154E-01	
16.0	10.0	1.000E+00	5.395E-02	17.0	10.0	1.000E+00	4.483E-03	
18.0	10.0	1.000E+00	1.089E-04	0.0	11.0	1.000E+00	3.038E-05	
1.0	11.0	1.000E+00	5.907E-04	2.0	11.0	1.000E+00	4.895E-03	
3.0	11.0	1.000E+00	2.187E-02	4.0	11.0	1.000E+00	5.519E-02	
5.0	11.0	1.000E+00	7.056E-02	6.0	11.0	1.000E+00	2.819E-02	
7.0	11.0	1.000E+00	2.739E-03	8.0	11.0	1.000E+00	5.721E-02	
9.0	11.0	1.000E+00	3.305E-02	10.0	11.0	1.000E+00	1.307E-02	
11.0	11.0	1.000E+00	7.897E-02	12.0	11.0	1.000E+00	2.617E-05	
13.0	11.0	1.000E+00	1.156E-01	14.0	11.0	1.000E+00	7.733E-04	
15.0	11.0	1.000E+00	1.945E-01	16.0	11.0	1.000E+00	2.443E-01	
17.0	11.0	1.000E+00	7.185E-03	18.0	11.0	1.000E+00	6.675E-03	
19.0	11.0	1.000E+00	1.658E-04	0.0	12.0	1.000E+00	1.114E-05	
1.0	12.0	1.000E+00	2.390E-04	2.0	12.0	1.000E+00	2.212E-03	
3.0	12.0	1.000E+00	1.151E-02	4.0	12.0	1.000E+00	3.567E-02	
5.0	12.0	1.000E+00	6.338E-02	6.0	12.0	1.000E+00	5.261E-02	
7.0	12.0	1.000E+00	6.400E-03	8.0	12.0	1.000E+00	1.952E-02	
9.0	12.0	1.000E+00	5.945E-02	10.0	12.0	1.000E+00	9.576E-03	
11.0	12.0	1.000E+00	3.527E-02	12.0	12.0	1.000E+00	5.946E-02	
13.0	12.0	1.000E+00	9.342E-03	14.0	12.0	1.000E+00	1.029E-01	
15.0	12.0	1.000E+00	1.330E-02	16.0	12.0	1.000E+00	1.516E-01	
17.0	12.0	1.000E+00	2.672E-01	18.0	12.0	1.000E+00	9.261E-02	
19.0	12.0	1.000E+00	9.615E-03	1.0	13.0	1.000E+00	9.827E-05	
3.0	13.0	1.000E+00	9.984E-04	3.0	13.0	1.000E+00	5.824E-03	
4.0	13.0	1.000E+00	2.128E-02	5.0	13.0	1.000E+00	4.795E-02	
42.2-		29.010	1 74 9					
	9	1.00	0.000E+00	0.000E+00	1.148E-03	0.000	0.000	1.00
	7.000	1.00	0.000E+00	0.000E+00	1.212E-03	0.000	42.900	1.00
6.0	89977.9	2047.178	28.445	2.03333	0.535	1.92478	0.019883	
6.0	59306.8	1733.391	14.1221	-0.05698	-3.612E-03	1.6374	0.01791	
3.0	49734.8	1460.518	13.3313	0.005999	1.853E-03	1.45455	0.013003	
1.0	103672.	746.0	0.	0.	0.	1.154	0.0048	
2.0	71698.8	1559.236	11.8974	0.003225	0.	1.489	0.0166	
2.0	69951.2	1894.208	13.9431	0.0079346	-2.911E-04	1.61638	0.017933	
1.0	67739.3	1530.254	12.0747	0.041292	2.896E-04	1.47998	0.016574	
3.0	65852.4	1516.993	12.181	0.041958	7.323E-04	1.47259	0.016861	
1.0	0.	2358.027	14.1351	-0.01751	-1.144E-04	1.9380	0.01772	
0.0	0.0	7.000E-01	4.493E-01	1.0	0.0	7.000E-01	3.399E-01	
2.0	0.0	7.000E-01	1.349E-01	3.0	3.0	7.000E-01	2.363E-02	
4.0	0.0	7.000E-01	2.191E-03	0.0	1.0	7.000E-01	3.297E-01	
1.0	1.0	7.000E-01	1.869E-02	2.0	1.0	7.000E-01	3.223E-01	
3.0	1.0	7.000E-01	2.515E-01	4.0	1.0	7.000E-01	6.957E-02	
0.0	2.0	7.000E-01	1.469E-01	1.0	2.0	7.000E-01	2.039E-01	
2.0	2.0	7.000E-01	3.239E-03	3.0	2.0	7.000E-01	1.630E-01	
4.0	2.0	7.000E-01	3.034E-01	0.0	3.0	7.000E-01	5.226E-02	
1.0	3.0	7.000E-01	2.003E-01	2.0	3.0	7.000E-01	5.957E-02	
3.0	3.0	7.000E-01	1.181E-01	4.0	3.0	7.000E-01	4.752E-02	

ORIGINAL FACTS
OF FOUR CORNERS

0.0	4.0	7.000E-01	1.635E-02	1.0	4.0	7.000E-01	1.124E-01	
2.0	4.0	7.000E-01	1.614E-01	3.0	4.0	7.000E-01	1.841E-03	
4.0	4.0	7.000E-01	1.570E-01	0.0	5.0	7.000E-01	4.726E-03	
1.0	5.0	7.000E-01	4.839E-02	2.0	5.0	7.000E-01	1.427E-01	
3.0	5.0	7.000E-01	8.891E-02	4.0	5.0	7.000E-01	1.416E-02	
0.0	6.0	7.000E-01	1.300E-03	1.0	6.0	7.000E-01	1.790E-02	
2.0	6.0	7.000E-01	8.303E-02	3.0	6.0	7.000E-01	1.345E-01	
4.0	6.0	7.000E-01	2.939E-02	0.0	7.0	7.000E-01	3.463E-04	
1.0	7.0	7.000E-01	6.024E-03	2.0	7.0	7.000E-01	3.960E-02	
3.0	7.0	7.000E-01	1.062E-01	4.0	7.0	7.000E-01	9.955E-02	
0.0	8.0	7.000E-01	9.043E-05	1.0	8.0	7.000E-01	1.905E-03	
2.0	8.0	7.000E-01	1.564E-02	3.0	8.0	7.000E-01	6.161E-02	
4.0	8.0	7.000E-01	1.105E-01	0.0	9.0	7.000E-01	2.332E-05	
1.0	9.0	7.000E-01	5.775E-04	2.0	9.0	7.000E-01	5.793E-03	
3.0	9.0	7.000E-01	2.980E-02	4.0	9.0	7.000E-01	8.023E-02	
1.0	10.0	7.000E-01	1.702E-04	2.0	10.0	7.000E-01	2.018E-03	
3.0	10.0	7.000E-01	1.232E-02	4.0	10.0	7.000E-01	4.614E-02	
1.0	11.0	7.000E-01	4.925E-05	2.0	11.0	7.000E-01	6.738E-04	
3.0	11.0	7.000E-01	5.089E-03	4.0	11.0	7.000E-01	2.292E-02	
1.0	12.0	7.000E-01	1.408E-05	2.0	12.0	7.000E-01	2.184E-04	
3.0	12.0	7.000E-01	1.911E-03	4.0	12.0	7.000E-01	1.032E-02	
2.0	13.0	7.000E-01	6.931E-05	3.0	13.0	7.000E-01	6.892E-04	
4.0	13.0	7.000E-01	4.332E-03	2.0	14.0	7.000E-01	2.169E-05	
3.0	14.0	7.000E-01	2.416E-04	4.0	14.0	7.000E-01	1.731E-03	
3.0	15.0	7.000E-01	8.300E-05	4.0	15.0	7.000E-01	6.671E-04	
4.0	16.0	7.000E-01	2.505E-04	4.0	17.0	7.000E-01	9.226E-05	
4.0	18.0	7.000E-01	3.352E-05	4.0	19.0	7.000E-01	1.207E-05	
N25H2	28.010	1	92	9				
	9	2.00	0.000E+00	0.000E+00	1.213E-08	0.000	0.000	1.00
	7.000	1.00	0.000E+00	0.000E+00	1.094E-08	78710.000	0.000	0.00
1.0	103672.	746.	0.	0.	0.	1.154E+00	0.0048	
1.0	0.	2358.027	14.1351	-0.01751	-1.144E-04	1.998E+00	0.01772	
5.0	39306.8	1733.391	14.1221	-0.05688	-3.612E-03	1.6374	0.01791	
3.0	49754.8	1460.518	13.8313	0.005999	1.853E-03	1.45455	0.019009	
6.0	88977.9	2047.178	28.445	2.08832	0.535	1.82473	0.018683	
2.0	71698.8	1559.236	11.8974	0.003225	0.	1.498	0.0166	
2.0	68951.2	1694.208	13.9491	0.0079346	-2.911E-04	1.61688	0.017933	
1.0	67739.3	1520.254	12.0747	0.041292	2.896E-04	1.47988	0.016574	
6.0	65852.4	1516.883	12.181	0.041858	7.323E-04	1.47359	0.016861	
0.0	5.0	4.400E+00	1.285E-03	0.0	6.0	4.400E+00	3.396E-03	
0.0	7.0	4.400E+00	7.757E-03	0.0	8.0	4.400E+00	1.557E-02	
0.0	9.0	4.400E+00	2.782E-02	0.0	10.0	4.400E+00	4.466E-02	
0.0	11.0	4.400E+00	6.484E-02	0.0	12.0	4.400E+00	8.563E-02	
0.0	13.0	4.400E+00	1.033E-01	0.0	14.0	4.400E+00	1.142E-01	
0.0	15.0	4.400E+00	1.160E-01	0.0	16.0	4.400E+00	1.084E-01	
0.0	17.0	4.400E+00	9.336E-02	0.0	18.0	4.400E+00	7.410E-02	
0.0	19.0	4.400E+00	5.424E-02	0.0	20.0	4.400E+00	3.659E-02	
1.0	5.0	4.400E+00	8.129E-03	1.0	6.0	4.400E+00	1.779E-02	
1.0	7.0	4.400E+00	3.287E-02	1.0	8.0	4.400E+00	5.180E-02	
1.0	9.0	4.400E+00	5.992E-02	1.0	10.0	4.400E+00	8.004E-02	
1.0	11.0	4.400E+00	7.654E-02	1.0	16.0	4.400E+00	9.173E-03	
1.0	17.0	4.400E+00	3.319E-02	1.0	18.0	4.400E+00	6.188E-02	
1.0	19.0	4.400E+00	8.403E-02	1.0	20.0	4.400E+00	9.254E-02	
2.0	2.0	4.400E+00	1.091E-03	2.0	3.0	4.400E+00	4.071E-03	
2.0	4.0	4.400E+00	1.132E-02	2.0	5.0	4.400E+00	2.468E-02	

ORIGINAL PAGE
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2.0	6.0	4.400E+00	4.332E-02	2.0	7.0	4.400E+00	6.166E-02	
2.0	8.0	4.400E+00	7.053E-02	2.0	9.0	4.400E+00	6.251E-02	
2.0	10.0	4.400E+00	3.936E-02	2.0	11.0	4.400E+00	1.305E-02	
2.0	12.0	4.400E+00	9.064E-03	2.0	14.0	4.400E+00	3.287E-02	
2.0	15.0	4.400E+00	5.315E-02	2.0	16.0	4.400E+00	5.418E-02	
2.0	17.0	4.400E+00	3.520E-02	2.0	18.0	4.400E+00	1.091E-02	
2.0	20.0	4.400E+00	1.150E-02	3.0	2.0	4.400E+00	3.720E-03	
3.0	3.0	4.400E+00	1.173E-02	3.0	4.0	4.400E+00	2.695E-02	
3.0	5.0	4.400E+00	4.702E-02	3.0	6.0	4.400E+00	6.286E-02	
3.0	7.0	4.400E+00	6.290E-02	3.0	8.0	4.400E+00	4.333E-02	
3.0	9.0	4.400E+00	1.557E-02	3.0	11.0	4.400E+00	9.250E-03	
3.0	12.0	4.400E+00	3.278E-02	3.0	13.0	4.400E+00	4.631E-02	
3.0	14.0	4.400E+00	3.668E-02	3.0	15.0	4.400E+00	1.271E-02	
3.0	17.0	4.400E+00	1.233E-02	3.0	18.0	4.400E+00	3.772E-02	
3.0	19.0	4.400E+00	5.101E-03	3.0	20.0	4.400E+00	3.937E-02	
4.0	1.0	4.400E+00	5.708E-03	4.0	2.0	4.400E+00	1.942E-02	
4.0	3.0	4.400E+00	4.130E-02	4.0	4.0	4.400E+00	5.878E-02	
4.0	5.0	4.400E+00	5.469E-02	4.0	6.0	4.400E+00	2.809E-02	
4.0	7.0	4.400E+00	3.065E-03	4.0	8.0	4.400E+00	4.927E-03	
4.0	9.0	4.400E+00	2.758E-02	4.0	10.0	4.400E+00	3.852E-02	
4.0	11.0	4.400E+00	2.197E-02	4.0	12.0	4.400E+00	1.637E-03	
4.0	13.0	4.400E+00	6.902E-03	4.0	14.0	4.400E+00	2.922E-02	
4.0	15.0	4.400E+00	3.449E-02	4.0	16.0	4.400E+00	1.460E-02	
4.0	18.0	4.400E+00	1.355E-02	4.0	19.0	4.400E+00	3.561E-02	
4.0	20.0	4.400E+00	3.359E-02	5.0	1.0	4.400E+00	5.708E-03	
5.0	2.0	4.400E+00	1.942E-02	5.0	3.0	4.400E+00	4.130E-02	
5.0	4.0	4.400E+00	5.879E-02	5.0	5.0	4.400E+00	5.469E-02	
5.0	6.0	4.400E+00	2.809E-02	5.0	7.0	4.400E+00	3.065E-03	
5.0	8.0	4.400E+00	4.927E-03	5.0	9.0	4.400E+00	2.758E-02	
5.0	10.0	4.400E+00	3.852E-02	5.0	11.0	4.400E+00	2.137E-02	
42E+2		25.010	1	96	9			
	9	2.00	0.000E+00	0.000E+00	1.213E-03	0.000	0.300	1.00
	7.000	1.00	0.000E+00	0.000E+00	1.394E-03	79710.000	0.000	0.00
1.0	103672.	746.	0.	0.	0.	1.154E+03	0.0048	
1.0	0.	2358.027	14.1251	-0.91751	-1.144E-04	1.993E+03	0.01772	
5.0	59366.8	1733.391	14.1221	-0.05689	-3.612E-03	1.6374	0.01791	
3.0	49754.9	1460.518	13.9313	0.005999	1.853E-03	1.45455	0.018009	
5.0	99977.9	2647.178	28.445	2.98833	0.535	1.82472	0.018683	
2.0	70699.6	1559.226	11.9874	0.003225	0.	1.438	0.0166	
2.0	68951.2	1694.209	13.9491	0.0079346	-2.911E-04	1.61688	0.017933	
1.0	67739.2	1539.254	12.0747	0.041292	2.896E-04	1.47338	0.016574	
6.0	65552.4	1516.883	12.181	0.041858	7.323E-04	1.47359	0.016861	
5.0	13.0	4.400E+00	6.902E-03	5.0	14.0	4.400E+00	2.922E-02	
5.0	15.0	4.400E+00	3.449E-02	5.0	16.0	4.400E+00	1.460E-02	
5.0	18.0	4.400E+00	1.355E-02	5.0	19.0	4.400E+00	3.561E-02	
5.0	20.0	4.400E+00	3.359E-02	6.0	1.0	4.400E+00	1.168E-02	
6.0	2.0	4.400E+00	3.272E-02	6.0	3.0	4.400E+00	5.475E-02	
6.0	4.0	4.400E+00	5.620E-02	6.0	5.0	4.400E+00	3.050E-02	
6.0	6.0	4.400E+00	3.394E-02	6.0	7.0	4.400E+00	5.377E-03	
6.0	8.0	4.400E+00	2.847E-02	6.0	9.0	4.400E+00	3.513E-02	
6.0	10.0	4.400E+00	1.459E-02	6.0	12.0	4.400E+00	1.441E-02	
6.0	13.0	4.400E+00	3.231E-02	6.0	14.0	4.400E+00	2.270E-02	
6.0	15.0	4.400E+00	2.200E-03	6.0	16.0	4.400E+00	6.476E-03	
6.0	17.0	4.400E+00	2.338E-02	6.0	18.0	4.400E+00	3.007E-02	
6.0	19.0	4.400E+00	8.564E-03	6.0	20.0	4.400E+00	1.228E-03	

ORIGINAL PARTS
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7.0	0.0	4.400E+00	4.176E-03	7.0	1.0	4.400E+00	2.062E-02	
7.0	2.0	4.400E+00	4.651E-02	7.0	3.0	4.400E+00	5.846E-02	
7.0	4.0	4.400E+00	3.822E-02	7.0	5.0	4.400E+00	6.758E-03	
7.0	6.0	4.400E+00	3.245E-03	7.0	7.0	4.400E+00	2.516E-02	
7.0	8.0	4.400E+00	3.350E-02	7.0	9.0	4.400E+00	1.227E-02	
7.0	11.0	4.400E+00	1.773E-02	7.0	12.0	4.400E+00	3.046E-02	
7.0	13.0	4.400E+00	1.414E-02	7.0	15.0	4.400E+00	1.501E-02	
7.0	16.0	4.400E+00	3.001E-02	7.0	17.0	4.400E+00	1.592E-02	
7.0	19.0	4.400E+00	1.367E-02	7.0	20.0	4.400E+00	3.152E-02	
8.0	0.0	4.400E+00	7.869E-03	8.0	1.0	4.400E+00	3.197E-02	
8.0	2.0	4.400E+00	5.638E-02	8.0	3.0	4.400E+00	4.940E-02	
8.0	4.0	4.400E+00	1.533E-02	8.0	5.0	4.400E+00	4.457E-04	
8.0	6.0	4.400E+00	2.080E-02	8.0	7.0	4.400E+00	3.340E-02	
8.0	8.0	4.400E+00	1.376E-02	8.0	10.0	4.400E+00	1.745E-02	
8.0	11.0	4.400E+00	2.839E-02	8.0	12.0	4.400E+00	1.026E-02	
8.0	14.0	4.400E+00	1.915E-02	8.0	15.0	4.400E+00	2.624E-02	
8.0	16.0	4.400E+00	7.006E-02	8.0	17.0	4.400E+00	2.257E-03	
8.0	18.0	4.400E+00	2.246E-02	8.0	19.0	4.400E+00	2.524E-02	
8.0	20.0	4.400E+00	4.681E-03	8.0	0.0	4.400E+00	1.343E-02	
9.0	1.0	4.400E+00	4.407E-02	9.0	2.0	4.400E+00	5.932E-02	
9.0	3.0	4.400E+00	3.110E-02	9.0	4.0	4.400E+00	1.250E-03	
9.0	5.0	4.400E+00	1.221E-02	9.0	6.0	4.400E+00	3.262E-02	
9.0	7.0	4.400E+00	1.358E-02	9.0	9.0	4.400E+00	1.439E-02	
9.0	10.0	4.400E+00	2.734E-02	9.0	11.0	4.400E+00	9.869E-03	
9.0	12.0	4.400E+00	1.053E-03	9.0	13.0	4.400E+00	1.971E-02	
9.0	14.0	4.400E+00	2.266E-02	9.0	15.0	4.400E+00	3.346E-03	
9.0	16.0	4.400E+00	5.687E-03	9.0	17.0	4.400E+00	2.459E-02	
9.0	18.0	4.400E+00	1.692E-02	9.0	20.0	4.400E+00	1.309E-02	
10.0	0.0	4.400E+00	2.100E-02	10.0	1.0	4.400E+00	5.445E-02	
10.0	2.0	4.400E+00	5.085E-02	10.0	3.0	4.400E+00	1.209E-02	
10.0	4.0	4.400E+00	2.797E-03	10.0	5.0	4.400E+00	2.752E-02	
10.0	6.0	4.400E+00	2.576E-02	10.0	7.0	4.400E+00	2.114E-03	
10.0	8.0	4.400E+00	9.006E-03	10.0	9.0	4.400E+00	2.641E-02	
10.0	10.0	4.400E+00	1.223E-02	10.0	12.0	4.400E+00	1.801E-02	
10.0	13.0	4.400E+00	2.150E-02	10.0	14.0	4.400E+00	2.462E-03	
N2BH2	23.010	1	34	10				
	10	2.00	0.	0.000000	1.213E-08	0.00	0.00	1.00
	7.00	1.00	0.	0.000000	1.094E-08	78710.00	0.00	0.00
1.0	103672.	751.64	4.92			1.154	0.0048	
	1.000	0.000	2359.610	14.456	.009	-0.001	2.01000	1.870E-02
	2.000	69290.000	1692.010	13.791	-0.349	0.000	1.63700	2.240E-02
	1.000	99227.000	670.000	0.000	0.000	0.000	1.46000	0.
	3.000	97564.000	0.000	0.000	0.000	0.000	0.00000	0.
	3.000	95770.000	2184.500	0.000	0.000	0.000	0.00000	0.
	6.000	99147.300	2035.100	17.080	-2.150	0.000	1.82590	1.970E-02
	2.000	63943.000	1560.100	11.900	0.000	0.000	3.00000	0.
	6.000	59626.300	1734.110	14.470	0.000	0.000	1.63800	1.840E-02
	3.000	50206.000	1460.370	13.991	-0.025	0.000	1.44000	1.300E-02
10.0	15.0	4.400E+00	7.051E-03	10.0	16.0	4.400E+00	2.390E-02	
10.0	17.0	4.400E+00	1.180E-02	10.0	19.0	4.400E+00	1.779E-02	
10.0	20.0	4.400E+00	2.212E-02	11.0	0.0	4.400E+00	3.040E-02	
11.0	1.0	4.400E+00	6.053E-02	11.0	2.0	4.400E+00	3.613E-02	
11.0	3.0	4.400E+00	1.074E-03	11.0	4.0	4.400E+00	1.551E-02	
11.0	5.0	4.400E+00	3.141E-02	11.0	6.0	4.400E+00	9.103E-03	
11.0	7.0	4.400E+00	2.807E-03	11.0	8.0	4.400E+00	2.344E-02	

11.0 9.0 4.400E+00 1.694E-02 11.0 11.0 4.400E+00 1.434E-02
 11.0 12.0 4.400E+00 2.177E-02 11.0 13.0 4.400E+00 3.233E-03
 11.0 14.0 4.400E+00 6.171E-03 11.0 15.0 4.400E+00 2.243E-02
 11.0 16.0 4.400E+00 9.941E-03 11.0 18.0 4.400E+00 1.884E-02
 11.0 19.0 4.400E+00 1.762E-02 12.0 0.0 4.400E+00 4.107E-02
 12.0 1.0 4.400E+00 6.050E-02 12.0 2.0 4.400E+00 1.919E-02
 12.0 3.0 4.400E+00 1.929E-03 12.0 4.0 4.400E+00 2.806E-02
 12.0 5.0 4.400E+00 2.129E-02 12.0 7.0 4.400E+00 1.520E-02
 12.0 8.0 4.400E+00 2.239E-02 12.0 9.0 4.400E+00 2.066E-03
 12.0 10.0 4.400E+00 8.758E-03 12.0 11.0 4.400E+00 2.229E-02
 12.0 12.0 4.400E+00 5.935E-03 12.0 13.0 4.400E+00 3.700E-03
 12.0 14.0 4.400E+00 2.079E-02 12.0 15.0 4.400E+00 1.053E-02
 12.0 17.0 4.400E+00 1.789E-02 12.0 18.0 4.400E+00 1.547E-02
 12.0 20.0 4.400E+00 1.380E-02 13.0 0.0 4.400E+00 5.211E-02
 13.0 1.0 4.400E+00 5.404E-02 13.0 2.0 4.400E+00 5.815E-03
 13.0 3.0 4.400E+00 1.196E-02 13.0 4.0 4.400E+00 3.106E-02
 13.0 5.0 4.400E+00 6.910E-03 13.0 6.0 4.400E+00 5.677E-03
 13.0 7.0 4.400E+00 2.439E-02 13.0 8.0 4.400E+00 8.604E-03
 13.0 9.0 4.400E+00 2.543E-03 13.0 10.0 4.400E+00 2.074E-02
 13.0 11.0 4.400E+00 1.069E-02 13.0 13.0 4.400E+00 1.801E-02
 13.0 14.0 4.400E+00 1.300E-02 13.0 16.0 4.400E+00 1.557E-02
 13.0 17.0 4.400E+00 1.544E-02 13.0 19.0 4.400E+00 1.319E-02
 13.0 20.0 4.400E+00 1.795E-02 14.0 0.0 4.400E+00 6.247E-02
 14.0 1.0 4.400E+00 4.244E-02 14.0 3.0 4.400E+00 2.409E-02
 14.0 4.0 4.400E+00 2.313E-02 14.0 6.0 4.400E+00 1.780E-02
 14.0 7.0 4.400E+00 1.843E-02 14.0 9.0 4.400E+00 1.484E-02
 14.0 10.0 4.400E+00 1.684E-02 14.0 12.0 4.400E+00 1.301E-02
 14.0 13.0 4.400E+00 1.646E-02 14.0 15.0 4.400E+00 1.176E-02
 14.0 16.0 4.400E+00 1.672E-02 14.0 18.0 4.400E+00 1.987E-02
 14.0 19.0 4.400E+00 1.742E-02 15.0 0.0 4.400E+00 7.109E-02
 15.0 1.0 4.400E+00 2.836E-02 15.0 2.0 4.400E+00 2.908E-03
 15.0 3.0 4.400E+00 3.119E-02 15.0 4.0 4.400E+00 1.046E-02
 15.0 5.0 4.400E+00 4.605E-03 15.0 6.0 4.400E+00 2.372E-02
 15.0 7.0 4.400E+00 5.966E-03 15.0 8.0 4.400E+00 5.453E-03
 15.0 9.0 4.400E+00 2.045E-02 15.0 10.0 4.400E+00 4.109E-03
 15.0 11.0 4.400E+00 6.011E-03 15.0 12.0 4.400E+00 1.875E-02
 15.0 13.0 4.400E+00 3.128E-03 15.0 14.0 4.400E+00 6.545E-03
 15.0 15.0 4.400E+00 1.794E-02 15.0 16.0 4.400E+00 2.497E-03
 15.0 17.0 4.400E+00 7.191E-03 15.0 18.0 4.400E+00 1.765E-02
 15.0 19.0 4.400E+00 2.020E-03 15.0 20.0 4.400E+00 8.027E-03

NO 8 30.010 1 96 6
 8 0.00 0.000E+00 0.000E+00 1.417E-08 0.000 0.000 1.00
 7.470 0.00 0.000E+00 0.000E+00 1.151E-08 52400.000 124.200 1.00
 4.000 45362.400 1037.630 7.602 0.097 0.000 1.12700 1.525E-02
 4.000 60.550 1903.855 12.970 -0.001 0.000 1.70460 1.780E-02
 2.000 60629.500 2373.600 15.850 0.000 0.000 1.98620 1.920E-02
 2.000 53093.000 2327.000 23.000 0.000 0.000 1.99170 0.000E+00
 2.000 52148.000 2347.000 0.000 0.000 0.000 1.95500 0.000E+00
 2.000 43965.700 2371.300 14.480 -0.220 0.000 1.99520 1.640E-02
 3.0 0.0 3.000E-02 1.000E-02 4.0 0.0 3.000E-02 3.000E-03
 5.0 0.0 5.000E-02 5.000E-03 6.0 0.0 3.000E-02 1.100E-02
 7.0 0.0 3.000E-02 1.700E-02 8.0 0.0 3.000E-02 2.200E-02
 9.0 0.0 3.000E-02 2.900E-02 10.0 0.0 3.000E-02 3.200E-02
 11.0 0.0 3.000E-02 4.100E-02 12.0 0.0 3.000E-02 5.100E-02
 1.0 1.0 3.000E-02 1.000E-03 2.0 1.0 3.000E-02 4.000E-03

3.0	1.0	8.000E-02	9.000E-03	4.0	1.0	8.000E-02	1.700E-02	
5.0	1.0	8.000E-02	3.200E-02	6.0	1.0	8.000E-02	4.400E-02	
7.0	1.0	8.000E-02	5.900E-02	8.0	1.0	8.000E-02	5.800E-02	
9.0	1.0	8.000E-02	6.000E-02	10.0	1.0	8.000E-02	5.700E-02	
11.0	1.0	8.000E-02	4.800E-02	12.0	1.0	8.000E-02	3.400E-02	
1.0	2.0	8.000E-02	1.000E-03	1.0	2.0	8.000E-02	6.000E-02	
2.0	2.0	8.000E-02	1.800E-02	3.0	2.0	8.000E-02	3.800E-02	
4.0	2.0	8.000E-02	5.400E-02	5.0	2.0	8.000E-02	6.900E-02	
6.0	2.0	8.000E-02	7.000E-02	7.0	2.0	8.000E-02	5.300E-02	
8.0	2.0	8.000E-02	3.600E-02	9.0	2.0	8.000E-02	1.900E-02	
10.0	2.0	8.000E-02	8.000E-03	11.0	2.0	8.000E-02	1.000E-03	
12.0	2.0	8.000E-02	3.000E-03	0.0	3.0	8.000E-02	5.000E-03	
1.0	3.0	8.000E-02	2.400E-02	2.0	3.0	8.000E-02	4.800E-02	
3.0	3.0	8.000E-02	7.600E-02	4.0	3.0	8.000E-02	7.600E-02	
5.0	3.0	8.000E-02	5.700E-02	6.0	3.0	8.000E-02	3.200E-02	
7.0	3.0	8.000E-02	7.000E-03	8.0	3.0	8.000E-02	1.400E-02	
10.0	3.0	8.000E-02	2.000E-02	11.0	3.0	8.000E-02	3.100E-02	
12.0	3.0	8.000E-02	3.800E-02	0.0	4.0	8.000E-02	1.700E-02	
1.0	4.0	8.000E-02	5.100E-02	2.0	4.0	8.000E-02	3.500E-02	
3.0	4.0	8.000E-02	9.400E-02	4.0	4.0	8.000E-02	4.300E-02	
5.0	4.0	8.000E-02	6.000E-03	6.0	4.0	8.000E-02	1.000E-03	
7.0	4.0	8.000E-02	2.400E-02	8.0	4.0	8.000E-02	2.400E-02	
9.0	4.0	8.000E-02	4.200E-02	10.0	4.0	8.000E-02	3.400E-02	
11.0	4.0	8.000E-02	2.000E-02	12.0	4.0	8.000E-02	1.000E-03	
0.0	5.0	8.000E-02	4.100E-02	1.0	5.0	8.000E-02	3.700E-02	
2.0	5.0	8.000E-02	9.200E-02	3.0	5.0	8.000E-02	3.800E-02	
4.0	5.0	8.000E-02	1.900E-03	5.0	5.0	8.000E-02	1.200E-02	
6.0	5.0	8.000E-02	3.800E-03	7.0	5.0	8.000E-02	4.600E-02	
8.0	5.0	8.000E-02	2.700E-02	9.0	5.0	8.000E-02	6.000E-03	
11.0	5.0	8.000E-02	5.000E-03	12.0	5.0	8.000E-02	2.600E-02	
0.0	6.0	8.000E-02	3.200E-02	1.0	6.0	8.000E-02	1.170E-01	
2.0	6.0	8.000E-02	4.700E-02	4.0	6.0	8.000E-02	3.900E-02	
5.0	6.0	8.000E-02	5.300E-02	6.0	6.0	8.000E-02	3.500E-02	
7.0	6.0	8.000E-02	5.000E-03	8.0	6.0	8.000E-02	2.000E-03	
9.0	6.0	8.000E-02	1.800E-02	10.0	6.0	8.000E-02	3.200E-02	
11.0	6.0	8.000E-02	3.100E-02	12.0	6.0	8.000E-02	1.100E-02	
0.0	7.0	8.000E-02	1.250E-01	1.0	7.0	8.000E-02	3.800E-02	
2.0	7.0	8.000E-02	2.000E-03	3.0	7.0	8.000E-02	3.300E-02	
4.0	7.0	8.000E-02	8.800E-02	5.0	7.0	8.000E-02	2.400E-02	
7.0	7.0	8.000E-02	2.300E-02	8.0	7.0	8.000E-02	3.800E-02	
9.0	7.0	8.000E-02	3.100E-02	10.0	7.0	8.000E-02	1.000E-02	
12.0	7.0	8.000E-02	1.300E-02	0.0	8.0	8.000E-02	1.530E-01	
NO E		30.010	1 94	6				
	6	0.00	0.000E+00	0.000E+00	1.417E-08	0.000	0.000	1.00
	7.471	0.00	0.000E+00	0.000E+00	1.151E-08	52480.000	124.200	1.00
	4.000	45832.400	1037.680	7.682	0.097	0.000	1.12700	1.525E-02
	4.000	60.550	1903.855	13.970	-0.001	0.000	1.70450	1.788E-02
	2.000	50628.500	2373.600	15.850	0.000	0.000	1.98630	1.820E-02
	2.000	53063.000	2327.000	23.000	0.000	0.000	1.99170	0.000E+00
	2.000	52148.000	2347.000	9.000	0.000	0.000	1.95500	0.000E+00
	2.000	42955.700	2571.200	14.450	-0.230	0.000	1.99520	1.540E-02
	1.0	8.0	8.000E-02	2.300E-02	2.0	8.0	8.000E-02	2.100E-02
	3.0	8.0	8.000E-02	6.200E-02	4.0	8.0	8.000E-02	2.100E-02
	5.0	8.0	8.000E-02	4.000E-03	6.0	8.0	8.000E-02	3.100E-02
	7.0	8.0	8.000E-02	3.600E-02	8.0	8.0	8.000E-02	1.400E-02

10.0	8.0	8.000E-02	1.400E-02	11.0	8.0	8.000E-02	2.800E-02
12.0	8.0	8.000E-02	2.000E-02	0.0	9.0	8.000E-02	1.670E-01
2.0	9.0	8.000E-02	7.300E-02	3.0	9.0	8.000E-02	4.200E-02
4.0	9.0	8.000E-02	8.000E-03	5.0	9.0	8.000E-02	4.600E-02
6.0	9.0	8.000E-02	8.400E-02	7.0	9.0	8.000E-02	1.000E-03
8.0	9.0	8.000E-02	1.300E-02	9.0	9.0	8.990E-02	3.000E-02
10.0	9.0	8.000E-02	2.700E-02	11.0	9.0	8.000E-02	9.000E-03
12.0	9.0	8.000E-02	3.000E-03	0.0	10.0	8.000E-02	1.520E-01
1.0	10.0	8.000E-02	2.100E-02	2.0	10.0	8.000E-02	8.200E-02
3.0	10.0	8.000E-02	1.000E-03	4.0	10.0	8.000E-02	3.900E-02
5.0	10.0	8.000E-02	3.700E-02	6.0	10.0	8.000E-02	1.000E-03
7.0	10.0	8.000E-02	2.200E-02	8.0	10.0	8.000E-02	3.500E-02
9.0	10.0	8.000E-02	1.800E-02	11.0	10.0	8.000E-02	8.000E-03
12.0	10.0	8.000E-02	2.600E-02	0.0	11.0	8.000E-02	1.140E-01
1.0	11.0	8.000E-02	7.400E-02	2.0	11.0	8.000E-02	4.100E-02
3.0	11.0	8.000E-02	2.400E-02	4.0	11.0	8.000E-02	5.400E-02
5.0	11.0	8.000E-02	1.800E-02	6.0	11.0	8.000E-02	2.500E-02
7.0	11.0	8.000E-02	4.000E-02	8.0	11.0	8.000E-02	2.000E-03
9.0	11.0	8.000E-02	8.000E-03	10.0	11.0	8.000E-02	2.400E-02
11.0	11.0	8.000E-02	2.600E-02	12.0	11.0	8.000E-02	1.000E-03
0.0	12.0	8.000E-02	7.600E-02	1.0	12.0	8.000E-02	1.260E-01
3.0	12.0	8.000E-02	7.200E-02	4.0	12.0	8.000E-02	1.200E-02
5.0	12.0	8.000E-02	2.500E-02	6.0	12.0	8.000E-02	4.300E-02
7.0	12.0	8.000E-02	2.000E-03	8.0	12.0	8.000E-02	1.730E-02
9.0	12.0	8.000E-02	3.400E-02	10.0	12.0	8.000E-02	1.400E-02
12.0	12.0	8.000E-02	1.200E-02	0.0	13.0	8.000E-02	3.200E-02
1.0	13.0	8.000E-02	1.390E-01	2.0	13.0	8.000E-02	1.800E-02
3.0	13.0	8.000E-02	5.400E-02	4.0	13.0	8.000E-02	1.700E-02
5.0	13.0	8.000E-02	5.200E-02	6.0	13.0	8.000E-02	2.000E-03
7.0	13.0	8.000E-02	2.800E-02	8.0	13.0	8.000E-02	2.700E-03
9.0	13.0	8.000E-02	2.000E-03	10.0	13.0	8.000E-02	1.400E-02
11.0	13.0	8.000E-02	3.200E-02	12.0	13.0	8.000E-02	7.000E-03
0.0	14.0	8.000E-02	1.600E-02	1.0	14.0	8.000E-02	1.050E-01
2.0	14.0	8.000E-02	8.200E-02	3.0	14.0	8.000E-02	9.000E-03
4.0	14.0	8.000E-02	6.600E-02	5.0	14.0	8.000E-02	1.400E-02
6.0	14.0	8.000E-02	1.800E-02	7.0	14.0	8.000E-02	3.400E-02
9.0	14.0	8.000E-02	2.100E-03	10.0	14.0	8.000E-02	2.700E-02
11.0	14.0	8.000E-02	8.000E-03	12.0	14.0	8.000E-02	8.000E-03
0.0	15.0	8.000E-02	7.000E-03	1.0	15.0	8.000E-02	6.800E-02
2.0	15.0	8.000E-02	1.260E-01	3.0	15.0	8.000E-02	1.300E-02
4.0	15.0	8.000E-02	5.600E-02	5.0	15.0	8.000E-02	1.000E-02
6.0	15.0	8.000E-02	5.000E-03	9.0	15.0	8.000E-02	3.300E-02
9.0	15.0	8.000E-02	2.000E-02	11.0	15.0	8.000E-02	1.800E-02
10.0	15.0	8.000E-02	1.400E-02	12.0	15.0	8.000E-02	1.800E-02
0.0	16.0	8.000E-02	2.000E-03	1.0	16.0	8.000E-02	2.800E-02
2.0	16.0	8.000E-02	1.240E-01	3.0	16.0	8.000E-02	8.600E-02
4.0	16.0	8.000E-02	5.000E-03	5.0	16.0	8.000E-02	6.300E-02

ORIGINAL PAPER
OF POOR QUALITY

40.0	6	30.000	1.40	6	0.000E+00	0.000E+00	1.417E-08	0.000	0.000	1.00
7.470	0.0	0.000E+00	0.000E+00	1.151E-08	52400.000	124.200	1.00			
4.000	45933.400	1937.690	7.600	0.097	0.000	1.12700	1.525E-02			
4.000	60.500	1903.955	13.970	-0.001	0.000	1.70460	1.730E-02			
2.000	80629.500	2373.600	15.850	0.000	0.000	1.98630	1.820E-02			
2.000	53093.000	2327.000	23.000	0.000	0.000	1.99170	0.000E+00			
2.000	52149.000	2347.000	0.000	0.000	0.000	1.95500	0.000E+00			
2.000	42965.700	2371.300	14.480	-0.280	0.000	1.99520	1.640E-02			
0.0	16.0	8.000E-02	2.000E-03	1.0	16.0	8.000E-02	2.800E-02			
2.0	16.0	8.000E-02	1.240E-01	3.0	16.0	8.000E-02	8.600E-02			
4.0	16.0	8.000E-02	5.000E-03	5.0	16.0	8.000E-02	6.300E-02			

6.0	16.0	8.000E-02	6.000E-03	7.0	16.0	8.000E-02	3.100E-02
8.0	16.0	8.000E-02	2.200E-02	10.0	16.0	8.000E-02	2.700E-02
11.0	16.0	8.000E-02	2.200E-02	12.0	16.0	8.000E-02	1.000E-03
1.0	17.0	8.000E-02	1.200E-02	2.0	17.0	8.000E-02	7.700E-02
3.0	17.0	8.000E-02	1.340E-01	4.0	17.0	8.000E-02	2.900E-02
5.0	17.0	8.000E-02	5.000E-02	6.0	17.0	8.000E-02	1.800E-02
7.0	17.0	8.000E-02	4.200E-02	9.0	17.0	8.000E-02	3.200E-02
10.0	17.0	8.000E-02	1.600E-02	11.0	17.0	8.000E-02	2.000E-03
12.0	17.0	8.000E-02	3.100E-02	1.0	18.0	8.000E-02	4.000E-03
3.0	18.0	8.000E-02	5.000E-02	3.0	18.0	8.000E-02	1.150E-01
4.0	18.0	8.000E-02	7.700E-02	5.0	18.0	8.000E-02	3.000E-03
6.0	18.0	8.000E-02	6.200E-02	7.0	18.0	8.000E-02	1.000E-03
8.0	18.0	8.000E-02	2.500E-02	9.0	18.0	8.000E-02	2.200E-02
10.0	18.0	8.000E-02	3.000E-03	11.0	18.0	8.000E-02	2.900E-02
12.0	18.0	8.000E-02	5.000E-03	1.0	19.0	8.000E-02	1.300E-03
2.0	19.0	8.000E-02	1.000E-02	3.0	19.0	8.000E-02	6.900E-02
4.0	19.0	8.000E-02	1.290E-01	5.0	19.0	8.000E-02	3.000E-02
6.0	19.0	8.000E-02	4.000E-02	7.0	19.0	8.000E-02	3.300E-02
8.0	19.0	8.000E-02	3.200E-02	9.0	19.0	8.000E-02	8.000E-03
10.0	19.0	8.000E-02	4.100E-02	11.0	19.0	8.000E-02	6.000E-03
NO 3		30.010	3 98	6			
	6	0.00	0.000E+00	0.000E+00	1.064E-08	0.000	0.000
7.470	0.00	0.000E+00	0.000E+00	1.151E-08	52400.000	124.200	1.00
2.000	42965.700	2371.300	14.400	-0.280	0.000	1.99520	1.640E-02
4.000	60.550	1903.855	13.970	-0.001	0.000	1.70460	1.780E-02
2.000	60629.500	2373.600	15.850	0.000	0.000	1.98620	1.820E-02
2.000	53093.000	2327.000	23.000	0.000	0.000	1.99170	0.000E+00
2.000	52142.000	2347.000	0.000	0.000	0.000	1.95500	0.000E+00
4.000	45932.400	1037.680	7.603	0.097	0.000	1.12700	1.525E-02
0.0	0.0	2.500E-02	2.270E-01	1.0	0.0	2.500E-02	3.670E-01
2.0	0.0	2.500E-02	2.750E-01	3.0	0.0	2.500E-02	9.900E-02
4.0	0.0	2.500E-02	2.600E-02	5.0	0.0	2.500E-02	5.000E-03
6.0	0.0	2.500E-02	2.000E-03	0.0	1.0	2.500E-02	3.050E-01
1.0	1.0	2.500E-02	5.600E-02	2.0	1.0	2.500E-02	8.700E-02
3.0	1.0	2.500E-02	2.740E-01	4.0	1.0	2.500E-02	1.930E-01
5.0	1.0	2.500E-02	7.700E-02	6.0	1.0	2.500E-02	1.000E-02
7.0	1.0	2.500E-02	1.000E-03	0.0	2.0	2.500E-02	2.180E-01
1.0	2.0	2.500E-02	2.400E-02	2.0	2.0	2.500E-02	1.690E-01
3.0	2.0	2.500E-02	1.000E-03	4.0	2.0	2.500E-02	1.740E-01
5.0	2.0	2.500E-02	2.700E-01	6.0	2.0	2.500E-02	1.050E-01
7.0	2.0	2.500E-02	3.090E-02	8.0	2.0	2.500E-02	3.000E-03
0.0	3.0	2.500E-02	1.330E-01	1.0	3.0	2.500E-02	1.330E-01
2.0	3.0	2.500E-02	1.500E-02	3.0	3.0	2.500E-02	1.120E-01
4.0	3.0	2.500E-02	5.300E-02	5.0	3.0	2.500E-02	4.200E-02
6.0	3.0	2.500E-02	2.340E-01	7.0	3.0	2.500E-02	1.920E-01
8.0	3.0	2.500E-02	6.000E-02	9.0	3.0	2.500E-02	1.600E-02
10.0	3.0	2.500E-02	3.000E-03	0.0	4.0	2.500E-02	6.500E-02
1.0	4.0	2.500E-02	1.600E-01	2.0	4.0	2.500E-02	2.000E-02
3.0	4.0	2.500E-02	3.400E-02	4.0	4.0	2.500E-02	2.000E-02
5.0	4.0	2.500E-02	1.270E-01	6.0	4.0	2.500E-02	6.000E-03
7.0	4.0	2.500E-02	1.490E-01	8.0	4.0	2.500E-02	2.210E-01
9.0	4.0	2.500E-02	1.100E-01	10.0	4.0	2.500E-02	2.400E-02
11.0	4.0	2.500E-02	4.000E-03	12.0	4.0	2.500E-02	1.000E-03
0.0	5.0	2.500E-02	2.800E-02	1.0	5.0	2.500E-02	1.260E-01
2.0	5.0	2.500E-02	9.200E-02	4.0	5.0	2.500E-02	1.090E-01

6.0	5.0	2.500E-02	1.270E-01	7.0	5.0	2.500E-02	1.800E-02	
8.0	5.0	2.500E-02	5.200E-02	9.0	5.0	2.500E-02	2.300E-01	
10.0	5.0	2.500E-02	1.390E-01	11.0	5.0	2.500E-02	6.100E-02	
12.0	5.0	2.500E-02	1.300E-02	0.0	6.0	2.500E-02	1.000E-02	
1.0	6.0	2.500E-02	7.000E-02	2.0	6.0	2.500E-02	1.250E-01	
3.0	6.0	2.500E-02	2.600E-02	4.0	6.0	2.500E-02	5.600E-02	
5.0	6.0	2.500E-02	6.200E-02	6.0	6.0	2.500E-02	2.200E-02	
7.0	6.0	2.500E-02	4.900E-02	8.0	6.0	2.500E-02	9.300E-02	
9.0	6.0	2.500E-02	6.000E-03	10.0	6.0	2.500E-02	1.790E-01	
11.0	6.0	2.500E-02	1.860E-01	12.0	6.0	2.500E-02	9.300E-02	
0.0	7.0	2.500E-02	3.000E-03	1.0	7.0	2.500E-02	3.400E-02	
2.0	7.0	2.500E-02	1.060E-01	3.0	7.0	2.500E-02	8.500E-02	
5.0	7.0	2.500E-02	8.200E-02	6.0	7.0	2.500E-02	2.600E-02	
7.0	7.0	2.500E-02	7.700E-02	8.0	7.0	2.500E-02	2.500E-02	
9.0	7.0	2.500E-02	1.060E-01	10.0	7.0	2.500E-02	2.000E-03	
11.0	7.0	2.500E-02	1.230E-01	12.0	7.0	2.500E-02	2.040E-01	
0.0	8.0	2.500E-02	2.000E-03	1.0	8.0	2.500E-02	1.300E-02	
2.0	8.0	2.500E-02	6.190E-02	3.0	8.0	2.500E-02	1.010E-01	
4.0	8.0	2.500E-02	3.100E-02	5.0	8.0	2.500E-02	2.100E-02	
6.0	8.0	2.500E-02	9.200E-02	7.0	8.0	2.500E-02	5.000E-03	
8.0	8.0	2.500E-02	9.200E-02	9.0	8.0	2.500E-02	3.000E-03	
10.0	8.0	2.500E-02	9.900E-02	11.0	8.0	2.500E-02	2.600E-02	
12.0	8.0	2.500E-02	6.200E-02	0.0	9.0	2.500E-02	1.000E-03	
NO 0	30.010	3	98	6				
	6	0.00	0.000E+00	0.000E+00	1.064E-08	0.000	0.000	0.00
	7.470	0.00	0.000E+00	0.000E+00	1.151E-08	52400.000	124.200	1.00
	2.000	43965.700	2371.300	14.480	-0.280	0.000	1.99520	1.640E-02
	4.000	60.550	1903.855	13.970	-0.001	0.000	1.70460	1.780E-02
	2.000	60628.500	2373.600	15.850	0.000	0.000	1.98630	1.820E-02
	2.000	53083.000	2327.000	23.000	0.300	0.000	1.99170	0.000E+00
	2.000	52148.000	2347.000	0.000	0.000	0.000	1.95500	0.000E+00
	4.000	45932.400	1037.680	7.603	0.097	0.000	1.12700	1.525E-02
2.0	9.0	2.500E-02	2.800E-02	3.0	9.0	2.500E-02	8.300E-02	
4.0	9.0	2.500E-02	8.300E-02	6.0	9.0	2.500E-02	3.600E-02	
7.0	9.0	2.500E-02	5.500E-02	8.0	9.0	2.500E-02	1.800E-02	
9.0	9.0	2.500E-02	7.500E-02	10.0	9.0	2.500E-02	1.600E-02	
11.0	9.0	2.500E-02	8.000E-02	12.0	9.0	2.500E-02	6.900E-02	
1.0	10.0	2.500E-02	3.000E-03	2.0	10.0	2.500E-02	1.400E-02	
3.0	10.0	2.500E-02	6.000E-02	4.0	10.0	2.500E-02	9.900E-02	
5.0	10.0	2.500E-02	2.500E-02	7.0	10.0	2.500E-02	6.800E-02	
8.0	10.0	2.500E-02	1.100E-02	9.0	10.0	2.500E-02	3.400E-02	
10.0	10.0	2.500E-02	5.300E-02	11.0	10.0	2.500E-02	2.500E-02	
12.0	10.0	2.500E-02	4.500E-02	1.0	11.0	2.500E-02	1.000E-03	
2.0	11.0	2.500E-02	7.000E-03	3.0	11.0	2.500E-02	3.300E-02	
4.0	11.0	2.500E-02	6.700E-02	5.0	11.0	2.500E-02	7.100E-02	
6.0	11.0	2.500E-02	1.700E-02	7.0	11.0	2.500E-02	3.000E-02	
8.0	11.0	2.500E-02	5.900E-02	9.0	11.0	2.500E-02	3.000E-03	
10.0	11.0	2.500E-02	6.300E-02	11.0	11.0	2.500E-02	2.400E-02	
12.0	11.0	2.500E-02	5.500E-02	2.0	12.0	2.500E-02	4.000E-03	
3.0	12.0	2.500E-02	1.400E-02	4.0	12.0	2.500E-02	4.000E-02	
5.0	12.0	2.500E-02	7.500E-02	6.0	12.0	2.500E-02	6.500E-02	
8.0	12.0	2.500E-02	1.700E-02	9.0	12.0	2.500E-02	4.100E-02	
10.0	12.0	2.500E-02	2.000E-03	11.0	12.0	2.500E-02	6.500E-02	
12.0	12.0	2.500E-02	2.000E-03	2.0	13.0	2.500E-02	2.000E-03	
3.0	13.0	2.500E-02	7.000E-03	4.0	13.0	2.500E-02	3.200E-02	

ORIGINAL FILE
OF POOR QUALITY

ORDER OF POOR

5.0	13.0	2.500E-02	5.900E-02	6.0	13.0	2.500E-02	7.400E-02
7.0	13.0	2.500E-02	2.000E-02	8.0	13.0	2.500E-02	4.100E-02
9.0	13.0	2.500E-02	5.300E-02	10.0	13.0	2.500E-02	1.400E-02
11.0	13.0	2.500E-02	3.200E-02	12.0	13.0	2.500E-02	5.400E-02
2.0	14.0	2.500E-02	1.900E-02	3.0	14.0	2.500E-02	3.000E-02
4.0	14.0	2.500E-02	1.400E-02	5.0	14.0	2.500E-02	3.800E-02
6.0	14.0	2.500E-02	6.500E-02	7.0	14.0	2.500E-02	6.100E-02
8.0	14.0	2.500E-02	2.100E-02	9.0	14.0	2.500E-02	2.000E-02
10.0	14.0	2.500E-02	5.000E-02	11.0	14.0	2.500E-02	9.000E-02
12.0	14.0	2.500E-02	2.900E-02	3.0	15.0	2.500E-02	1.000E-02
4.0	15.0	2.500E-02	7.000E-02	5.0	15.0	2.500E-02	2.400E-02
6.0	15.0	2.500E-02	5.600E-02	7.0	15.0	2.500E-02	7.100E-02
8.0	15.0	2.500E-02	1.300E-02	9.0	15.0	2.500E-02	8.000E-02
10.0	15.0	2.500E-02	3.400E-02	11.0	15.0	2.500E-02	3.500E-02
12.0	15.0	2.500E-02	3.000E-02	4.0	16.0	2.500E-02	5.000E-02
5.0	16.0	2.500E-02	1.100E-02	6.0	16.0	2.500E-02	3.200E-02
7.0	16.0	2.500E-02	5.400E-02	8.0	16.0	2.500E-02	5.200E-02
9.0	16.0	2.500E-02	4.000E-02	10.0	16.0	2.500E-02	1.200E-02
11.0	16.0	2.500E-02	4.800E-02	12.0	16.0	2.500E-02	1.400E-02
4.0	17.0	2.500E-02	1.000E-02	5.0	17.0	2.500E-02	7.000E-02
6.0	17.0	2.500E-02	1.800E-02	7.0	17.0	2.500E-02	4.400E-02
8.0	17.0	2.500E-02	6.200E-02	9.0	17.0	2.500E-02	3.400E-02
11.0	17.0	2.500E-02	1.700E-02	12.0	17.0	2.500E-02	3.200E-02
5.0	18.0	2.500E-02	1.000E-02	6.0	18.0	2.500E-02	6.000E-02
7.0	18.0	2.500E-02	2.800E-02	8.0	18.0	2.500E-02	5.600E-02
9.0	18.0	2.500E-02	5.400E-02	10.0	18.0	2.500E-02	2.500E-02
02 SR	32.000	1	100	5			
5	1.00	0.000E+00	0.000E+00	1.604E-08	14300.000	0.000	0.00
8.000	0.00	0.000E+00	0.000E+00	1.207E-08	47600.000	0.000	0.00
3.000	4802.100	700.360	8.002	-0.375	0.000	0.81900	1.100E-02
3.000	0.000	1580.361	12.073	0.055	-0.001	1.44567	1.579E-02
3.000	36096.000	819.000	22.500	0.000	0.000	1.05000	0.000E+00
1.000	13195.220	1432.687	13.950	-0.011	0.000	1.40042	1.817E-02
2.000	7918.100	1509.300	12.900	0.000	0.000	1.42640	1.710E-02
0.0	7.0	5.000E-01	4.723E-03	0.0	8.0	5.000E-01	1.253E-02
0.0	9.0	5.000E-01	2.802E-02	0.0	10.0	5.000E-01	5.326E-02
0.0	11.0	5.000E-01	8.667E-02	0.0	12.0	5.000E-01	1.213E-01
0.0	13.0	5.000E-01	1.465E-01	0.0	14.0	5.000E-01	1.529E-01
0.0	15.0	5.000E-01	1.379E-01	0.0	16.0	5.000E-01	1.080E-01
0.0	17.0	5.000E-01	7.210E-02	0.0	18.0	5.000E-01	4.159E-02
0.0	19.0	5.000E-01	2.051E-02	0.0	20.0	5.000E-01	8.560E-03
1.0	5.0	5.000E-01	2.407E-03	1.0	6.0	5.000E-01	7.886E-03
1.0	7.0	5.000E-01	2.049E-02	1.0	8.0	5.000E-01	4.262E-02
1.0	9.0	5.000E-01	7.981E-02	1.0	10.0	5.000E-01	9.271E-02
1.0	11.0	5.000E-01	9.195E-02	1.0	12.0	5.000E-01	6.286E-02
1.0	13.0	5.000E-01	2.184E-02	1.0	14.0	5.000E-01	1.026E-02
1.0	15.0	5.000E-01	1.833E-02	1.0	16.0	5.000E-01	6.704E-02
1.0	17.0	5.000E-01	1.137E-01	1.0	18.0	5.000E-01	1.301E-01
1.0	19.0	5.000E-01	1.121E-01	1.0	20.0	5.000E-01	7.598E-02
1.0	21.0	5.000E-01	4.138E-02	2.0	4.0	5.000E-01	2.200E-03
2.0	5.0	5.000E-01	7.886E-03	2.0	6.0	5.000E-01	2.138E-02
2.0	7.0	5.000E-01	4.420E-02	2.0	8.0	5.000E-01	6.899E-02
2.0	9.0	5.000E-01	7.920E-02	2.0	10.0	5.000E-01	5.805E-02
2.0	11.0	5.000E-01	2.000E-02	2.0	13.0	5.000E-01	2.140E-02
2.0	14.0	5.000E-01	6.073E-02	2.0	15.0	5.000E-01	6.959E-02

2.0	16.0	5.000E-01	3.556E-02	2.0	17.0	5.000E-01	1.924E-03
2.0	18.0	5.000E-01	1.536E-02	2.0	19.0	5.000E-01	7.004E-02
2.0	20.0	5.000E-01	1.182E-01	2.0	21.0	5.000E-01	1.245E-01
3.0	4.0	5.000E-01	5.844E-03	3.0	5.0	5.000E-01	1.767E-02
3.0	6.0	5.000E-01	3.296E-02	3.0	7.0	5.000E-01	6.189E-02
3.0	8.0	5.000E-01	6.716E-02	3.0	9.0	5.000E-01	4.257E-02
3.0	10.0	5.000E-01	8.035E-03	3.0	11.0	5.000E-01	3.644E-03
3.0	12.0	5.000E-01	2.544E-02	3.0	13.0	5.000E-01	5.617E-02
3.0	14.0	5.000E-01	3.187E-02	3.0	16.0	5.000E-01	1.776E-02
3.0	17.0	5.000E-01	5.938E-02	3.0	18.0	5.000E-01	5.971E-02
3.0	19.0	5.000E-01	1.770E-02	3.0	21.0	5.000E-01	4.695E-02
4.0	3.0	5.000E-01	3.310E-03	4.0	4.0	5.000E-01	1.202E-02
4.0	5.0	5.000E-01	3.033E-02	4.0	6.0	5.000E-01	5.306E-02
4.0	7.0	5.000E-01	6.118E-02	4.0	8.0	5.000E-01	3.937E-02
4.0	9.0	5.000E-01	6.993E-03	4.0	10.0	5.000E-01	4.802E-03
4.0	11.0	5.000E-01	3.540E-02	4.0	12.0	5.000E-01	4.551E-02
4.0	13.0	5.000E-01	1.519E-02	4.0	14.0	5.000E-01	1.519E-03
4.0	15.0	5.000E-01	3.357E-02	4.0	16.0	5.000E-01	4.976E-02
4.0	17.0	5.000E-01	1.687E-02	4.0	18.0	5.000E-01	2.120E-03
4.0	19.0	5.000E-01	4.176E-02	4.0	20.0	5.000E-01	6.476E-03
4.0	21.0	5.000E-01	2.800E-03	5.0	3.0	5.000E-01	6.558E-03
5.0	4.0	5.000E-01	2.038E-02	5.0	5.0	5.000E-01	4.224E-02
5.0	6.0	5.000E-01	5.654E-02	5.0	7.0	5.000E-01	4.268E-02
5.0	8.0	5.000E-01	1.022E-02	5.0	9.0	5.000E-01	2.305E-03
5.0	10.0	5.000E-01	2.965E-02	5.0	11.0	5.000E-01	4.003E-02
5.0	12.0	5.000E-01	1.149E-02	5.0	13.0	5.000E-01	3.120E-03
5.0	14.0	5.000E-01	3.425E-02	5.0	15.0	5.000E-01	3.611E-02
5.0	16.0	5.000E-01	3.720E-03	5.0	17.0	5.000E-01	1.360E-02
5.0	18.0	5.000E-01	4.762E-02	5.0	19.0	5.000E-01	2.937E-02
02 SR		32.000	1 100	5			
	5 1.0	0.	0.	1.604E-08	14300.	0.	0.
9.0	0.	0.	0.	1.207E-08	47600.	0.	0.
3.000	49802.1	700.36	8.002	-.375	0.	0.819	0.0110
3.0	0.	1580.361	12.073	0.055	-0.001	1.44567	0.01579
3.0	36096.0	819.	22.5	0.	0.	1.05	0.
1.0	12195.22	1432.687	13.95	-0.011	0.	1.4004	0.01817
2.0	7918.1	1509.3	12.9	0.	0.	1.4264	0.01710
5.0	21.0	5.000E-01	3.390E-02	6.0	2.0	5.000E-01	2.684E-03
6.0	3.0	5.000E-01	1.121E-02	6.0	4.0	5.000E-01	2.956E-02
6.0	5.0	5.000E-01	4.930E-02	6.0	6.0	5.000E-01	4.767E-02
6.0	7.0	5.000E-01	1.875E-02	6.0	9.0	5.000E-01	2.025E-02
6.0	10.0	5.000E-01	3.754E-02	6.0	11.0	5.000E-01	1.415E-02
6.0	12.0	5.000E-01	1.541E-03	6.0	13.0	5.000E-01	2.919E-02
6.0	14.0	5.000E-01	3.050E-02	6.0	15.0	5.000E-01	1.698E-02
6.0	16.0	5.000E-01	1.677E-02	6.0	17.0	5.000E-01	4.000E-02
6.0	18.0	5.000E-01	1.169E-02	6.0	19.0	5.000E-01	6.046E-03
6.0	20.0	5.000E-01	4.371E-02	6.0	21.0	5.000E-01	3.137E-02
7.0	2.0	5.000E-01	4.661E-03	7.0	3.0	5.000E-01	1.698E-02
7.0	4.0	5.000E-01	3.759E-02	7.0	5.0	5.000E-01	4.900E-02
7.0	6.0	5.000E-01	3.094E-02	7.0	7.0	5.000E-01	2.485E-03
7.0	8.0	5.000E-01	8.958E-03	7.0	9.0	5.000E-01	3.321E-02
7.0	10.0	5.000E-01	2.094E-02	7.0	12.0	5.000E-01	2.098E-02
7.0	13.0	5.000E-01	3.004E-02	7.0	14.0	5.000E-01	3.011E-03
7.0	15.0	5.000E-01	3.305E-02	7.0	16.0	5.000E-01	3.437E-02
7.0	17.0	5.000E-01	8.005E-03	7.0	18.0	5.000E-01	8.607E-03

ORIGINAL PAGE
OF POOR QUALITY

7.0	19.0	5.000E-01	3.852E-02	7.0	20.0	5.000E-01	1.472E-02
7.0	21.0	5.000E-01	4.996E-03	8.0	2.0	5.000E-01	7.343E-03
8.0	3.0	5.000E-01	2.323E-02	8.0	4.0	5.000E-01	4.259E-02
8.0	5.0	5.000E-01	4.158E-02	8.0	6.0	5.000E-01	1.399E-02
8.0	8.0	5.000E-01	2.307E-02	8.0	9.0	5.000E-01	2.830E-02
8.0	10.0	5.000E-01	3.144E-03	8.0	11.0	5.000E-01	1.033E-02
8.0	12.0	5.000E-01	2.975E-02	8.0	13.0	5.000E-01	7.896E-03
8.0	14.0	5.000E-01	6.209E-03	8.0	15.0	5.000E-01	3.032E-02
8.0	16.0	5.000E-01	1.014E-02	8.0	17.0	5.000E-01	5.727E-03
9.0	18.0	5.000E-01	3.281E-02	8.0	19.0	5.000E-01	1.098E-02
9.0	20.0	5.000E-01	6.914E-03	8.0	21.0	5.000E-01	3.776E-02
9.0	1.0	5.000E-01	2.088E-03	9.0	2.0	5.000E-01	1.065E-02
9.0	3.0	5.000E-01	2.910E-02	9.0	4.0	5.000E-01	4.341E-02
9.0	5.0	5.000E-01	2.967E-02	9.0	6.0	5.000E-01	2.828E-03
9.0	7.0	5.000E-01	8.790E-03	9.0	8.0	5.000E-01	2.931E-02
9.0	9.0	5.000E-01	1.313E-02	9.0	11.0	5.000E-01	2.422E-02
9.0	12.0	5.000E-01	1.651E-02	9.0	14.0	5.000E-01	2.382E-02
9.0	15.0	5.000E-01	1.687E-02	9.0	17.0	5.000E-01	2.692E-02
9.0	18.0	5.000E-01	1.340E-02	9.0	19.0	5.000E-01	3.987E-03
9.0	20.0	5.000E-01	3.189E-02	9.0	21.0	5.000E-01	9.477E-03
10.0	1.0	5.000E-01	3.172E-03	10.0	2.0	5.000E-01	1.439E-02
10.0	3.0	5.000E-01	3.372E-02	10.0	4.0	5.000E-01	4.000E-02
10.0	5.0	5.000E-01	1.701E-02	10.0	7.0	5.000E-01	1.904E-02
10.0	8.0	5.000E-01	2.433E-02	10.0	9.0	5.000E-01	1.735E-03
10.0	10.0	5.000E-01	1.193E-02	10.0	11.0	5.000E-01	2.385E-02
10.0	12.0	5.000E-01	1.969E-03	10.0	13.0	5.000E-01	1.272E-02
10.0	14.0	5.000E-01	2.247E-02	10.0	16.0	5.000E-01	1.795E-02
10.0	17.0	5.000E-01	1.902E-02	10.0	19.0	5.000E-01	2.545E-02
10.0	20.0	5.000E-01	1.242E-02	10.0	21.0	5.000E-01	5.561E-03
11.0	1.0	5.000E-01	4.537E-03	11.0	2.0	5.000E-01	1.828E-02
11.0	3.0	5.000E-01	3.245E-02	11.0	4.0	5.000E-01	3.327E-02
11.0	5.0	5.000E-01	6.837E-03	11.0	6.0	5.000E-01	4.150E-02
02 SR		32.000	1 100	5			
	5	1.00	0.000E+00	0.000E+00	1.604E-08	14300.000	0.000 0.00
	8.000	0.00	0.000E+00	0.000E+00	1.207E-08	47600.000	0.000 0.00
	3.000	49802.100	700.360	9.002	-0.375	0.000	0.81900 1.103E-02
	3.000	0.000	1530.361	12.073	0.055	-0.001	1.44557 1.579E-02
	3.000	36396.000	919.000	22.500	0.000	0.000	1.05000 0.000E+00
	1.000	13195.220	1432.687	13.950	-0.011	0.000	1.40042 1.817E-02
	2.000	7918.100	1539.300	12.900	0.000	0.000	1.42640 1.710E-02
11.0	7.0	5.000E-01	2.481E-02	11.0	8.0	5.000E-01	1.333E-02
11.0	10.0	5.000E-01	2.122E-02	11.0	11.0	5.000E-01	1.208E-02
11.0	12.0	5.000E-01	1.904E-03	11.0	13.0	5.000E-01	2.231E-02
11.0	14.0	5.000E-01	7.268E-03	11.0	15.0	5.000E-01	6.456E-03
11.0	16.0	5.000E-01	2.364E-02	11.0	18.0	5.000E-01	1.584E-02
11.0	19.0	5.000E-01	1.838E-02	11.0	21.0	5.000E-01	2.619E-02
12.0	1.0	5.000E-01	6.158E-03	12.0	2.0	5.000E-01	2.199E-02
12.0	3.0	5.000E-01	3.695E-02	12.0	4.0	5.000E-01	2.477E-02
12.0	5.0	5.000E-01	1.126E-02	12.0	7.0	5.000E-01	2.375E-02
12.0	8.0	5.000E-01	3.731E-03	12.0	9.0	5.000E-01	8.040E-03
12.0	10.0	5.000E-01	2.115E-02	12.0	11.0	5.000E-01	1.905E-03
12.0	12.0	5.000E-01	1.175E-02	12.0	13.0	5.000E-01	1.759E-02
12.0	15.0	5.000E-01	1.968E-02	12.0	16.0	5.000E-01	9.781E-03
12.0	17.0	5.000E-01	4.556E-03	12.0	18.0	5.000E-01	2.221E-02
12.0	20.0	5.000E-01	1.712E-02	12.0	21.0	5.000E-01	1.494E-02

13.0	1.0	5.000E-01	7.982E-03	13.0	2.0	5.000E-01	2.521E-02
13.0	3.0	5.000E-01	3.526E-02	13.0	4.0	5.000E-01	1.616E-02
13.0	6.0	5.000E-01	1.764E-02	13.0	7.0	5.000E-01	1.750E-02
13.0	9.0	5.000E-01	1.582E-02	13.0	10.0	5.000E-01	1.339E-02
13.0	12.0	5.000E-01	1.879E-02	13.0	13.0	5.000E-01	6.176E-03
13.0	14.0	5.000E-01	6.366E-03	13.0	15.0	5.000E-01	1.853E-02
13.0	17.0	5.000E-01	1.697E-02	13.0	18.0	5.000E-01	9.347E-03
13.0	19.0	5.000E-01	5.333E-03	13.0	20.0	5.000E-01	2.075E-02
14.0	1.0	5.000E-01	9.934E-03	14.0	2.0	5.000E-01	2.766E-02
14.0	3.0	5.000E-01	3.176E-02	14.0	4.0	5.000E-01	8.805E-03
14.0	5.0	5.000E-01	2.585E-03	14.0	6.0	5.000E-01	2.089E-02
14.0	7.0	5.000E-01	9.600E-03	14.0	8.0	5.000E-01	2.259E-03
14.0	9.0	5.000E-01	1.896E-02	14.0	10.0	5.000E-01	4.627E-03
14.0	11.0	5.000E-01	6.856E-03	14.0	12.0	5.000E-01	1.685E-02
14.0	14.0	5.000E-01	1.529E-02	14.0	15.0	5.000E-01	8.271E-02
14.0	16.0	5.000E-01	4.622E-03	14.0	17.0	5.000E-01	1.784E-02
14.0	19.0	5.000E-01	1.736E-02	14.0	20.0	5.000E-01	6.571E-03
14.0	21.0	5.000E-01	8.579E-03	15.0	0.0	5.000E-01	1.744E-03
15.0	1.0	5.000E-01	1.192E-02	15.0	2.0	5.000E-01	2.920E-02
15.0	3.0	5.000E-01	2.700E-02	15.0	4.0	5.000E-01	3.562E-03
15.0	5.0	5.000E-01	6.901E-03	15.0	6.0	5.000E-01	2.040E-02
15.0	7.0	5.000E-01	3.278E-03	15.0	8.0	5.000E-01	7.630E-03
15.0	9.0	5.000E-01	1.649E-02	15.0	11.0	5.000E-01	1.358E-02
15.0	12.0	5.000E-01	9.107E-03	15.0	13.0	5.000E-01	2.838E-03
15.0	14.0	5.000E-01	1.673E-02	15.0	16.0	5.000E-01	1.366E-02
15.0	17.0	5.000E-01	7.900E-03	15.0	18.0	5.000E-01	5.183E-03
15.0	19.0	5.000E-01	1.622E-02	15.0	21.0	5.000E-01	1.859E-02
16.0	0.0	5.000E-01	2.224E-03	16.0	1.0	5.000E-01	1.385E-02
16.0	2.0	5.000E-01	2.974E-02	16.0	3.0	5.000E-01	2.162E-02
16.0	5.0	5.000E-01	1.140E-02	16.0	6.0	5.000E-01	1.694E-02
16.0	8.0	5.000E-01	1.275E-02	16.0	9.0	5.000E-01	1.062E-02
16.0	10.0	5.000E-01	1.745E-03	16.0	11.0	5.000E-01	1.597E-02
16.0	12.0	5.000E-01	2.152E-03	16.0	13.0	5.000E-01	9.547E-03
16.0	14.0	5.000E-01	1.066E-02	16.0	15.0	5.000E-01	1.707E-03
16.0	16.0	5.000E-01	1.586E-02	16.0	18.0	5.000E-01	1.391E-02
02 SR		32.000	1	94	5		
	5	1.00	0.000E+00	0.000E+00	1.604E-08	14300.000	0.000 0.00
	8.000	0.00	0.000E+00	0.000E+00	1.207E-08	47600.000	0.000 0.00
	3.000	49802.100	700.360	8.002	-0.375	0.000	0.61900 1.100E-02
	3.000	0.000	1580.361	12.073	0.055	-0.001	1.44567 1.579E-02
	3.000	36096.000	819.000	22.500	0.000	0.000	1.05000 0.000E+00
	1.000	13195.220	1432.687	13.950	-0.011	0.000	1.40042 1.817E-02
	2.000	7918.100	1509.300	12.900	0.000	0.000	1.42640 1.710E-02
16.0	19.0	5.000E-01	5.651E-03	16.0	20.0	5.000E-01	7.729E-03
16.0	21.0	5.000E-01	1.293E-02	17.0	0.0	5.000E-01	2.754E-03
17.0	1.0	5.000E-01	1.564E-02	17.0	2.0	5.000E-01	2.933E-02
17.0	3.0	5.000E-01	1.622E-02	17.0	5.0	5.000E-01	1.484E-02
17.0	6.0	5.000E-01	1.199E-02	17.0	8.0	5.000E-01	1.537E-02
17.0	9.0	5.000E-01	4.635E-03	17.0	10.0	5.000E-01	5.657E-03
17.0	11.0	5.000E-01	1.330E-02	17.0	13.0	5.000E-01	1.393E-02
17.0	14.0	5.000E-01	3.339E-03	17.0	15.0	5.000E-01	7.991E-03
17.0	16.0	5.000E-01	1.020E-02	17.0	17.0	5.000E-01	2.004E-03
17.0	18.0	5.000E-01	1.480E-02	17.0	20.0	5.000E-01	1.506E-02
17.0	21.0	5.000E-01	2.363E-03	18.0	0.0	5.000E-01	3.320E-03
18.0	1.0	5.000E-01	1.720E-02	18.0	2.0	5.000E-01	2.807E-02

ORIGINAL PAIRING
OF POOR QUALITY

18.0	3.0	5.000E-01	1.130E-02	18.0	5.0	5.000E-01	1.661E-02	
18.0	6.0	5.000E-01	7.024E-03	18.0	7.0	5.000E-01	3.099E-03	
18.0	9.0	5.000E-01	1.491E-02	18.0	10.0	5.000E-01	1.019E-02	
18.0	11.0	5.000E-01	7.953E-03	18.0	12.0	5.000E-01	2.536E-02	
18.0	13.0	5.000E-01	1.329E-02	18.0	15.0	5.000E-01	1.272E-02	
18.0	16.0	5.000E-01	3.045E-03	18.0	17.0	5.000E-01	8.362E-03	
18.0	18.0	5.000E-01	8.371E-03	18.0	19.0	5.000E-01	3.627E-03	
18.0	20.0	5.000E-01	1.278E-02	19.0	0.0	5.000E-01	3.907E-03	
19.0	1.0	5.000E-01	1.949E-02	19.0	2.0	5.000E-01	2.612E-02	
19.0	3.0	5.000E-01	7.175E-03	19.0	4.0	5.000E-01	3.010E-03	
19.0	5.0	5.000E-01	1.661E-02	19.0	6.0	5.000E-01	3.118E-03	
19.0	7.0	5.000E-01	6.500E-03	19.0	8.0	5.000E-01	1.210E-02	
19.0	10.0	5.000E-01	1.264E-02	19.0	11.0	5.000E-01	2.987E-03	
19.0	12.0	5.000E-01	6.918E-03	19.0	13.0	5.000E-01	8.927E-03	
19.0	14.0	5.000E-01	1.645E-03	19.0	15.0	5.000E-01	1.250E-02	
19.0	17.0	5.000E-01	1.247E-02	19.0	16.0	5.000E-01	1.695E-03	
19.0	19.0	5.000E-01	1.006E-02	19.0	20.0	5.000E-01	5.097E-03	
19.0	21.0	5.000E-01	6.978E-03	20.0	0.0	5.000E-01	4.498E-03	
20.0	1.0	5.000E-01	1.943E-02	20.0	2.0	5.000E-01	2.369E-02	
20.0	3.0	5.000E-01	4.013E-03	20.0	4.0	5.000E-01	5.428E-03	
20.0	5.0	5.000E-01	1.515E-02	20.0	7.0	5.000E-01	9.502E-03	
20.0	9.0	5.000E-01	8.216E-03	20.0	9.0	5.000E-01	1.617E-03	
20.0	10.0	5.000E-01	1.295E-02	20.0	12.0	5.000E-01	1.032E-02	
20.0	13.0	5.000E-01	3.923E-03	20.0	14.0	5.000E-01	5.718E-03	
20.0	15.0	5.000E-01	2.395E-03	20.0	16.0	5.000E-01	1.896E-03	
20.0	17.0	5.000E-01	1.137E-02	20.0	19.0	5.000E-01	1.240E-02	
20.0	21.0	5.000E-01	1.204E-02	21.0	0.0	5.000E-01	5.073E-03	
21.0	1.0	5.000E-01	2.004E-02	21.0	2.0	5.000E-01	2.095E-02	
21.0	3.0	5.000E-01	1.836E-03	21.0	4.0	5.000E-01	7.755E-03	
21.0	5.0	5.000E-01	1.274E-02	21.0	7.0	5.000E-01	1.136E-02	
21.0	9.0	5.000E-01	4.495E-03	21.0	9.0	5.000E-01	4.324E-03	
21.0	10.0	5.000E-01	9.952E-03	21.0	12.0	5.000E-01	1.129E-02	
21.0	14.0	5.000E-01	9.318E-03	21.0	15.0	5.000E-01	3.559E-03	
21.0	16.0	5.000E-01	5.491E-03	21.0	17.0	5.000E-01	6.817E-03	
21.0	19.0	5.000E-01	3.159E-03	21.0	19.0	5.000E-01	9.426E-03	
CON UID		26.920	1	79	3			
	3	0.00	0.000E+00	0.000E+00	1.149E-09	59500.000	0.000	0.00
	6.469	0.00	0.000E+00	0.000E+00	1.172E-02	66200.000	0.000	0.00
	2.000	25751.200	2168.610	20.200	0.000	0.000	1.97010	2.215E-02
	2.000	0.000	2062.745	13.134	-0.00E	0.000	1.89900	1.731E-02
	4.300	9245.344	1812.555	12.609	-0.012	0.000	1.71510	1.708E-02
0.0	0.0	9.870E-02	9.179E-01	1.0	0.0	7.480E-02	8.090E-02	
2.0	0.0	3.100E-02	1.200E-03	0.0	1.0	8.940E-02	7.630E-02	
1.0	1.0	9.000E-02	7.795E-01	2.0	1.0	7.330E-02	1.417E-01	
3.0	1.0	2.300E-02	2.800E-03	0.0	2.0	7.550E-02	5.900E-03	
1.0	2.0	8.990E-02	1.240E-01	2.0	2.0	8.900E-02	6.754E-01	
3.0	2.0	7.160E-02	1.905E-01	4.0	2.0	1.900E-02	4.330E-03	
1.0	3.0	6.090E-02	3.000E-04	1.0	3.0	7.600E-02	1.430E-02	
2.0	3.0	9.010E-02	1.550E-01	3.0	3.0	8.800E-02	5.929E-01	
4.0	3.0	6.950E-02	2.318E-01	2.0	4.0	7.760E-02	2.290E-02	
3.0	4.0	9.010E-02	1.745E-01	4.0	4.0	8.660E-02	5.273E-01	
5.0	4.0	6.780E-02	2.668E-01	3.0	5.0	7.920E-02	3.420E-02	
4.0	5.0	8.980E-02	1.325E-01	5.0	5.0	8.500E-02	4.824E-01	
6.0	5.0	6.500E-02	2.933E-01	4.0	6.0	8.050E-02	4.520E-02	
5.0	6.0	8.978E-02	1.781E-01	6.0	6.0	8.300E-02	4.593E-01	

7.0	6.0	6.200E-02	3.095E-01	9.0	6.0	6.670E-02	3.100E-03		
5.0	7.0	8.200E-02	5.540E-02	6.0	7.0	8.680E-02	1.640E-01		
7.0	7.0	8.070E-02	4.554E-01	8.0	7.0	5.920E-02	3.122E-01		
10.0	7.0	5.420E-02	5.000E-03	6.0	8.0	8.390E-02	6.390E-02		
9.0	8.0	7.230E-02	4.750E-01	9.0	8.0	5.400E-02	2.956E-01		
11.0	8.0	3.950E-02	6.700E-03	7.0	9.0	8.620E-02	7.080E-02		
9.0	9.0	7.560E-02	5.184E-01	10.0	9.0	4.860E-02	2.537E-01		
8.0	10.0	8.900E-02	7.660E-02	10.0	10.0	7.340E-02	5.801E-01		
11.0	10.0	4.000E-02	1.897E-01	12.0	10.0	8.750E-02	4.810E-02		
14.0	10.0	6.640E-02	3.400E-03	7.0	11.0	4.940E-02	3.100E-03		
9.0	11.0	9.180E-02	8.280E-02	11.0	11.0	7.110E-02	6.447E-01		
12.0	11.0	2.700E-02	1.131E-01	13.0	11.0	7.730E-02	8.540E-02		
15.0	11.0	4.750E-02	5.500E-03	8.0	12.0	5.130E-02	3.700E-03		
12.0	12.0	6.960E-02	6.967E-01	14.0	12.0	6.770E-02	1.203E-01		
9.0	13.0	5.600E-02	4.100E-03	13.0	13.0	6.850E-02	7.127E-01		
15.0	13.0	5.850E-02	1.380E-01	18.0	13.0	5.690E-02	4.000E-03		
14.0	14.0	6.850E-02	6.762E-01	16.0	14.0	4.750E-02	1.234E-01		
17.0	14.0	8.340E-02	4.470E-02	15.0	15.0	6.970E-02	5.786E-01		
16.0	15.0	8.950E-02	9.180E-02	17.0	15.0	3.100E-02	7.700E-02		
18.0	15.0	7.130E-02	7.900E-02	16.0	16.0	7.280E-02	4.319E-01		
17.0	16.0	7.970E-02	2.190E-01	18.0	17.0	7.390E-02	3.234E-01		
CN RED		26.020	3 86 3						
3		0.00	5.933E-06	0.000E+00	1.223E-08	57400.000	-52.200	1.00	
6.460		0.00	6.352E-06	0.000E+00	1.172E-08	66200.000	0.000	0.00	
4.000	9245.344	1812.555	12.609	-0.012	0.000	1.71510	1.708E-02		
2.000	0.000	2068.745	13.124	-0.006	0.000	1.89900	1.701E-02		
2.000	25751.800	2168.610	20.200	0.000	0.000	1.97010	2.215E-02		
0.0	0.0	3.160E-01	5.002E-01	1.0	0.0	3.160E-01	3.179E-01		
2.0	0.0	3.160E-01	1.269E-01	3.0	0.0	3.160E-01	4.020E-02		
4.0	0.0	3.160E-01	1.118E-02	5.0	0.0	3.160E-01	2.950E-02		
6.0	0.0	3.160E-01	7.500E-04	7.0	0.0	3.160E-01	2.009E-04		
8.0	0.0	3.160E-01	5.009E-05	0.0	1.0	3.160E-01	3.711E-01		
1.0	1.0	3.160E-01	4.609E-02	2.0	1.0	3.160E-01	2.409E-01		
3.0	1.0	3.160E-01	1.942E-01	4.0	1.0	3.160E-01	9.410E-02		
5.0	1.0	3.160E-01	3.615E-02	6.0	1.0	3.160E-01	1.220E-02		
7.0	1.0	3.160E-01	3.800E-03	8.0	1.0	3.160E-01	1.100E-02		
9.0	1.0	3.160E-01	3.500E-04	10.0	1.0	3.160E-01	1.000E-04		
0.0	2.0	3.160E-01	1.107E-01	1.0	2.0	3.160E-01	3.528E-01		
2.0	2.0	3.160E-01	1.160E-02	3.0	2.0	3.160E-01	9.950E-02		
4.0	2.0	3.160E-01	1.812E-01	5.0	2.0	3.160E-01	1.330E-01		
6.0	2.0	3.160E-01	6.755E-02	7.0	2.0	3.160E-01	2.810E-02		
8.0	2.0	3.160E-01	1.040E-02	9.0	2.0	3.160E-01	3.600E-03		
10.0	2.0	3.160E-01	1.150E-03	11.0	2.0	3.160E-01	3.500E-04		
12.0	2.0	3.160E-01	1.500E-04	13.0	2.0	3.160E-01	5.000E-05		
0.0	3.0	3.160E-01	1.670E-02	1.0	3.0	3.160E-01	2.234E-01		
2.0	3.0	3.160E-01	2.136E-01	3.0	3.0	3.160E-01	8.780E-02		
4.0	3.0	3.160E-01	1.615E-02	5.0	3.0	3.160E-01	1.228E-01		
6.0	3.0	3.160E-01	1.416E-01	7.0	3.0	3.160E-01	9.500E-02		
8.0	3.0	3.160E-01	4.855E-02	9.0	3.0	3.160E-01	2.125E-02		
10.0	3.0	3.160E-01	8.450E-03	11.0	3.0	3.160E-01	3.150E-03		
12.0	3.0	3.160E-01	1.100E-03	13.0	3.0	3.160E-01	4.000E-04		
14.0	3.0	3.160E-01	1.500E-04	15.0	3.0	3.160E-01	5.000E-05		
0.0	4.0	3.160E-01	1.400E-03	1.0	4.0	3.160E-01	5.355E-02		
2.0	4.0	3.160E-01	2.872E-01	3.0	4.0	3.160E-01	9.785E-02		
4.0	4.0	3.160E-01	1.489E-01	5.0	4.0	3.160E-01	1.800E-03		

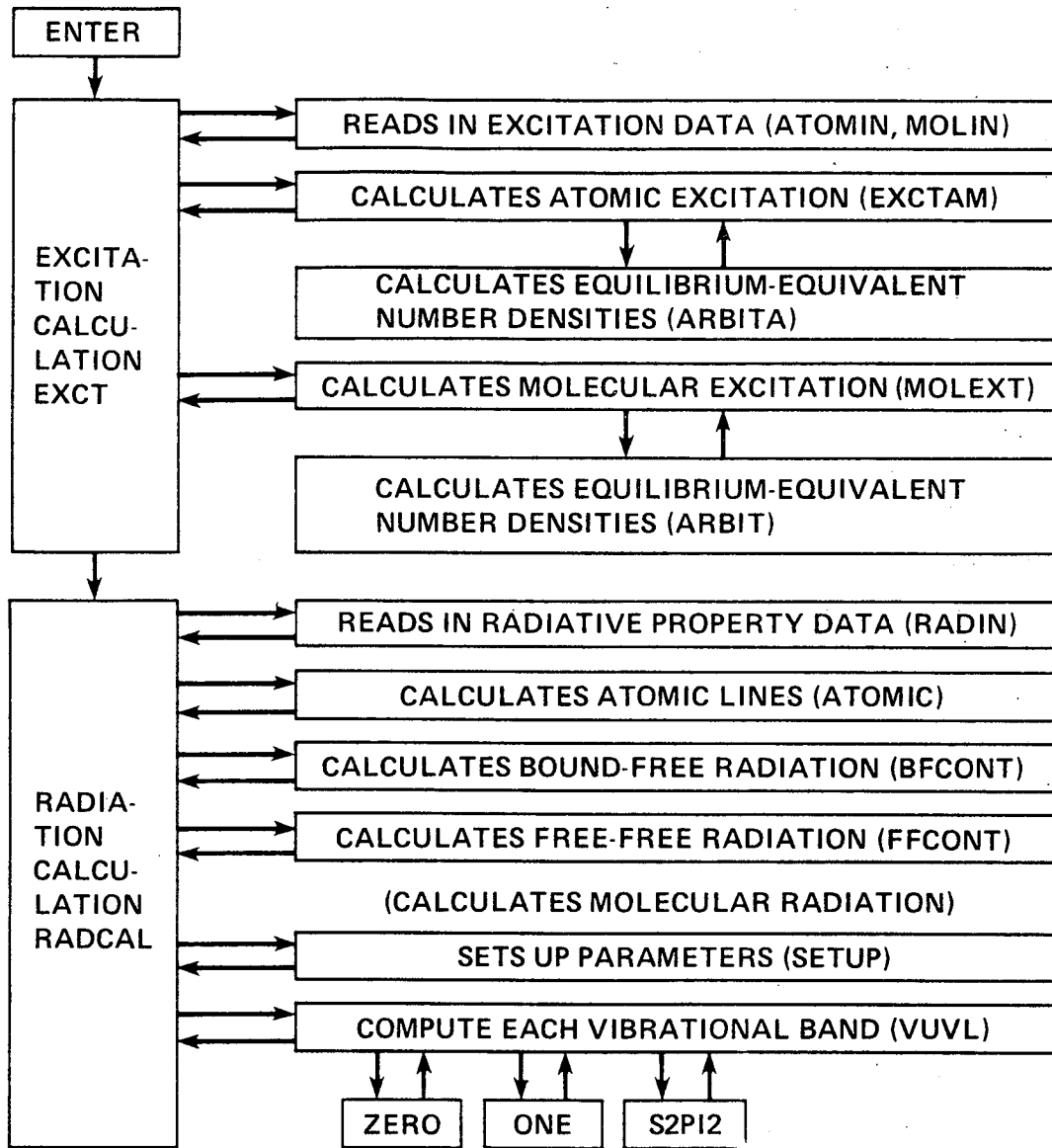
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6.0	4.0	3.160E-01	5.970E-02	7.0	4.0	3.160E-01	1.210E-01				
8.0	4.0	3.160E-01	1.088E-01	9.0	4.0	3.160E-01	6.855E-02				
10.0	4.0	3.160E-01	3.530E-02	11.0	4.0	3.160E-01	1.600E-02				
12.0	4.0	3.160E-01	6.650E-03	13.0	4.0	3.160E-01	2.650E-03				
14.0	4.0	3.160E-01	1.000E-03	15.0	4.0	3.160E-01	4.000E-04				
16.0	4.0	3.160E-01	1.500E-04	17.0	4.0	3.160E-01	5.000E-05				
3.0	5.0	3.160E-01	1.000E-04	1.0	5.0	3.160E-01	6.150E-03				
2.0	5.0	3.160E-01	1.027E-01	3.0	5.0	3.160E-01	2.994E-01				
4.0	5.0	3.160E-01	1.595E-02	5.0	5.0	3.160E-01	1.591E-01				
6.0	5.0	3.160E-01	3.040E-02	7.0	5.0	3.160E-01	1.505E-02				
8.0	5.0	3.160E-01	8.440E-02	9.0	5.0	3.160E-01	1.869E-01				
10.0	5.0	3.160E-01	8.305E-02	11.0	5.0	3.160E-01	5.020E-02				
12.0	5.0	3.160E-01	2.590E-02	13.0	5.0	3.160E-01	1.210E-02				
14.0	5.0	3.160E-01	5.200E-03	15.0	5.0	3.160E-01	2.150E-03				
16.0	5.0	3.160E-01	8.500E-04	17.0	5.0	3.160E-01	3.000E-04				
CN RED		26.020	3 96 3								
	3	0.00	5.932E-06	0.000E+00	1.232E-08	57400.000	-52.200	1.00			
	6.460	0.00	6.392E-06	0.000E+00	1.172E-09	66290.000	0.000	0.00			
	4.000	9245.344	1812.555	12.609	-0.012	0.000	1.71510	1.708E-02			
	2.000	0.000	2066.745	13.134	-0.006	0.000	1.89900	1.701E-02			
	2.000	25751.800	2168.610	20.200	0.000	0.000	1.97010	2.215E-02			
1.0	6.0	3.160E-01	4.900E-04	2.0	6.0	3.160E-01	1.590E-02				
3.0	6.0	3.160E-01	1.567E-01	4.0	6.0	3.160E-01	2.669E-01				
5.0	6.0	3.160E-01	7.500E-04	6.0	6.0	3.160E-01	1.287E-01				
7.0	6.0	3.160E-01	6.960E-02	8.0	6.0	3.160E-01	1.500E-04				
9.0	6.0	3.160E-01	4.555E-02	10.0	6.0	3.160E-01	9.310E-02				
11.0	6.0	3.160E-01	8.890E-02	12.0	6.0	3.160E-01	6.315E-02				
13.0	6.0	3.160E-01	3.725E-02	14.0	6.0	3.160E-01	1.940E-02				
15.0	6.0	3.160E-01	9.300E-03	16.0	6.0	3.160E-01	4.200E-03				
17.0	6.0	3.160E-01	1.950E-03	18.0	6.0	3.160E-01	7.500E-04				
2.0	7.0	3.160E-01	1.250E-02	3.0	7.0	3.160E-01	3.130E-02				
4.0	7.0	3.160E-01	2.067E-01	5.0	7.0	3.160E-01	2.069E-01				
6.0	7.0	3.160E-01	2.408E-02	7.0	7.0	3.160E-01	8.095E-02				
8.0	7.0	3.160E-01	9.778E-02	9.0	7.0	3.160E-01	9.450E-03				
10.0	7.0	3.160E-01	1.610E-02	11.0	7.0	3.160E-01	6.515E-02				
12.0	7.0	3.160E-01	8.440E-02	13.0	7.0	3.160E-01	7.165E-02				
14.0	7.0	3.160E-01	4.825E-02	15.0	7.0	3.160E-01	2.865E-02				
16.0	7.0	3.160E-01	1.433E-02	17.0	7.0	3.160E-01	7.300E-03				
18.0	7.0	3.160E-01	3.400E-03	2.0	8.0	3.160E-01	5.000E-05				
3.0	8.0	3.160E-01	2.950E-03	4.0	8.0	3.160E-01	5.285E-02				
5.0	8.0	3.160E-01	2.455E-01	6.0	8.0	3.160E-01	1.390E-01				
7.0	8.0	3.160E-01	6.345E-02	8.0	8.0	3.160E-01	3.650E-02				
9.0	8.0	3.160E-01	1.050E-01	10.0	8.0	3.160E-01	3.190E-02				
11.0	8.0	3.160E-01	1.650E-03	12.0	8.0	3.160E-01	3.825E-02				
13.0	8.0	3.160E-01	7.115E-02	14.0	8.0	3.160E-01	7.365E-02				
15.0	8.0	3.160E-01	5.700E-02	16.0	8.0	3.160E-01	3.705E-02				
17.0	8.0	3.160E-01	2.140E-02	18.0	8.0	3.160E-01	1.145E-02				
3.0	9.0	3.160E-01	1.000E-04	4.0	9.0	3.160E-01	6.000E-03				
5.0	9.0	3.160E-01	7.995E-02	6.0	9.0	3.160E-01	2.670E-01				
7.0	9.0	3.160E-01	7.770E-02	8.0	9.0	3.160E-01	1.002E-01				
9.0	9.0	3.160E-01	8.250E-03	10.0	9.0	3.160E-01	9.250E-02				
11.0	9.0	3.160E-01	5.585E-02	12.0	9.0	3.160E-01	2.490E-03				
13.0	9.0	3.160E-01	1.650E-02	14.0	9.0	3.160E-01	5.265E-02				
15.0	9.0	3.160E-01	6.860E-02	16.0	9.0	3.160E-01	6.170E-02				
17.0	9.0	3.160E-01	4.525E-02	18.0	9.0	3.160E-01	2.970E-02				

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4.0	10.0	3.160E-01	3.500E-04	5.0	10.0	3.160E-01	1.070E-02
6.0	10.0	3.160E-01	1.107E-01	7.0	10.0	3.160E-01	2.728E-01
8.0	10.0	3.160E-01	3.205E-02	9.0	10.0	3.160E-01	1.242E-01
10.0	10.0	3.160E-01	2.500E-04	11.0	10.0	3.160E-01	6.780E-02
12.0	10.0	3.160E-01	7.205E-02	13.0	10.0	3.160E-01	1.425E-02
14.0	10.0	3.160E-01	3.500E-03	15.0	10.0	3.160E-01	3.275E-02
16.0	10.0	3.160E-01	5.760E-02	17.0	10.0	3.160E-01	6.145E-02
18.0	10.0	3.160E-01	5.065E-02	5.0	11.0	3.160E-01	6.500E-04
6.0	11.0	3.160E-01	1.765E-02	7.0	11.0	3.160E-01	1.432E-01
8.0	11.0	3.160E-01	2.606E-01	9.0	11.0	3.160E-01	6.450E-03
10.0	11.0	3.160E-01	1.297E-01	11.0	11.0	3.160E-01	9.750E-03
12.0	11.0	3.160E-01	3.975E-02	13.0	11.0	3.160E-01	7.685E-02
14.0	11.0	3.160E-01	3.125E-02	15.0	11.0	3.160E-01	7.500E-04
16.0	11.0	3.160E-01	1.575E-02	17.0	11.0	3.160E-01	4.290E-02

SECTION 5. FLOW DIAGRAM



SECTION 6. TYPICAL INPUT DECK

```

JOB, IN=NEGDIR, T=99, CG=25, NA=PAFK, X=8084
ACCOUNT, US=XXXX, UPW=YYYY, AC=ZZZZ.
ACCESS, DN=#PL, PDN=NEGDIR, IO=PAFK.
ACCESS, DN=FT01, PDN=EXOTINEP, IO=PAFK.
ACCESS, DN=FT02, PDN=RADOCALINP, IO=PAFK.
UPDATE, T.
CFT, I=#CPL, L=0.
END.
/EOF
*10 NOV84
/EOF

```

2	1	110000	1							
4.813E-01	3.435E-02	1.788E-01	6.294E-03	4.269E-02	6.188E-04	2.143E-01	3.032E-02			
1.160E-02	1.000E-10	1.000E-10	8.013E+16	1.800E+04	1.400E+04	1.200E+04	9.650E+03			
150	2	4.391E+00	4.839E+00	0.000E+00	5.000E+00	1.000E+03	1.000E+04	2.000E+03		

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NUMBER DENSITY FRACTIONS OF SPECIES

N= 4.813E-01 N+= 3.435E-02 O= 1.788E-01 O+= 6.204E-03 NE= 4.269E-02 N2+= 6.188E-04 N2= 2.143E-01 NO= 3.032E-02
 O2= 1.160E-02 CN= 1.000E-10 C= 1.000E-10

PRESSURE= 1.965E-01 ATM DENSITY= 2.325E-06 G/CM3 ENTHALPY= 4.571E+11 ERG/G

NITROGEN EION= 117345.0 CM-1
 ION: C= 9.0 5.0 1.0 5.0 E= 100.0 15315.0 32687.0 47168.0

OXYGEN EION= 109837.0 CM-1
 ION: C= 4.0 10.0 6.0 12.0 E= 0.0 26310.0 40467.0 120000.0

MOLECULAR BAND NAME=N2+ MOLECULAR WEIGHT= 28.010
 NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION SET= 4
 NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION SET = 6
 NUMBER OF ELECTRONIC LEVELS = 5
 NUMBER OF LEVELS IN QUASI-STEADY-STATE CALC. = 4
 DEGEN TERM WE WEXE WEYE WEZE BE ALPHA

MOLECULAR BAND NAME=N2 MOLECULAR WEIGHT= 28.010
 NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION SET= 4
 NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION SET = 6
 NUMBER OF ELECTRONIC LEVELS = 5
 NUMBER OF LEVELS IN QUASI-STEADY-STATE CALC. = 4
 DEGEN TERM WE WEXE WEYE WEZE BE ALPHA

MOLECULAR BAND NAME=NO MOLECULAR WEIGHT= 30.010
 NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION SET= 3
 NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION SET = 3
 NUMBER OF ELECTRONIC LEVELS = 6
 NUMBER OF LEVELS IN QUASI-STEADY-STATE CALC. = 3
 DEGEN TERM WE WEXE WEYE WEZE BE ALPHA

MOLECULAR BAND NAME=O2 MOLECULAR WEIGHT= 32.000
 NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION SET= 0
 NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION SET = 0
 NUMBER OF ELECTRONIC LEVELS = 5
 NUMBER OF LEVELS IN QUASI-STEADY-STATE CALC. = 0
 DEGEN TERM WE WEXE WEYE WEZE BE ALPHA

MOLECULAR BAND NAME=CN MOLECULAR WEIGHT= 26.020
 NUMBER OF ELECTRON-IMPACT DISSOCIATION CROSS-SECTION SET= 3
 NUMBER OF ELECTRON-IMPACT EXCITATION CROSS-SECTION SET = 3
 NUMBER OF ELECTRONIC LEVELS = 3
 NUMBER OF LEVELS IN QUASI-STEADY-STATE CALC. = 3
 DEGEN TERM WE WEXE WEYE WEZE BE ALPHA
 N: EXCITATION TEMPERATURE= 9607.6 DENSITY MULTIPLICATIVE FACTOR= 2.186E-02
 O: EXCITATION TEMPERATURE= 9278.2 DENSITY MULTIPLICATIVE FACTOR= 1.609E-02

N2+
 NUMBER DENSITIES OF ELECTRONIC STATE= 2.517E+13 2.260E+13 1.055E+12 7.419E+11 5.993E+07 CM3
 ELECTRONIC EXCITATION TEMPERATURE = 12000.0 11999.5 11999.0 11985.4 16969.7 K

N2
 NUMBER DENSITIES OF ELECTRONIC STATE= 1.711E+16 3.815E+13 1.433E+13 1.519E+12 4.641E+07 CM3
 ELECTRONIC EXCITATION TEMPERATURE = 12000.0 8774.6 8993.8 9294.9 11767.7 K

NO
 NUMBER DENSITIES OF ELECTRONIC STATE= 2.425E+15 2.651E+10 4.248E+12 1.000E+10 1.000E+10 CM3
 ELECTRONIC EXCITATION TEMPERATURE = 12000.0 6135.8 8835.5 12000.0 12000.0 K

O2
 NUMBER DENSITIES OF ELECTRONIC STATE= 1.000E+10 1.000E+10 1.000E+10 1.000E+10 2.747E+07 CM3
 ELECTRONIC EXCITATION TEMPERATURE = 12000.0 12000.0 12000.0 12000.0 5909.1 K

CN
 NUMBER DENSITIES OF ELECTRONIC STATE= 4.319E+06 3.527E+06 1.653E+08 1.000E+10 1.000E+10 CM3
 ELECTRONIC EXCITATION TEMPERATURE = 12000.0 11654.9 11556.8 12000.0 12000.0 K
 DENSITY MULTIPLICATIVE FACTOR= 5.826E+00 5.826E+00 1.540E+00 1.540E+00 2.648E+01
 1.660E+00 1.660E+00 1.660E+00 1.660E+00 1.660E+00
 1.236E+00 1.236E+00 1.236E+00 6.314E-02 6.314E-02
 2.744E-02 2.744E-02 5.053E+00 3.455E+00 3.455E+00
 EXCITATION TEMPERATURE = 11999.0 11999.0 8993.8 8993.8 11767.7
 9294.9 9294.9 9294.9 9294.9 9294.9
 8835.5 8835.5 8835.5 6135.8 6135.8
 5909.1 5909.1 11556.8 11654.9 11654.9

BASIC ATOM DATA
 NAME=NITROGEN ATOMIC WEIGHT= 14.007 IONIZATION POTENTIAL= 117345.0 CM-1
 NUMBER OF LINES,BOUND-FREE CONTINUUM, AND FREE-FREE CONTINUUM PARAMETERS = 179 35 1

BASIC ATOM DATA
 NAME=OXYGEN ATOMIC WEIGHT= 16.000 IONIZATION POTENTIAL= 109837.0 CM-1
 NUMBER OF LINES,BOUND-FREE CONTINUUM, AND FREE-FREE CONTINUUM PARAMETERS = 109 15 5

MOLECULAR BAND NAME=N2+ 1- MOLECULAR WEIGHT= 28.010
 NDEX= 1 NO. OF BANDS= 94 NO. OF LEVELS= 4 MOLECULE NO.= 0 ORDER= 0

MOLECULAR BAND NAME=N2+ 1- MOLECULAR WEIGHT= 28.010
 NDEX= 1 NO. OF BANDS= 94 NO. OF LEVELS= 4 MOLECULE NO.= 0 ORDER= 0

MOLECULAR BAND NAME=N2 1+ MOLECULAR WEIGHT= 28.010
 NDEX= 2 NO. OF BANDS= 94 NO. OF LEVELS= 10 MOLECULE NO.= 0 ORDER= 0

MOLECULAR BAND NAME=N2 1+ MOLECULAR WEIGHT= 28.010
 NDEX= 2 NO. OF BANDS= 94 NO. OF LEVELS= 10 MOLECULE NO.= 0 ORDER= 0

MOLECULAR BAND NAME=N2 2+ NDEX= 1 NO. OF BANDS= 74	MOLECULAR WEIGHT= NO. OF LEVELS= 10	28.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=N2LBH NDEX= 2 NO. OF BANDS= 98	MOLECULAR WEIGHT= NO. OF LEVELS= 10	28.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=N2LBH NDEX= 2 NO. OF BANDS= 96	MOLECULAR WEIGHT= NO. OF LEVELS= 10	28.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=N2BH1 NDEX= 2 NO. OF BANDS= 92	MOLECULAR WEIGHT= NO. OF LEVELS= 10	28.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=N2BH2 NDEX= 1 NO. OF BANDS= 92	MOLECULAR WEIGHT= NO. OF LEVELS= 10	28.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=N2BH2 NDEX= 1 NO. OF BANDS= 96	MOLECULAR WEIGHT= NO. OF LEVELS= 10	28.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=NO B NDEX= 1 NO. OF BANDS= 96	MOLECULAR WEIGHT= NO. OF LEVELS= 6	30.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=NO B NDEX= 1 NO. OF BANDS= 94	MOLECULAR WEIGHT= NO. OF LEVELS= 6	30.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=NO B NDEX= 1 NO. OF BANDS= 46	MOLECULAR WEIGHT= NO. OF LEVELS= 6	30.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=NO G NDEX= 3 NO. OF BANDS= 98	MOLECULAR WEIGHT= NO. OF LEVELS= 6	30.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=NO G NDEX= 3 NO. OF BANDS= 98	MOLECULAR WEIGHT= NO. OF LEVELS= 6	30.010 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=O2 SR NDEX= 1 NO. OF BANDS= 96	MOLECULAR WEIGHT= NO. OF LEVELS= 5	32.000 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=O2 SR NDEX= 1 NO. OF BANDS= 96	MOLECULAR WEIGHT= NO. OF LEVELS= 5	32.000 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=CN VIO NDEX= 1 NO. OF BANDS= 70	MOLECULAR WEIGHT= NO. OF LEVELS= 3	26.020 MOLECULE NO.= 0	ORDER= 0
MOLECULAR BAND NAME=CN RED NDEX= 3 NO. OF BANDS= 86	MOLECULAR WEIGHT= NO. OF LEVELS= 3	26.020 MOLECULE NO.= 0	ORDER= 0

MOLECULAR BAND NAME=CN RED MOLECULAR WEIGHT= 26.020
 NDEX= 3 NO. OF BANDS= 96 NO. OF LEVELS= 3 MOLECULE NO.= 0 ORDER= 0

NITROG LINES FINISHED	GLOBAL POWER EMISSION. TOTAL= 2.36487E+01	ABOVE 2500 A= 2.36487E+01	ABOVE 3500 A= 2.36487E+01	W/CM3
NITROG ATOM FINISHED	GLOBAL POWER EMISSION. TOTAL= 2.37468E+01	ABOVE 2500 A= 2.37456E+01	ABOVE 3500 A= 2.37416E+01	W/CM3
OXYGEN LINES FINISHED	GLOBAL POWER EMISSION. TOTAL= 2.67208E+01	ABOVE 2500 A= 2.67196E+01	ABOVE 3500 A= 2.67156E+01	W/CM3
OXYGEN ATOM FINISHED	GLOBAL POWER EMISSION. TOTAL= 2.67402E+01	ABOVE 2500 A= 2.67387E+01	ABOVE 3500 A= 2.67341E+01	W/CM3
N2+ 1- FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.03269E+01	ABOVE 2500 A= 3.03255E+01	ABOVE 3500 A= 2.89483E+01	W/CM3
N2+ 1- FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.07642E+01	ABOVE 2500 A= 3.07628E+01	ABOVE 3500 A= 2.91468E+01	W/CM3
N2 1+ FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.15319E+01	ABOVE 2500 A= 3.15305E+01	ABOVE 3500 A= 2.99146E+01	W/CM3
N2 1+ FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.16307E+01	ABOVE 2500 A= 3.16292E+01	ABOVE 3500 A= 3.00133E+01	W/CM3
N2 2+ FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.16828E+01	ABOVE 2500 A= 3.16813E+01	ABOVE 3500 A= 3.00269E+01	W/CM3
N2LBH FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.16828E+01	ABOVE 2500 A= 3.16813E+01	ABOVE 3500 A= 3.00269E+01	W/CM3
N2LBH FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.16830E+01	ABOVE 2500 A= 3.16813E+01	ABOVE 3500 A= 3.00269E+01	W/CM3
N2EH1 FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.16830E+01	ABOVE 2500 A= 3.16813E+01	ABOVE 3500 A= 3.00269E+01	W/CM3
N2EH2 FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.17215E+01	ABOVE 2500 A= 3.16828E+01	ABOVE 3500 A= 3.00269E+01	W/CM3
N2BH2 FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.17245E+01	ABOVE 2500 A= 3.16828E+01	ABOVE 3500 A= 3.00269E+01	W/CM3
NO B FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.34358E+01	ABOVE 2500 A= 3.27552E+01	ABOVE 3500 A= 3.01866E+01	W/CM3
NO B FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.38316E+01	ABOVE 2500 A= 3.31485E+01	ABOVE 3500 A= 3.04594E+01	W/CM3
NO B FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.38653E+01	ABOVE 2500 A= 3.31822E+01	ABOVE 3500 A= 3.04929E+01	W/CM3
NO C FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.39178E+01	ABOVE 2500 A= 3.31900E+01	ABOVE 3500 A= 3.04930E+01	W/CM3
NO C FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.39237E+01	ABOVE 2500 A= 3.31935E+01	ABOVE 3500 A= 3.04930E+01	W/CM3
O2 SR FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.39500E+01	ABOVE 2500 A= 3.32168E+01	ABOVE 3500 A= 3.05032E+01	W/CM3
O2 SR FINISHED	GLOBAL POWER EMISSION. TOTAL= 3.39686E+01	ABOVE 2500 A= 3.32279E+01	ABOVE 3500 A= 3.05063E+01	W/CM3

>>>> POINTS OUT OF RANGE. THEY WILL BE IGNORED.
 >>>> I X(I) Y(I)

>>>> 2 2.0000E+04 0.0000E+00
 I MAX= 984

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REFERENCES

1. Whiting, E. E.; Arnold, J. O.; and Lyle, G.C.: A Computer Program for a Line-by-line Calculation of Spectra From Diatomic Molecules and Atoms Assuming a Voigt Line Profile. NASA TN D-5088, March 1969.
2. Park, C.: Calculation of Nonequilibrium Radiation in the Flight Regimes of Aeroassisted Orbital Transfer Vehicles. In Progress in Astronautics and Aeronautics, Vol. 96: Thermal Design of Aeroassisted Orbital Transfer Vehicles. H. F. Nelson, ed., AIAA, New York, 1985, pp. 395-418.
3. Wiese, W. L.; Smith, M. W.; and Glennon, B. M.: Atomic Transition Probabilities. Vol. 1. Hydrogen Through Neon. NSRDS-NBS 4, National Bureau of Standards, May 1966.
4. Peach, G.: Continuous Absorption Coefficients for Non-Hydrogenic Atoms. Mem. Roy. Astronom. Soc., vol. 73, pt. 1, 1970.
5. Allen, R. A.: Air Radiation Tables: Spectral Distribution Functions for Molecular Band Systems. Research Report 236, AVCO-Everett Research Laboratory, Everett, Mass., April 1966.
6. Arnold, J. O.; and Nicholls, R. W.: A Shock Tube Determination of the Electronic Transition Moment of the CN Red Band System. J. Quan. Spec., vol. 12, no. 10, 1972, pp. 1435-1452.
7. Arnold, J. O.; and Nicholls, R. W.: A Shock Tube Determination of the CN Ground Dissociation Energy and the CN Violet Electronic Transition Moment. J. Quan. Spec., vol. 13, no. 2, 1973, pp. 115-133.

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16. Abstract <p>This memorandum is a supplement to the paper entitled "Calculation of Nonequilibrium Radiation in Flight Regimes of Aeroassisted Orbital Transfer Vehicles", AIAA Paper Number 84-0306, January, 1984, and contains the listings of the computer code NEQAIR (Nonequilibrium Air Radiation), its primary input data, and explanation of the user-supplied input variables. The user-supplied input variables are the thermodynamic variables of air at a given point, i.e., number densities of various chemical species, translational temperatures of heavy particles and electrons, and vibrational temperature. These thermodynamic variables do not necessarily have to be in thermodynamic equilibrium. The code calculates emission and absorption characteristics of air under these given conditions.</p>					
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