

ADAS Subroutine rpengv

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SUBROUTINE RPENGV (IZ, WI, EI, WJ, EJ, N, LI, LJ, PHI, TV, TEV, DENS, TAU, EM,  
& IZC, QI, QJ, GA)  
  IMPLICIT REAL*8 (A-H, O-Z)
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C PURPOSE: CALCULATES PENGELLY & SEATON (1964) COLLISION RATES BETWEEN  
C           NEARLY DEGENERATE LEVELS.  
C  
C A VARIATION OF IMPACT PARAMETER THEORY FOR DIPOLE TRANSITIONS IS USED.  
C ***** H.P.SUMMERS, JET 2 DEC 1984 *****  
C *** CORRECTIONS 13/5/85  
C INPUT  
C   IZ=TARGET ION CHARGE  
C   WI=STATISTICAL WEIGHT OF STATE I (FULL WEIGHTING INCLUDING SPIN)  
C   EI=BINDING ENERGY OF STATE I (RYD)  
C   WJ=STATISTICAL WEIGHT OF STATE J  
C   EJ=BINDING ENERGY OF STATE J (RYD)  
C   PHI=FIJ/EIJ (=SIJ/WI) WITH FIJ=ABSORPTION OSCILLATOR STRENGTH  
C           EIJ=TRANSITION ENERGY (RYDBERGS)  
C           SIJ=LINE STRENGTH (AT. UNITS)  
C   TV=TEMPERATURE (EV) (COLLIDING PARTICLE DISTRIBUTION)  
C   TEV=TEMPERATURE (EV) (ELECTRON DISTRIBUTION)  
C   DENS=ELECTRON DENSITY (CM-3)  
C   TAU=MEAN RADIATIVE LIFETIME OF INITIAL AND FINAL LEVELS (SEC)  
C   EM=REDUCED MASS FOR COLLIDING PARTICLE (ELECTRON MASSES)  
C   IZC=CHARGE OF COLLIDING PARTICLE  
C OUTPUT  
C   QI=EXCITATION RATE COEFFICIENT (CM**3 SEC-1)  
C   QJ=DEEXCITATION RATE COEFFICIENT  
C   GA=GAMMA RATE PARAMETER  
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C VERSION   : 1.1  
C DATE      : 18-03-1999  
C MODIFIED  : ???  
C  
C VERSION   : 1.2  
C DATE      : 05-10-2000  
C MODIFIED  : ???  
C           - Removed junk from columns > 72  
C  
C VERSION   : 1.3  
C DATE      : 16-05-2007  
C MODIFIED  : Allan Whiteford  
C           - Updated comments as part of subroutine documentation  
C           procedure.  
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C  
C   T=1.16054D4*TV  
C   TE=1.16054D4*TEV  
C   ATP=1.5789D5/T  
C   Z1=IZ+1  
C   ZC=IZC  
C   XN=N
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XLI=LI
XLJ=LJ
XL=0.5D0*(XLI+XLJ)
DNL=6.0D0*(ZC*XN/Z1)**2*(XN*XN-XL*XL-XL-1.0D0)
EIJ=DABS(EI-EJ)
TAU1=1.0D10
IF(EIJ.GT.0.0D0)TAU1=7.53D-17/EIJ
IF(TAU1-TAU)3,3,2
2  TAU1=TAU
   IND1=0
   GO TO 4
3  IND1=1
C  IND1=0 INDICATES FINITE RADIATIVE LIFETIME CUT-OFF
C  =1 INDICATES BETHE CUT-OFF
4  F1=1.68+DLOG10(TE/DENS)
   F=10.95+DLOG10(T*TAU1*TAU1/EM)
C** WRITE(6,100)TAU,TAU1,IND1,F,F1
100 FORMAT(1H0,'CHECK OUTPUT FROM RPENGV' /
&1H ,'TAU =' ,1PD10.2,3X,'TAU1 =' ,1PD10.2,3X,'IND1 =' ,I3,3X,
&'F =' ,1PD10.2,3X,'F1 =' ,1PD10.2)
   IF(F-F1)8,8,9
8  IND2=0
   GO TO 10
9  F=F1
   IND2=1
C  IND2=0 INDICATES LIFETIME OR BETHE CUTOFF USED IN RATE
C  =1 INDICATES DEBYE CUT-OFF USED IN RATE
10 B=11.54+DLOG10(T/(DNL*EM))+F
C** WRITE(6,101)EIJ,DNL,T,EM,B,F
101 FORMAT(1H ,'EIJ =' ,1PD10.2,3X,'DNL =' ,1PD10.2,3X,'T =' ,1PD10.2,
&3X,'EM =' ,1PD10.2,3X,'B =' ,1PD10.2,3X,'F =' ,1PD10.2)
   IF(B-1.0D0)14,14,15
14 IF(B.GT.0.0D0.AND.IND2.EQ.1)GO TO 15
   IF(B.GT.0.0D0.AND.IND1.EQ.0)GO TO 15
   QI=0.0D0
   GO TO 16
15 QI=7.94D-5*DSQRT(EM/T)*ZC*ZC*PHI*B
16 QJ=WI*QI/WJ
   GA=4.604D7*WJ*QJ/DSQRT(ATP)
   RETURN
END
INTEGER          IZ,          IZC,          LI,          LJ
INTEGER          N
REAL*8           DENS,        EI,          EJ,          EM
REAL*8           GA,          PHI,         QI,          QJ
REAL*8           TAU,        TEV,         TV,          WI
REAL*8           WJ

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