

## ADAS Subroutine d8eval

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      SUBROUTINE D8EVAL ( dsn03      , dsn35      ,
&                        NUMTE      , TEMIN      , TEMAX      ,
&                        NUMNE      , FNEMIN     , FNEMAX     ,
&                        FUELMAS    ,
&                        TEL        , FNEL       , NAME      ,
&                        iz0        , iz1        , izu        ,
&                        RAL        , SAL0       , SAL        , CAL      ,
&                        PRBL       , PRCL       , PLTL0     , PLTL     ,
&                        PLSL0      , PLSL      ,
&                        PRBLNFL    , PRCLNFL    , PLTL0NFL  , PLTLNFL  ,
&                        ralrr      , raldr     ,
&                        prbrr      , prbdr     , prbbr     ,
&                        prbrnfl    , prbdrnfl  , prbbrnfl  ,
&                        INFRA      , INFSA      , INFCA      ,
&                        INFPRB     , INFPRC    , INFPLT    , INFPLS   ,
&                        INFPRBN    , INFPRCN   , INFPLTN   ,
&                        METRAL     , METSA     , METCA     ,
&                        METPRB     , METPRC    , METPLT    , METPLS   ,
&                        METPRBN    , METPRCN   , METPLTN   ,
&                        ltick
&                                )
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C-----
C
C ***** FORTRAN77 SUBROUTINE: D8EVAL *****
C
C
C PURPOSE:  To calculate tables of values of ionisation, recombination
C           and radiated power rates for non-coronal impurity studies
C           over a given temperature and density range with atomic
C           data parameters from files of format adf03
C
C CALLING PROGRAM: ADAS408
C
C
C SUBROUTINE:
C
C INPUT:   (C*80) dsn03      = adf03 atompars file
C INPUT:   (C*80) dsn35      = adf35 filter data file
C
C
C THE OUTPUT ARRAYS ARE INDEXED
C           XXX(,) = XXX(ITDIMD,IDDIMD,IZDIMD) 1ST DIMENSION TEMPERATURE
C                                           2ND DIMENSION DENSITY
C                                           3RD DIMENSION ION STAGE
C ALL TABLES ARE LOG10 IN CGS UNITS
C
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C
C OUTPUT: (R*8) TEL() = TEMPERATURE SET OF TABLES - LOG MESH
C          (R*8) FNEL() = DENSITY SET OF TABLES - LOG MESH
C          (C*13) NAME = ELEMENT NAME
C
C          (R*8) RAL(,,) = RADIATIVE AND DIELECTRONIC RECOMB.
C          (R*8) CAL(,,) = CHARGE EXCHANGE RECOMBINATION
C
C          (R*8) SALO(,) = IONISATION (NEUTRAL)
C          (R*8) SAL(,,) = IONISATION (NON-NEUTRAL)
C
C          (R*8) PLTL0(,) = TOTAL LINE RADIATED POWER (NEUTRAL)
C          (R*8) PLTL(,,) = TOTAL LINE RADIATED POWER (NON-NEUTRAL)
C
C          (R*8) PRBL(,,) = RAD. + DIEL RECOM. + BREMS. POWER
C          (R*8) PRCL(,,) = CX. RECOM. POWER
C
C          (R*8) PLSL0(,) = SPECIFIC LINE POWER (NEUTRAL)
C          (R*8) PLSL(,,) = SPECIFIC LINE POWER (NON-NEUTRAL)
C
C          (R*8) PRBLNFL(,,) = RECOM+BREMM POWER (NO FILTER)
C          (R*8) PRCLNFL(,,) = CX POWER (NO FILTER)
C          (R*8) PLTLNFL(,,) = LINE POWER (NO FILTER)
C          (R*8) PLTL0NFL(,,) = NEUTRAL LINE POWER (NO FILTER)
C
C          (C*8) INFRAL() = RECOMBINATION INFO STRING
C          (C*8) INFSAI() = IONISATION INFO STRING
C          (C*8) INFCAI() = CX INFO STRING
C          (C*8) INFPRB() = RECOM+BREMM POWER INFO STRING
C          (C*8) INFPRC() = CX POWER INFO STRING
C          (C*8) INFPLT() = TOTAL LINE POWER INFO STRING
C          (C*8) INFPLS() = SPECIFIC LINE POWER INFO STRING
C          (C*8) INFPRBN() = RECOM+BREM POWER (NO FILTER) INFO
C          (C*8) INFPRCN() = CX POWER (NO FILTER) INFO STRING
C          (C*8) INFPLTN() = TOTAL LINE POWER (NO FILTER) INFO
C
C          (C*24) METRAL = RECOMBINATION METHOD STRING
C          (C*24) METSAL = IONISATION METHOD STRING
C          (C*24) METCAL = CX METHOD STRING
C          (C*24) METPRB = RECOM+BREMM POWER METHOD STRING
C          (C*24) METPRC = CX POWER METHOD STRING
C          (C*24) METPLT = TOTAL LINE POWER METHOD STRING
C          (C*24) METPLS = SPECIFIC LINE POWER METHOD STRING
C          (C*24) METPRBN = RECOM+BREM POWER (NO FILTER) METHOD
C          (C*24) METPRCN = CX POWER (NO FILTER) METHOD STRING
C          (C*24) METPLTN = TOTAL LINE POWER (NO FILTER) METHOD
C
C
C PROGRAM:
C
C THE PARAMETER ARRAYS ARE INDEXED
C          XXX() = XXX(IZDIMD)          1ST DIMENSION ION STAGE
C

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C           XXX(,) = XXX(IZDIMD,IGDIMD)  1ST DIMENSION ION STAGE
C                                           2ND DIMENSION GROUP
C
C
C INPUT:  (I*4)  IZDIMD  = MAXIMUM NUMBER OF IONISATION STAGES
C          (I*4)  IGDIMD  = MAXIMUM NUMBER OF GROUPS
C
C          (I*4)  ITDIMD  = MAXIMUM NUMBER OF TEMPERATURES
C          (I*4)  IDDIMD  = MAXIMUM NUMBER OF DENSITIES
C
C          (R*8)  TEMIN   = MINIMIUM TEMPERATURE OF TABLE
C          (R*8)  TEMAX   = MAXIMUM TEMPERATURE
C          (I*4)  NUMTE   = NUMBER OF TEMPERATURE
C
C          (R*8)  FNEMIN  = MINIMIUM DENSITY OF TABLE
C          (R*8)  FNEMAX  = MAXIMUM DENSITY
C          (I*4)  NUMNE   = NUMBER OF DENSITIES
C
C
C          (R*8)  FUELMAS = MASS OF FUEL      (AMU)
C
C          (I*4)  IZ0     = NUCLEAR CHARGE
C          (I*4)  IZL     = LOWEST INCLUDED ION
C          (I*4)  IZU     = HIGHEST INCLUDED ION
C
C          (I*4)  IZRA()  = RECOMBINING ION (RAD. RECOM.)
C          (I*4)  IZDA()  = RECOMBINING ION (DIEL. RECOM.)
C          (I*4)  IZIA()  = IONISING ION   (COLL. IONIS.)
C          (I*4)  IZTA()  = RADIATING ION   (TOTAL LINE POWER)
C          (I*4)  IZSA()  = RADIATING ION   (SPECIFIC LINE POWER)
C
C
C          (C*5)  CRRCA()  = RADIATIVE RECOM. CODE
C          (I*4)  NRRCA()  = - NOT USED -
C          (I*4)  ISRRCA() = - NOT USED -
C
C          (I*4)  NZA()    = LOWEST ACCESSIBLE SHELL FOR RAD. RECOM.
C          (I*4)  KSIA()   = NUMBER OF ELECTRONS IN SHELL
C
C          (I*4)  NORA()   = LOWEST ACCESSIBLE PRINC. QUANTUM SHELL
C                           FOR RAD. RECOM.
C          (R*8)  VORA()   = EFFECTIVE PRINCIPAL QUANTUM NUMBER
C                           FOR SHELL
C          (R*8)  PHFCRA() = PHASE SPACE OCCUPANCY AVAILABILITY
C                           FOR SHELL
C          (R*8)  EDSpra() = ENERGY ADJUSTMENT IN LOWEST SHELL
C                           RATE COEFFICIENT
C          (R*8)  SCLERA() = MULTIPLIER FOR LOWEST SHELL
C                           RATE COEFFICIENT
C
C
C
C

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C (C\*5) CDRCA() = DIELECTRONIC RECOM. CODE  
C (I\*4) NDRCA() = NUMBER OF TRANSITIONS FOLLOWING  
C (I\*4) ISDRCA() = - NOT USED -  
C  
C (R\*8) DEDA(,) = TRANSITION ENERGY (EV)  
C (R\*8) FDA(,) = OSCILLATOR STRENGTH  
C (R\*8) GDA(,) = GAUNT FACTOR  
C (I\*4) NNDA(,) = DELTA N FOR TRANSITION  
C (I\*4) MSDA(,) = MERTZ SWITCH (0=OFF, 1=ON)  
C  
C (I\*4) ITYPDA(,) = TYPE OF DIELECTRONIC TRANSITION  
C (I\*4) NODA(,) = LOWEST ACCESSIBLE PRINC. QUANTUM SHELL  
C FOR DIEL. RE  
C (I\*4) NCUA(,) = CUT-OFF PRINC. QUANTUM SHELL IN  
C GENERAL PROGRAM  
C (I\*4) VODA(,) = EFFECTIVE PRINC. QUANTUM NUMBER  
C FOR LOWEST ACCESS  
C (R\*8) PHFCDA(,) = PHASE SPACE OCCUPANCY AVAILABILITY  
C FOR LOWEST SHELL  
C (R\*8) CRFCDA(,) = ADJUSTMENT FOR BETHE CORRECTIONS  
C IN GENERAL PROGRAM  
C (R\*8) EPSIJA(,) = Z-SCALED PARENT TRANSITION ENERGY (RYD)  
C (R\*8) FIJA(,) = OSCILLATOR STRENGTH FOR TRANSITION  
C (R\*8) EDSPDA(,) = ENERGY ADJUSTMENT IN BURGESS GENERAL  
C FORMULA (RYD)  
C (R\*8) SCLEDA(,) = MULTIPLIER ON BURGESS GENERAL FORMULA  
C  
C  
C (C\*5) CCIOA() = COLLISIONAL IONIS. CODE  
C (I\*4) NCIOSA() = NUMBER OF SHELL VALUES FOLLOWING  
C (I\*4) NCIORA() = NUMBER OF RESON. VALUES FOLLOWING  
C (I\*4) ISCIOA() = - NOT USED -  
C  
C (R\*8) PIOA(,) = SHELL IONISATION POTENTIAL (EV)  
C (R\*8) AIOA(,) = LOTZ PARAMETER  
C (R\*8) BIOA(,) = LOTZ PARAMETER  
C (R\*8) CIOA(,) = LOTZ PARAMETER  
C (I\*4) NQIOA(,) = EQUIVALENT ELECTRONS IN SHELL  
C  
C (R\*8) ZETAA(,) = NUMBER OF EQUIVALENT ELECTRONS FOR SHELL  
C (R\*8) EIONA(,) = IONISATION ENERGY FOR SHELL (RYD)  
C (R\*8) CIA(,) = MULTIPLIER FOR BURGESS-CHIDICHIMO RATE  
C FOR SHELL  
C (R\*8) WGHTA(,) = WEIGHTING FACTOR FOR EXCITATION TO  
C RESONANCE  
C (R\*8) ENERA(,) = EXCITATION ENERGY FOR TRANSITION  
C TO RESONANCE (RYD)  
C (R\*8) CRA(,) = MULTIPLIER ON EXCITATION RATE EXPRESSSION  
C  
C  
C (C\*5) CPLTA() = TOTAL LINE POWER CODE

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C      (I*4)  NPLTA( )   =  NUMBER OF TRANSITIONS FOLLOWING
C      (I*4)  ISPLTA( ) =    - NOT USED -
C
C      (R*8)  DEPTA( , ) =  TRANSITION ENERGY (EV)
C      (R*8)  FPTA( , ) =  OSCILLATOR STRENGTH
C      (R*8)  GPTA( , ) =  GAUNT FACTOR
C      (I*4)  NNPTA( , ) =  DELTA N FOR TRANSITION
C
C      (R*8)  SPYLTA( , ) = MULTIPLIER OF VAN REGEMORTER P
C                          FACTOR IN TOTAL POWER
C
C
C      (C*5)  CPLSA( )   =  SPECIFIC LINE POWER CODE
C      (I*4)  NPLSA( )   =  - NOT USED -
C      (I*4)  ISPLSA( ) =  - NOT USED -
C      (C*8)  INFO( )    =  WAVELENGTH OF SPECIFIC LINE FOR
C                          NAMING PURPOSES
C
C      (R*8)  DEPSA( , ) =  TRANSITION ENERGY (EV)
C      (R*8)  FPSA( , ) =  OSCILLATOR STRENGTH
C      (R*8)  GPSA( , ) =  GAUNT FACTOR
C      (I*4)  NNPSA( , ) =  DELTA N FOR TRANSITION
C
C      (R*8)  SPYLSA( , ) = MULTIPLIER OF VAN REGEMORTER P FACTOR
C                          IN SPECIFIC LINE POWER
C
C

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ROUTINES:

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C      ROUTINE      SOURCE      DESCRIPTION
C      -----
C      I4UNIT       ADAS        FETCH UNIT NUMBER FOR MESSAGE OUTPUT
C      D8FLIN       ADAS408     INITIALISE ENERGY MESH FOR FILTER
C                          INTEGRATION
C      D8TRAN       ADAS408     FILTER TRANSMISSION AT PARTICULAR ENERGY
C      D8INTG       ADAS408     INTEGRATE WITH FILTER
C      D8CXSC       ADAS408     RETURNS CROSS-SECTIONS FROM CX COLLISION
C      D8VGOL       ADAS408     CALCULATES VON GOELER RECOMB. COEFFS
C      NGFFMH       ADAS        FREE-FREE GAUNT FACTOR
C
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C HISTORY:  DERIVED FROM NCRATO --- J. SPENSE,      TESSELLA
C                        H. P. SUMMERS, JET
C                        27/3/1990
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C CHANGES : 13/12/90  H.P.SUMMERS - CHANGE CONSTANTS FOR LINE POWER AND
C                        BREMSSTRAHLUNG POWER TO MATCH
C                        ABELS-VAN MAANEN (1985).
C                        NB. NO MERTZ SWITCH ON H-LIKE
C                        AND HE-LIKE DIELECTRONIC RECOMB.
C
C : 5/ 2/91  H.P.SUMMERS - ALTER COMMON /RATCOM/ TO REMOVE

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C UNNECESSARY STORAGE AND ORGANISE  
C FOR NEW (ADF03) DATA INPUT.  
C : 1/ 8/91 H.P.SUMMERS - ALTER LINFO DIMENSION TO ALLOW  
C IT AS AN INFORMATION STRING FOR ALL  
C DATA SETS. SET THE HYDROGEN  
C ISOTOPE MASS IN LINFO AS  
C ' MH=\*.\*\*' FOR CCD AND PRC.  
C ADD HMADAS TO /RATCOM/  
C : 6/8/92 M O'MULLANE - STAND-ALONE VERSION  
C  
C  
C  
C ADAS408 IMPLEMENTATION  
C  
C AUTHOR: M O'MULLANE, UCC  
C  
C DATE: 10/05/94  
C  
C  
C UNIX-IDL PORT:  
C  
C VERSION: 1.1 DATE: 15-04-96  
C MODIFIED: WILLIAM OSBORN (TESSELLA SUPPORT SERVICES PLC)  
C - FIRST CONVERTED  
C  
C VERSION: 1.2 DATE: 14-05-96  
C MODIFIED: WILLIAM OSBORN  
C REARRANGED ARGUMENTS TO STAY UNDER  
C LIMIT OF 20 CONTINUATION CHARACTERS AT ARCETRI AND GARCHING  
C  
C VERSION: 1.3 DATE: 14-05-96  
C MODIFIED: WILLIAM OSBORN  
C S.C.C.S. ERROR  
C  
C VERSION: 1.4 DATE: 30-01-98  
C MODIFIED: Martin O'Mullane  
C Added free-free Gaunt factor to the evaluation of bremsstrahlung  
C power. Used NGFFMH to calculate gff.  
C  
C VERSION: 1.5 DATE: 05-08-2003  
C MODIFIED: Martin O'Mullane  
C - ADAS408 restructured.  
C - Pass in adf03 and adf35 data files rather than the  
C data in them.  
C  
C VERSION : 1.6  
C DATE : 05-03-2004  
C MODIFIED: Martin O'Mullane  
C - Alter dimensions for 55 temperatures, 50 densities,  
C 80 ion stages, and 15 groups.  
C - Type B ionisation was wrong. Calculate it with a call  
C to rbchid.for.  
C - Warn when EA contribution to type B ionisation is

C attempted as it is not coded.  
C - Warn when type B radiative recombination is  
C requested as the prb is not yet calculated.  
C - Pass out separated RR and DR recombination rates.  
C - Pass out separated RR, DR and BR power coefficients  
C but only for the non-filtered case.

C VERSION : 1.7

C DATE : 06-10-2004

C MODIFIED: Martin O'Mullane

C - Increase number of groups in the adf03 file to 20  
C from 15 to cope with high Z DR.

C VERSION : 1.8

C DATE : 24-06-2005

C MODIFIED: Martin O'Mullane

C - Add arrays for filtered rr/dr/br power.

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CHARACTER*80	DSN03,	DSN35		
CHARACTER*8	INFCAL (IZDIMD),		INFPLS (IZDIMD)	
CHARACTER*8	INFPLT (IZDIMD),		INFPLTN (IZDIMD)	
CHARACTER*8	INFPRB (IZDIMD),		INFPRBN (IZDIMD)	
CHARACTER*8	INFPRC (IZDIMD),		INFPRCN (IZDIMD)	
CHARACTER*8	INFRAL (IZDIMD),		INFSAL (IZDIMD)	
CHARACTER*24	METCAL,	METPLS,	METPLT,	METPLTN
CHARACTER*24	METPRB,	METPRBN,	METPRC,	METPRCN
CHARACTER*24	METRAL,	METSAL		
CHARACTER*13	NAME			
INTEGER	IZ0,	IZL,	IZU,	NUMNE
INTEGER	NUMTE			
LOGICAL	LTICK			
REAL*8	CAL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	FNEL (ITDIMD),		FNEMAX,	FNEMIN
REAL*8	FUELMAS,	PLSL (ITDIMD, IDDIMD, IZDIMD)		
REAL*8	PLSL0 (ITDIMD, IDDIMD)			
REAL*8	PLTL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PLTL0 (ITDIMD, IDDIMD)			
REAL*8	PLTLONFL (ITDIMD, IDDIMD)			
REAL*8	PLTLNFL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBBR (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBBRNFL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBDR (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBDRNFL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBLNFL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBRR (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRBRRNFL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRCL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	PRCLNFL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	RAL (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	RALDR (ITDIMD, IDDIMD, IZDIMD)			
REAL*8	RALRR (ITDIMD, IDDIMD, IZDIMD)			

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REAL*8          SAL (ITDIMD, IDDIMD, IZDIMD)
REAL*8          SAL0 (ITDIMD, IDDIMD) ,          TEL (ITDIMD) , TEMAX
REAL*8          TEMIN
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