

ADAS Subroutine xcoef

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      SUBROUTINE XCOEF ( FILELS , IFAIL , LFXIST ,
&                      NION   , MAXT   ,
&                      INDA   , NIND   , NSPEC ,
&                      LPSEL  , LZSEL  , LISEL , LHSEL , LRSEL ,
&                      TEVA   , TPVA   , THVA ,
&                      DENSA  , DENSPA , RATHA , RATIA ,
&                      ZEFF   ,
&                      COEF   , SPEC
&                      )
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C-----
C ***** FORTRAN77 SUBROUTINE: IONBAL *****
C
C VERSION:  1.1
C
C CALLING PROGRAM: ADAS412
C
C PURPOSE:  TO CALCULATE COMPLETE SETS OF SPECTRUM LINE EMISSIVITIES
C           FOR THE IONS OF AN ELEMENT
C
C           PROCESSES CAN INCLUDE ELECTRON AND PROTON IMPACT, SPON-
C           TANEOUS EMISSION, FREE ELECTRON RECOMBINATION AND CHARGE
C           EXCHANGE RECOMBINATION DEPENDING ON THE INPUT DATA SET.
C
C           ACCEPTS MULTIPLE INPUT FILES.  DESIGNED FOR USE IN G(T)
C           CALCULATIONS ETC.
C
C DATA:    THE SOURCE DATA ARE SPECIFIC ION EXCITATION FILES STORED AS
C           PARTITIONED DATA SET MEMBERS AS FOLLOWS:-
C
C           ' JETSHP.<SE>LIKE.DATA (<MEMBER>)'
C
C           ACCORDING TO ADAS DATA FORMAT ADF04.
C
C INPUT   : (C*60) FILELS ()= INPUT COPASE FILE NAMES
C           (L*4)  LFXIST ()= .TRUE.  => COPASE FILE FOR THIS ION
C                   .FALSE. => NO COPASE FILE FOR THIS ION
C           (I*4)  NION    = NUMBER OF IONS TO BE COMPUTED
C           (I*4)  MAXT    = NUMBER OF TEMPERATURE/DENSITY PAIRS
C           (L*4)  LPSEL   = .TRUE.   => PROTON DATA TO BE INCLUDED
C                   = .FALSE.  => PROTON DATA TO BE EXCLUDED
C           (L*4)  LZSEL   = .TRUE.   => SCALE PROTON DATA WITH ZEFF
C                   = .FALSE.  => DO NOT SCALE PROTON DATA
C           (L*4)  LISEL   = .TRUE.   => IONISATION TO BE INCLUDED
C                   = .FALSE.  => IONISATION TO BE EXCLUDED
C           (L*4)  LHSEL   = .TRUE.   => CHARGE TRANSFER TO BE INCLUDED
C                   = .FALSE.  => CHARGE TRANSFER TO BE EXCLUDED
C           (L*4)  LRSEL   = .TRUE.   => RECOMBINATION TO BE INCLUDED
C                   = .FALSE.  => RECOMBINATION TO BE EXCLUDED
C           (R*8)  TEVA () = ELECTRON TEMPERATURES (EV)
C           (R*8)  TPVA () = PROTON TEMPERATURES (EV)
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C      (R*8) THVA() = NEUTRAL HYDROGEN TEMPERATURES (EV)
C      (R*8) DENSA() = ELECTRON DENSITIES (CM-3)
C      (R*8) DENSPA() = PROTON DENSITIES (CM-3)
C      (R*8) RATHA() = RATIO (NEUTRAL H DENSITY/ELECTRON DENSITY)
C      (R*8) RATIA() = RATIO (N(Z+1)/N(Z) STAGE ABUNDANCES)
C
C OUTPUT : (I*4) IFAIL = 0 SUBROUTINE SUCCESSFUL
C              1 SUBROUTINE FAILURE OR WARNING
C      (I*4) INDA(,) = IDENTIFIER FOR SPECTRUM LINE (10000*IL+IU)
C              1ST DIMENSION - INDEX OF LINES FOR AN ION
C              2ND DIMENSION - ION COUNT INDEX
C      (I*4) NIND() = NUMBER OF LINES FOR AN ION
C              1ST DIMENSION - ION COUNT INDEX
C      (I*4) NSPEC() = NUMBER OF LEVELS FOR AN ION
C              1ST DIMENSION - ION COUNT INDEX
C      (R*8) ZEFF = PLASMA Z EFFECTIVE ( IF 'LZSEL' = .TRUE.)
C              (IF 'LZSEL' = .FALSE. => 'ZEFF=1.0')
C      (R*8) COEF(,,) = EMISSIVITY FOR SPECTRUM LINE (10000*J+I)
C              1ST DIMENSION - INDEX OF LINES FOR AN ION
C              2ND DIMENSION - TEMPERATURE INDEX
C              3RD DIMENSION - ION COUNT INDEX
C      (C*51) SPEC(,) = INFORMATION STRING FOR LEVEL
C              1ST DIMENSION - INDEX OF LEVELS FOR AN ION
C              2ND DIMENSION - ION COUNT INDEX
C
C PROGRAM:
C      (I*4) NDLEV = PARAMETER = MAX. NUMBER OF LEVELS ALLOWED
C      (I*4) NDTRN = PARAMETER = MAX. NO. OF TRANSITIONS ALLOWED
C      (I*4) NDTEM = PARAMETER = MAX. NO. OF TEMPERATURES ALLOWED
C      (I*4) NZDIM = PARAMETER = MAX. NO. OF IONS ALLOWED
C      (I*4) NDMET = PARAMETER = MAX. NO. OF METASTABLES ALLOWED
C
C      (I*4) IUNT10 = PARAMETER = INPUT UNIT FOR COPASE DATA SET
C              PASSING FILE.
C      (I*4) L1 = PARAMETER = 1
C
C      (R*8) D1 = PARAMETER = 1.0D0
C
C      (I*4) ICNTE = NUMBER OF ELECTRON IMPACT TRANSITIONS INPUT
C      (I*4) ICNTP = NUMBER OF PROTON IMPACT TRANSITIONS INPUT
C      (I*4) ICNTR = NUMBER OF FREE ELECTRON RECOMBINATIONS INPUT
C      (I*4) ICNTH = NO. OF CHARGE EXCHANGE RECOMBINATIONS INPUT
C      (I*4) IL = INPUT DATA FILE: NUMBER OF ENERGY LEVELS
C      (I*4) ITRAN = INPUT DATA FILE: NUMBER OF TRANSITIONS
C      (I*4) IZ0 = NUCLEAR CHARGE
C      (I*4) IZ = RECOMBINED ION CHARGE
C      (I*4) IZ1 = RECOMBINING ION CHARGE
C              (NOTE: IZ1 SHOULD EQUAL IZ+1)
C      (I*4) MAXLEV = HIGHEST INDEX LEVEL IN READ TRANSITIONS
C      (I*4) MAXT = NO. OF INPUT TEMP/DENS PAIRS ( 1 -> 'NDTEM' )
C      (I*4) NMET = NUMBER OF METASTABLES (1 <= NMET <= 'NDMET' )
C      (I*4) NORD = NUMBER OF ORDINARY LEVELS ('IL' - 'NMET')

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C      (I*4)  NV      = INPUT DATA FILE: NUMBER OF GAMMA/TEMPERATURE
C                      PAIRS FOR A GIVEN TRANSITION.
C      (I*4)  I      = GENERAL INDEX
C      (I*4)  IT     = TEMPERATURE ARRAY INDEX
C      (I*4)  IS     = ENERGY LEVEL ARRAY INDEX
C
C      (R*8)  TEA()   = INPUT ELECTRON TEMPERATURES (K)
C      (R*8)  TPA()   = INPUT PROTON TEMPERATURES (K)
C      (R*8)  THA()   = INPUT NEUTRAL HYDROGEN TEMPERATURES (K)
C      (R*8)  R8FBCH  = FUNCTION (SEE ROUTINE SECTION BELOW)
C      (R*8)  BWNO    = IONISATION POTENTIAL (CM-1)
C      (R*8)  ZEFFSQ  = 'ZEFF' * 'ZEFF'
C      (R*8)  DMINT   = +1 or -1 DEPENDING ON WHETHER THE NUMBER OF
C                      ROW INTERCHANGES WAS EVEN OR ODD,
C                      RESPECTIVELY, WHEN INVERTING A MATRIX USING
C                      'XXMINV'.
C
C      (L*4)  LSOLVE  = .TRUE.  => SOLVE LINEAR EQUATION USING
C                      'XXMINV'.
C                      .FALSE. =>DO NOT SOLVE LINEAR EQUATION USING
C                      'XXMINV' - INVERT MATRIX ONLY.
C      (L*4)  OPEN10  = .TRUE.  => FILE ALLOCATED TO UNIT 10.
C                      = .FALSE. => NO FILE ALLOCATED TO UNIT 10.
C      (C*3)  TITLED  = ELEMENT SYMBOL.
C      (C*8)  DATE    = CURRENT DATE AS 'DD/MM/YY'
C      (C*60) DSNINC  = INPUT COPASE DATA SET NAME (MVS DSN)
C      (C*51) CLINE   = LEVEL SPECIFICATION LINE
C
C      (I*4)  IA()    = ENERGY LEVEL INDEX NUMBER
C      (I*4)  ILA()   = QUANTUM NUMBER (L) FOR LEVEL 'IA()'
C      (I*4)  ISA()   = MULTIPLICITY FOR LEVEL 'IA()'
C                      NOTE: (ISA-1)/2 = QUANTUM NUMBER (S)
C      (I*4)  IMETR() = INDEX OF METASTABLE IN COMPLETE LEVEL LIST
C                      (ARRAY SIZE = 'NDMET' )
C      (I*4)  IORDR() = INDEX OF ORDINARY EXCITED LEVELS IN COMPLETE
C                      LEVEL LIST.
C      (I*4)  I1A()   = TRANSITION:
C                      LOWER ENERGY LEVEL INDEX (CASE ' ' & 'P')
C                      NOT USED (CASE 'H' & 'R')
C      (I*4)  I2A()   = TRANSITION:
C                      UPPER ENERGY LEVEL INDEX (CASE ' ' & 'P')
C                      CAPTURING LEVEL INDEX (CASE 'H' & 'R')
C      (I*4)  IETRN() = ELECTRON IMPACT TRANSITION:
C                      INDEX VALUES IN MAIN TRANSITION ARRAYS WHICH
C                      REPRESENT ELECTRON IMPACT TRANSITIONS.
C      (I*4)  IPTRN() = PROTON IMPACT TRANSITION:
C                      INDEX VALUES IN MAIN TRANSITION ARRAYS WHICH
C                      REPRESENT PROTON IMPACT TRANSITIONS.
C      (I*4)  IRTRN() = FREE ELECTRON RECOMBINATION:
C                      INDEX VALUES IN MAIN TRANSITION ARRAYS WHICH
C                      REPRESENT FREE ELECTRON RECOMBINATIONS.
C      (I*4)  IHTRN() = CHARGE EXCHANGE RECOMBINATION:
C                      INDEX VALUES IN MAIN TRANSITION ARRAYS WHICH

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C REPRESENT CHARGE EXCHANGE RECOMBINATIONS.
 C (I*4) IE1A () = ELECTRON IMPACT TRANSITION:
 C LOWER ENERGY LEVEL INDEX
 C (I*4) IE2A () = ELECTRON IMPACT TRANSITION:
 C UPPER ENERGY LEVEL INDEX
 C (I*4) IP1A () = PROTON IMPACT TRANSITION:
 C LOWER ENERGY LEVEL INDEX
 C (I*4) IP2A () = PROTON IMPACT TRANSITION:
 C UPPER ENERGY LEVEL INDEX
 C
 C (R*8) PAR (,) =
 C (R*8) ER () = ENERGY RELATIVE TO LEVEL 1 (RYDBERGS)
 C DIMENSION: LEVEL INDEX
 C (R*8) XIA () = ENERGY RELATIVE TO ION. POT. (RYDBERGS)
 C DIMENSION: LEVEL INDEX
 C (R*8) AA () = ELECTRON IMPACT TRANSITION: A-VALUE (SEC-1)
 C (R*8) AVAL () = TRANSITION:
 C A-VALUE (SEC-1) (CASE ' ')
 C NEUTRAL BEAM ENERGY (CASE 'H')
 C NOT USED (CASE 'P' & 'R')
 C (R*8) SCOM (,) = TRANSITION:
 C GAMMA VALUES (CASE ' ' & 'P')
 C RATE COEFFT. (CM3 SEC-1) (CASE 'H' & 'R')
 C 1ST DIMENSION - TEMPERATURE 'SCEF ()'
 C 2ND DIMENSION - TRANSITION NUMBER
 C (R*8) SCEF () = INPUT DATA FILE: ELECTRON TEMPERATURES (K)
 C (R*8) WA () = ENERGY RELATIVE TO LEVEL 1 (CM-1)
 C DIMENSION: LEVEL INDEX
 C (R*8) XJA () = QUANTUM NUMBER (J-VALUE) FOR LEVEL 'IA ()'
 C NOTE: (2*XJA)+1 = STATISTICAL WEIGHT
 C (R*8) RHS () = USED ONLY IF 'LSOLVE=.TRUE.' WHEN CALLING
 C THE SUBROUTINE 'XXMINV'. CONTAINS THE SET
 C OF 'N' LINEAR EQUATIONS TO BE SOLVED.
 C INPUT TO 'XXMINV': RIGHT HAND SIDE VECTOR
 C OUTPUT FROM 'XXMINV': SOLUTION VECTOR
 C (ACTS ONLY AS A DUMMY IN THIS PROGRAM)
 C (R*8) CIE () = IONISATION RATE COEFFICIENT VECTOR FOR
 C FIXED TEMPERATURE.
 C DIMENSION: ENERGY LEVEL INDEX
 C (R*8) VHRED () = CHARGE EXCHANGE RECOMBINATION:
 C VECTOR OF RECOMBINATION RATE CONTRIBUTIONS
 C FOR EACH METASTABLE LEVEL.
 C (UNITS: SEC-1)
 C VALUES FOR GIVEN TEMPERATURE AND DENSITY.
 C DIMENSION: METASTABLE LEVEL INDEX
 C (R*8) VRRED () = FREE ELECTRON RECOMBINATION:
 C VECTOR OF RECOMBINATION RATE CONTRIBUTIONS
 C FOR EACH METASTABLE LEVEL.
 C (UNITS: SEC-1)
 C VALUES FOR GIVEN TEMPERATURE AND DENSITY.
 C DIMENSION: METASTABLE LEVEL INDEX
 C
 C (R*8) EXCRE (,) = ELECTRON IMPACT TRANSITION:

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C          EXCITATION RATE COEFFS (cm**3/s)
C          PRE 'BXRATE': UNIT GAMMA VALUES
C          POST 'BXRATE': TRUE VALUES
C          1st DIMENSION: TEMPERATURE INDEX ('TOUT')
C          2nd DIMENSION: TRANSITION INDEX
C (R*8)  DEXCRE(,) = ELECTRON IMPACT TRANSITION:
C          DE-EXCITATION RATE COEFFS (cm**3/s)
C          PRE 'BXRATE': UNIT GAMMA VALUES
C          POST 'BXRATE': TRUE VALUES
C          1st DIMENSION: TEMPERATURE INDEX ('TOUT')
C          2nd DIMENSION: TRANSITION INDEX
C (R*8)  EXCRP(,) = PROTON IMPACT TRANSITION:
C          EXCITATION RATE COEFFS (cm**3/s)
C          PRE 'BXRATE': UNIT GAMMA VALUES
C          POST 'BXRATE': TRUE VALUES
C          1st DIMENSION: TEMPERATURE INDEX ('TOUT')
C          2nd DIMENSION: TRANSITION INDEX
C (R*8)  DEXCRP(,) = PROTON IMPACT TRANSITION:
C          DE-EXCITATION RATE COEFFS (cm**3/s)
C          PRE 'BXRATE': UNIT GAMMA VALUES
C          POST 'BXRATE': TRUE VALUES
C          1st DIMENSION: TEMPERATURE INDEX ('TOUT')
C          2nd DIMENSION: TRANSITION INDEX
C (R*8)  VECH(,) = CHARGE-EXCHANGE RECOMBINATION:
C          SPLINED RECOMBINATION RATE COEFFT. VALUES.
C          1st DIMENSION: TEMPERATURE INDEX ('TOUT')
C          2nd DIMENSION: CAPTURING LEVEL INDEX.
C (R*8)  VECR(,) = FREE ELECTRON RECOMBINATION:
C          SPLINED RECOMBINATION RATE COEFFT. VALUES.
C          1st DIMENSION: TEMPERATURE INDEX ('TOUT')
C          2nd DIMENSION: CAPTURING LEVEL INDEX.
C (R*8)  CRA(,) = A-VALUE (sec-1) MATRIX COVERING ALL
C          TRANSITIONS.
C          1st DIMENSION: ENERGY LEVEL INDEX
C          2nd DIMENSION: ENERGY LEVEL INDEX
C          (NOTE: DIAGONAL ELEMENTS REPRESENT THE
C          NEGATIVE SUM OF THEIR RESPECTIVE
C          COLUMNS.)
C (R*8)  CRCE(,) = ELECTRON IMPACT TRANSITION:
C          EXCIT'N/DE-EXCIT'N RATE COEFFT MATRIX
C          COVERING ALL TRANSITIONS (cm**3/s).
C          VALUES FOR GIVEN TEMPERATURE & TRANSITION
C          TYPE.
C          1st DIMENSION: ENERGY LEVEL INDEX
C          2nd DIMENSION: ENERGY LEVEL INDEX
C          (NOTE: DIAGONAL ELEMENTS REPRESENT THE
C          NEGATIVE SUM OF THEIR RESPECTIVE
C          COLUMNS.)
C (R*8)  CRCP(,) = PROTON IMPACT TRANSITION:
C          EXCIT'N/DE-EXCIT'N RATE COEFFT MATRIX
C          COVERING ALL TRANSITIONS (cm**3/s).
C          VALUES FOR GIVEN TEMPERATURE & TRANSITION
C          TYPE.

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C 1st DIMENSION: ENERGY LEVEL INDEX
 C 2nd DIMENSION: ENERGY LEVEL INDEX
 C (NOTE: DIAGONAL ELEMENTS REPRESENT THE
 C NEGATIVE SUM OF THEIR RESPECTIVE
 C COLUMNS.)
 C (R*8) CC(,) = RATE MATRIX COVERING ALL TRANSITIONS
 C (UNITS: SEC-1)
 C VALUES FOR GIVEN TEMPERATURE AND DENSITY.
 C 1st DIMENSION: ENERGY LEVEL INDEX
 C 2nd DIMENSION: ENERGY LEVEL INDEX
 C (R*8) CMAT(,) = (INVERTED) RATE MATRIX COVERING ALL
 C NON-METASTABLE/ORDINARY EXCITED LEVELS.
 C (UNITS: SEC)
 C VALUES FOR GIVEN TEMPERATURE AND DENSITY.
 C PRE 'XXMINV' : NOT-INVERTED
 C POST 'XXMINV' : INVERTED
 C 1st DIMENSION: ORDINARY EXCITED LEVEL INDEX
 C 2nd DIMENSION: ORDINARY EXCITED LEVEL INDEX
 C (R*8) CRED(,) = MATRIX OF TRANSITION RATES BETWEEN
 C METASTABLE LEVELS.
 C (UNITS: SEC-1)
 C VALUES FOR GIVEN TEMPERATURE AND DENSITY.
 C 1st DIMENSION: METASTABLE LEVEL INDEX
 C 2nd DIMENSION: METASTABLE LEVEL INDEX
 C (R*8) CRMAT(,) = INVERTED METASTABLE LEVEL RATE MATRIX
 C COVERING ALL TRANSITIONS BETWEEN METASTABLE
 C LEVELS EXCEPT THOSE INVOLVING LEVEL 1.
 C VALUES FOR GIVEN TEMPERATURE AND DENSITY.
 C BEFORE INPUT TO XXMINV: NOT INVERTED
 C AFTER OUTPUT FROM XXMINV: AS-ABOVE
 C 1st DIMENSION: METASTABLE LEVEL INDEX - 1
 C 2nd DIMENSION: METASTABLE LEVEL INDEX - 1
 C
 C
 C (R*8) POPAR(,) = LEVEL POPULATIONS
 C 1st DIMENSION: LEVEL INDEX
 C 2nd DIMENSION: TEMPERATURE INDEX
 C (R*8) STVR(,) = ORDINARY EXCITED LEVEL:
 C FREE-ELECTRON RECOMBINATION COEFFICIENTS
 C (UNITS* CM**3/SEC-1)
 C 1st DIMENSION: ORDINARY LEVEL INDEX
 C 2nd DIMENSION: TEMPERATURE INDEX
 C (R*8) STVH(,) = ORDINARY EXCITED LEVEL:
 C CHARGE-EXCHANGE RECOMBINATION COEFFICIENTS
 C (UNITS* CM**3/SEC-1)
 C 1st DIMENSION: ORDINARY LEVEL INDEX
 C 2nd DIMENSION: TEMPERATURE INDEX
 C (R*8) STACK(,,) = ORDINARY EXCITED LEVEL POPULAT'N DEPENDENCE
 C ON METASTABLE LEVEL.
 C 1st DIMENSION: ORDINARY LEVEL INDEX
 C 2nd DIMENSION: METASTABLE INDEX
 C 3rd DIMENSION: TEMPERATURE INDEX
 C (R*8) STVRM(,) = METASTABLE LEVEL:

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C          FREE-ELECTRON RECOMBINATION COEFFICIENTS
C          (UNITS* CM**3/SEC-1)
C          1st DIMENSION: METASTABLE INDEX
C          2nd DIMENSION: TEMPERATURE INDEX
C          (R*8) STVHM(,) = METASTABLE LEVEL:
C          CHARGE-EXCHANGE RECOMBINATION COEFFICIENTS
C          (UNITS* CM**3/SEC-1)
C          1st DIMENSION: METASTABLE INDEX
C          2nd DIMENSION: TEMPERATURE INDEX
C          (R*8) STCKM(,) = METASTABLE POPULATIONS STACK
C          1st DIMENSION: METASTABLE INDEX
C          2nd DIMENSION: TEMPERATURE INDEX
C
C          (C*1) TCODE() = TRANSITION: DATA TYPE POINTER:
C          ' ' => Electron Impact Transition
C          'P' => Proton Impact Transition
C          'H' => Charge Exchange Recombination
C          'R' => Free Electron Recombination
C          (C*18) CSTRGA() = NOMENCLATURE/CONFIGURATION FOR LEVEL 'IA()'
C          (C*22) STRGA() = LEVEL DESIGNATIONS
C
C          (L*4) LTRNG(,) = .TRUE. => TEMPERATURE VALUE WITHIN RANGE
C          READ FROM INPUT COPASE DATA SET.
C          = .FALSE. => TEMPERATURE VALUE NOT WITHIN RANGE
C          READ FROM INPUT COPASE DATA SET.
C          1st DIMENSION: TEMPERATURE INDEX.
C          2nd DIMENSION: TEMPERATURE TYPE -
C          1) => ELECTRON
C          2) => PROTON
C          3) => NEUTRAL HYDROGEN

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C NOTE:

C INPUT/OUTPUT STREAM ALLOCATIONS:

C -----

C STREAM 10: INPUT - SPECIFIC ION RATE DATA INPUT FILE FROM
C ('IUNT10') DATABASE (SEE DATA SECTION ABOVE).

C AUTHOR: HP SUMMERS
C K1/1/57
C JET EXT. 4941

C DATE: 27/06/91

C UPDATE: 12/04/94 - H. P. SUMMERS - RATIONALISING OF DIMENSIONS WITH
C LATEST ADAS9120 ROUTINES. NOTED
C STACK IS REAL*4

C#

C DATE: mar20-95 - A. C. Lanzafame - conversion to Unix
C mar21-95 - A. C. Lanzafame - call to XXDATE avoided: redundant

C mar24-95 - - FILELS from C*44 to C*60
C - DSNINC from C*44 to C*60
C apr27-95 - A. C. Lanzafame - STACK changed to R*8
C

C ROUTINES:

C	ROUTINE	SOURCE	BRIEF DESCRIPTION
C	DCSTKC	ADAS	STACK UP TRANSITION RATE BETWEEN METS.
C	DCSTKA	ADAS	STACK UP ORDINARY POP. DEPENDENCE ON MET
C	DCPOPM	ADAS	CALCULATE BASIC MET. LEVEL POPULATIONS.
C	DCPOPO	ADAS	CALCULATE ORDINARY LEVEL POPULATIONS.
C	DCLNORM	ADAS	NORMALISES LINE EMISSIVITY.
C	BXDATA	ADAS	GATHERS RELEVANT DATA FROM INPUT FILE
C	BXTTYP	ADAS	SORT TRANSITIONS INTO TRAN/RECOMB TYPES
C	BXIORD	ADAS	SETS UP ORDINARY LEVEL INDEX.
C	BXRATE	ADAS	CALCULATES EXC. & DE-EXC. RATE COEFFTS.
C	BXRCOM	ADAS	ESTABLISHES RECOMBINATION RATE COEFFTS.
C	BXMCRA	ADAS	CONSTRUCTS A-VALUE MATRIX.
C	BXMCRC	ADAS	CONSTRUCTS EXC./DE-EXC. RATE COEF MATRIX
C	BXMCCA	ADAS	CONSTRUCTS WHOLE RATE MATRIX.
C	BXMCMA	ADAS	CONSTRUCTS ORDINARY LEVEL RATE MATRIX.
C	BXSTKB	ADAS	STACK UP RECOMB. CONTRIBUTION FOR ORD.
C	BXSTKD	ADAS	STACK UP RECOMB RATE FOR EACH MET. LEVEL
C	BXMPOP	ADAS	CALCULATE METASTABLE LEVEL POPULATIONS.
C	BXSTVM	ADAS	CALCULATE MET. LEVEL RECOMB. COEFFTS.
C	XXERYD	ADAS	CONVERTS ENERGIES FROM W.NO. TO RYDBERGS
C	XXRATE	ADAS	CALCULATES EXC. & DE-EXC. RATE COEFFTS.
C	XXMINV	ADAS	INVERTS MATRIX AND SOLVES EQUATIONS.
C			FOR UNIT GAMMA VALUE
C	R8FBCH	ADAS	REAL*8 FUNCTION:EVALUATES SHELL CONTRIB.
C			TO IONISATION RATE COEFFICIENT IN THE
C			BURGESS-CHIDICHIMO APPROX.

C VERSION 1.1 DATE: 28-10-97
C RICHARD MARTIN
C PUT UNDER SCCS CONTROL (ADAS412).
C

C VERSION: 1.2 DATE: 02-05-2003
C MODIFIED: Martin O'Mullane
C - Use xxdata_04 to read adf04 file. This requires
C new arrays some of which are not used in the
C population calculation.
C - bxttyp parameter list extended.
C

C VERSION : 1.3
C DATE : 04-08-2008
C MODIFIED: Martin O'Mullane
C - Increase number of transitions to 3000.
C

C VERSION : 1.4
C DATE : 29-08-2008
C MODIFIED: Martin O'Mullane
C - Reduce nzdlim from 20 to 1.

C

C-----

CHARACTER*60	FILELS (NZDIM)		
CHARACTER*51	SPEC (NDLEV, NZDIM)		
INTEGER	IFAIL, INDA (NDTRN, NZDIM) ,		MAXT
INTEGER	NIND (NZDIM) , NION, NSPEC (NZDIM)		
LOGICAL	LFXIST (NZDIM) , LHSEL, LISEL		
LOGICAL	LPSEL, LRSEL, LZSEL		
REAL*8	COEF (NDTRN, NDTEM, NZDIM) ,	DENSA (NDTEM)	
REAL*8	DENSPA (NDTEM) ,	RATHA (NDTEM)	
REAL*8	RATIA (NDTEM) ,	TEVA (NDTEM)	
REAL*8	THVA (NDTEM) , TPVA (NDTEM) ,	ZEFF	