

ADAS Subroutine d5mpop

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SUBROUTINE D5MPOP( NTDIM , IZDIMD, IPDIMD,
&                 NSTAGE, ITMAX , NPRT  , NMSUM ,
&                 ACDA  , SCDA  , CCDA  , QCDA  , XCDA  ,
&                 DENS  , DENSH ,
&                 ITEM  ,
&                 CFREC , CFION , CFMET ,
&                 POPN  , POPNMO, POPNPO,
&                 CPOPN , CPOPND, CPOPNZ,
&                 POPF  ,
&                 XTEMP , YTEMP , YTEM  ,
&                 RHS   , RDUM  , SOLVE , LSOLVE
&                 )
IMPLICIT REAL*8 (A-H,O-Z)

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C ***** FORTRAN 77 SUBROUTINE: D5MPOP *****
C
C PURPOSE: CALCULATION OF METASTABLE RESOLVED IONISATION STAGE
C           POPULATIONS OF A PARTICULAR ELEMENT FOR A GIVEN TEMPERATURE
C           AND DENSITY
C
C CALLING PROGRAM: ADAS405
C
C SUBROUTINE:
C
C INPUT  : (I*4) NTDIM           = MAXIMUM NUMBER OF MODEL TEMPS/DENSITIES
C INPUT  : (I*4) IZDIMD         = MAXIMUM NUMBER OF STAGES-1
C INPUT  : (I*4) IPDIMD         = MAXIMUM SIZE OF METASTABLES FRO A STAGE
C INPUT  : (I*4) NSTAGE         = NUMBER OF STAGES-1
C INPUT  : (I*4) ITMAX          = NUMBER OF MODEL TEMPS/DENSITIES
C INPUT  : (R*8) NPRT ( )       = PARTITION OF TOTAL METASTABLES ACCORDING
C                               TO IONISATION STAGES
C                               1ST DIM: STAGE INDEX
C INPUT  : (I*4) NMSUM          = TOTAL NUMBER OF POPULATIONS
C INPUT  : (R*8) ACDA ( , , , ) = GENERALISED CR RECOMBINATION COEFFICIENT
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: STAGE INDEX (LESS 1)
C                               3RD DIM: METASTABLE INDEX
C                               4TH DIM: METASTABLE INDEX
C INPUT  : (R*8) SCDA ( , , , ) = GENERALISED CR IONISATION COEFFICIENT
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: STAGE INDEX (LESS 1)
C                               3RD DIM: METASTABLE INDEX
C                               4TH DIM: METASTABLE INDEX
C INPUT  : (R*8) CCDA ( , , , ) = GENERALISED CR CHARGE EXCH. COEFFICIENT
C                               1ST DIM: TEMPERATURE INDEX
C                               2ND DIM: STAGE INDEX (LESS 1)
C                               3RD DIM: METASTABLE INDEX
C                               4TH DIM: METASTABLE INDEX
C INPUT  : (R*8) QCDA ( , , , ) = GENERALISED CR CROSS-COUPLED COEFFICIENT

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C          1ST DIM: TEMPERATURE INDEX
C          2ND DIM: STAGE INDEX (LESS 1)
C          3RD DIM: METASTABLE INDEX
C          4TH DIM: METASTABLE INDEX
C INPUT  : (R*8) XCDA( , , , ) = GENERALISED CR PARENT X-CP. COEFFICIENT
C          1ST DIM: TEMPERATURE INDEX
C          2ND DIM: STAGE INDEX (LESS 1)
C          3RD DIM: METASTABLE INDEX
C          4TH DIM: METASTABLE INDEX
C INPUT  : (R*8) DENS( ) = ELECTRON DENSITIES FOR MODEL
C INPUT  : (R*8) DENS( ) = NEUTRAL HYDROGEN DENSITIES FOR MODEL
C
C INPUT  : (I*4) ITEM = CURRENT TEMP/DENSITY INDEX
C
C OUTPUT: (R*8) CFREC( , , ) = RECOMBINATION RATE COEFFICIENTS TO ALL
C          METASTABLE IPDIMD; STARTING FROM FIRST TO
C          GROUND LEVEL, WITH CFREC(1, IPDIMD, IPDIMD)
C          SET TO ZERO
C          DIMENSIONS = (IPDIMD, IPDIMD, IZDIMD)
C OUTPUT: (R*8) CFION( , , ) = IONISATION RATE COEFFICIENTS TO ALL
C          METASTABLE IPDIMD; STARTING FROM GROUND
C          TO FIRST LEVEL, WITH
C          CFION(NSTAGE, IPDIMD, IPDIMD)
C          SET TO ZERO
C          DIMENSIONS = (IPDIMD, IPDIMD, IZDIMD)
C OUTPUT: (R*8) CFMET( , , ) = CROSS COUPLING COEFFICIENTS BETWEEN
C          METASTABLE IPDIMD WITH LEADING DIAGONAL
C          CALCULATED
C          DIMENSIONS = (IPDIMD, IPDIMD, IZDIMD)
C
C OUTPUT: (R*8) POPN( , , ) = ARRAY HOLDING POPULATION STATE VALUES
C          WITH SECOND DIMENSION SET TO 1
C          DIMENSIONS = (IPDIMD, NDONE, IZDIMD+1)
C OUTPUT: (R*8) POPNMO( , , ) = TEMPORARY NAME OF MATRIX HOLDING POPULATI ON
C          STATE VALUES AFTER NORMALIZATION, TO BE
C          SUBSTITUTED INTO NEXT EQUATION IN
C          DOWNWARD LOOP
C          DIMENSIONS = (IPDIMD, NDONE, IZDIMD+1)
C OUTPUT: (R*8) POPNPO( , , ) = TEMPORARY NAME OF MATRIX HOLDING POPULATI ON
C          STATE VALUES AFTER NORMALIZATION, TO BE
C          SUBSTITUTED INTO NEXT EQUATION IN UPWARD
C          LOOP
C          DIMENSIONS = (IPDIMD, NDONE, IZDIMD+1)
C
C OUTPUT: (R*8) CPOPN( , , ) = ARRAY HOLDING COEFFICIENTS OF POPULATION
C          STATE EQUATIONS
C          DIMENSIONS = (IPDIMD, IPDIMD, IZDIMD+1)
C OUTPUT: (R*8) CPOPND( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C          INTO NEXT EQUATION IN UPWARD LOOP
C          DIMENSIONS = (IPDIMD, IPDIMD, IZDIMD+1)
C OUTPUT: (R*8) CPOPNZ( , , ) = TEMPORARY NAME OF MATRIX TO BE SUBSTITUTED
C          INTO NEXT EQUATION IN DOWNWARD LOOP
C          DIMENSIONS = (IPDIMD, IPDIMD, IZDIMD+1)

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C
C OUTPUT: (R*8) POPF ( )           = POPULATIONS FOR A SPECIFIED TEMPERATURE  D
C                                  1ST DIM: INDEX OVER STAGES/METASTABLES
C
C OUTPUT: (R*8) XTEMP ( , )       =TEMPORARY MATRIX USED DURING SUBROUTINE
C                                  CALCULATIONS
C                                  DIMENSIONS = (IPDIMD,IPDIMD)
C OUTPUT: (R*8) YTEMP ( , )       =TEMPORARY MATRIX FOR DURING SUBROUTINE
C                                  CALCULATIONS
C                                  DIMENSIONS = (IPDIMD,IPDIMD)
C OUTPUT: (R*8) YTEM ( )          = TEMPORARY ARRAY FOR HOLDING VALUES OF
C                                  DIFFERENCE BETWEEN RECOMBINATION AND
C                                  IONISATION GROUND LEVEL COEFFICIENTS
C                                  DIMENSIONS = (NSTAGE)
C
C OUTPUT: (R*8) RHS ( )           = SIPHONED OFF COLUMN OF NORMALIZATION
C                                  MATRIX,USED TO CALCULATE METASTABLE
C                                  IPDIMD OF DOMINANT STAGE THROUGH MATINV
C                                  DIMENSIONS = (2*IPDIMD-1)
C OUTPUT: (R*8) RDUM ( )          = DUMMY ARRAY USED IN MATINV AS RHS WHEN
C                                  LSOLVE = FALSE
C OUTPUT: (R*8) SOLVE ( , )       = NORMALIZATION MATRIX AT CRITICAL STAGE
C                                  DIMENSIONS = (2*IPDIMD-1,2*IPDIMD-1)
C OUTPUT: (L*4) LSOLVE            = .TRUE. => SOLVE SET OF EQUATIONS
C                                  = .FALSE. => INVERT MATRIX ONLY
C
C      (I*4) NDONE                 = PARAMETER = 1 TO ALLOW 3D MATRIX USE
C      (I*4) ID                    = POSITION OF DOMINANT TERM
C      (I*4) ISTATE                = STAGE INDEX
C      (I*4) ITEM                  = GENERAL INDEX
C      (I*4) I                     = GENERAL INDEX
C      (I*4) J                     = GENERAL INDEX
C      (I*4) K                     = GENERAL INDEX
C      (R*8) YMIN                  = VALUE OF DIFFERENCE BETWEEN
C                                  RECOMBINATION AND IONISATION COEFFICIENTS
C                                  OF GROUND IPDIMD
C
C ROUTINES:
C      ROUTINE      SOURCE      BRIEF DESCRIPTION
C      -----
C      D5DIAG      ADAS        SETS UP ON-DIAGONAL ELEMENT OF MATRIX
C      D5MFSP      ADAS        EXECUTES PARTITION MATRIX INVERSION
C      DXMADD      ADAS        MATRIX ADDITION/SUBTRACTION
C      DXMMUL      ADAS        MATRIX MULTIPLICATION
C      XXMINV      ADAS        MATRIX INVERSION
C
C AUTHOR:  D. BROOKS, H. P. SUMMERS, JET
C          K1/1/57
C          JET EXT. 4941
C
C DATE:    02/06/94
C

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C UPDATE: 14/02/95 HPS - INTRODUCED IAGAIN TO IMPROVE DOMINANT STAGE
 C IDENTIFICATION. CHANGED A LOOP LIMIT.
 C UNIX-IDL PORT:
 C
 C VERSION: 1.1 DATE: 08-11-95
 C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
 C - FIRST RELEASE
 C
 C VERSION: 1.2 DATE: 01-12-95
 C MODIFIED: TIM HAMMOND (TESSELLA SUPPORT SERVICES PLC)
 C - COPIED FOLLOWING CHANGES MADE BY DAVID BROOKS
 C
 C UPDATE: 29/11/95 DHB - CHANGED THE METHOD FOR THE FIRST GUESS AT THE
 C DOMINANT STAGE TO AVOID DIVISION BY ZERO
 C ERRORS IN D5MFSP. NOW PICK A STAGE THAT HAS AN
 C INVERTIBLE SOLUTION AND ADJUST AFTER THE
 C POPULATION FRACTIONS HAVE BEEN CALCULATED.
 C
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INTEGER	IPDIMD,	ITEM,	ITMAX,	IZDIMD
INTEGER	NMSUM,	NPRT (IZDIMD) ,		NSTAGE
INTEGER	NTDIM			
LOGICAL	LSOLVE			
REAL*8	ACDA (NTDIM, IZDIMD, IPDIMD, IPDIMD)			
REAL*8	CCDA (NTDIM, IZDIMD, IPDIMD, IPDIMD)			
REAL*8	CFION (IPDIMD, IPDIMD, IZDIMD)			
REAL*8	CFMET (IPDIMD, IPDIMD, IZDIMD)			
REAL*8	CFREC (IPDIMD, IPDIMD, IZDIMD)			
REAL*8	CPOP (IPDIMD, IPDIMD, IZDIMD+1)			
REAL*8	CPOPND (IPDIMD, IPDIMD, IZDIMD+1)			
REAL*8	CPOPNZ (IPDIMD, IPDIMD, IZDIMD+1)			
REAL*8	DENS (NTDIM) , DENS (NTDIM)			
REAL*8	POPF (NMSUM) , POPN (IPDIMD, NDONE, IZDIMD+1)			
REAL*8	POP (IPDIMD, NDONE, IZDIMD+1)			
REAL*8	POP (IPDIMD, NDONE, IZDIMD+1)			
REAL*8	QCDA (NTDIM, IZDIMD, IPDIMD, IPDIMD)			
REAL*8	RDUM (IPDIMD) ,		RHS (2*IPDIMD-1)	
REAL*8	SCDA (NTDIM, IZDIMD, IPDIMD, IPDIMD)			
REAL*8	SOLVE (2*IPDIMD-1, 2*IPDIMD-1)			
REAL*8	XCDA (NTDIM, IZDIMD, IPDIMD, IPDIMD)			
REAL*8	XTEMP (IPDIMD, IPDIMD) ,		YTEM (IZDIMD)	
REAL*8	YTEMP (IPDIMD, IPDIMD)			