ADAS Subroutine r8fmon1

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C
       REAL*8 FUNCTION R8FMON1(E1,E2,L)
       IMPLICIT REAL*8(A-H,O-Z)
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 FUNCTION: R8FMON1 **********************
C
C PURPOSE: CALCULATES THE MONOPOLE INTEGRAL |<E1,L|1/r>|E2,L>|^2
C
C
C NOTE: CREATED BY  ALAN BURGESS FOR USE IN THE DIPOLE INTEGRAL
C       I(KAPPA1,L1,KAPPA2,L2,1) EVALUATION AS DEFINED IN PHIL.
C       TRANS. ROY. SOC. A226,255,1970, WHERE E1=KAPPA1**2 AND
C       E2=KAPPA2**2. APPLIES TO POSITIVE ELECTRON ENERGIES, .
c       THAT IS THE FREE-FREE CASE.
C
C CALLING PROGRAMS: R8MON1
C
C INPUT:  (R*8)  E1      = KAPPA1**2 WHERE KAPPA1 IS SCALED INITIAL
C                          ELECTRON WAVE NUMBER
C INPUT:  (I*4)  L       = ORBITAL ANGULAR OMENTUM OF INITIAL ELECTRON
C INPUT:  (R*8)  E2      = KAPPA2**2 WHERE KAPPA2 IS SCALED INITIAL
C                          ELECTRON WAVE NUMBER
C
C OUTPUT: (R*8)  R8MON1 = |<E1,L|1/r>|E2,L>|^2
C
C ROUTINES:
C          ROUTINE    SOURCE   BRIEF DESCRIPTION
C          ------------------------------------------------------------
C          ARGAM      ADAS     CALCULATES ARGGAMMA(L+1+I*A)
C
C UNIX-IDL PORT:
C
C VERSION: 1.1                          DATE: 17-04-07
C MODIFIED: HUGH SUMMERS
C               - FIRST FULLY COMMENTED RELEASE
C
C-----------------------------------------------------------------------
       IF(E1+E2-1.0D-40)28,28,29
   28  R8FMON1=1.0D50
       RETURN
   29  CONTINUE
       VMAX=200.0D0
       X1=DSQRT(E1)
       X2=DSQRT(E2)
       X3=X1+X2
       X4=X3*X3
       X5=X1*X2
       X6=X2-X1
       X7=4.0D0/X4
       PI=3.141592653589793D0
       IF(E1-E2)1,1,2
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 1  ETA=1.0D0/X2
    GO TO 3
 2  ETA=1.0D0/X1
 3  G=0.5D0*PI*DEXP(-PI*ETA)
    A1=1.0D0
    A2=1.0D0
    MG=0
    MA1=0
    MA2=0
    M=-1
 4  M=M+1
    EM=M
    T=EM+EM+1.0D0
    G=G*X7/(T*(T+1.0D0))
    EMM=EM*EM
    A1=A1*(1.0D0+EMM*E1)
    A2=A2*(1.0D0+EMM*E2)
30  IF(G-0.015625D0) 31,32,32
31  G=64.0D0*G
    MG=MG-1
    GO TO 30
32  IF(G-64.0D0) 34,34,33
33  G=0.015625D0*G
    MG=MG+1
    GO TO 32
34  IF(A1-64.0D0) 36,36,35
35  A1=0.015625D0*A1
    MA1=MA1+1
    GO TO 34
36  IF(A2-64.0D0) 38,38,37
37  A2=0.015625D0*A2
    MA2=MA2+1
    GO TO 36
38  CONTINUE
    IF(M-L)4,5,5
 5  G=G*(T+1.0D0)
    IF(X1-300.0D0)7,6,6
 6  B=PI/X1
    A1=1.5D0*A1/(B*(3.0D0-B*(3.0D0-B*(2.0D0-B))))
    GO TO 9
 7  IF(X1-0.2D0)9,9,8
 8  B=-PI/X1
    A1=A1/(1.0D0-DEXP(B+B))
 9  IF(X2-300.0D0)11,10,10
10  B=PI/X2
    A2=1.5D0*A2/(B*(3.0D0-B*(3.0D0-B*(2.0D0-B))))
    GO TO 13
11  IF(X2-0.2)13,13,12
12  B=-PI/X2
    A2=A2/(1.0D0-DEXP(B+B))
13  G=G*DSQRT(A1*A2)*(8.0D0)**(MG+MG+MA1+MA2)
    S0=1.0D0
    S1=0.0D0
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```
      U=L
      V=0.0D0
      W=U+U+1.0D0
      T0=1.0D0
      T1=0.0D0
   14 U=U+1.0D0
      V=V+1.0D0
      W=W+1.0D0
      IF(V-VMAX)21,21,20
   20 R8FMON1=0.0D0
      RETURN
   21 CONTINUE
      U0=U*U*X5+1.0D0
      U1=U*X6
      T=T0*U0-T1*U1
      T1=T0*U1+T1*U0
      T0=T
      T=X7/(V*W)
      T0=T*T0
      T1=T*T1
      S0=S0+T0
      S1=S1+T1
      S=S0*S0+S1*S1
      T=T0*T0+T1*T1
      IF(S-1.0D24*T)14,15,15
   15 R8FMON1=G*DSQRT(S)
      IV=V
      RETURN
     END
     INTEGER             L
     REAL*8              E1,          E2
```