ADAS Subroutine r8fdip2

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C
       REAL*8 FUNCTION R8FDIP2(E1,L1,E2,L2)
       IMPLICIT REAL*8(A-H,O-Z)
C-----------------------------------------------------------------------
C
C  ****************** FORTRAN77 FUNCTION: R8FDIP2 **********************
C
C PURPOSE: CALCULATES THE DIPOLE INTEGRAL I(KAPPA1,L1,KAPPA2,L2,1) FOR
C          WHERE MIN(E1,E2)/EMAX(E1,E2) > 0.03
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: R8FDIP
C
C INPUT:  (R*8)  E1      = KAPPA1**2 WHERE KAPPA1 IS SCALED INITIAL
C                          ELECTRON WAVE NUMBER
C INPUT:  (I*4)  L1      = ORBITAL ANGULAR OMENTUM OF INITIAL ELECTRON
C INPUT:  (R*8)  E2      = KAPPA2**2 WHERE KAPPA2 IS SCALED INITIAL
C                          ELECTRON WAVE NUMBER
C INPUT:  (I*4)  L2      = ORBITAL ANGULAR OMENTUM OF FINAL ELECTRON
C
C OUTPUT: (R*8)  R8FDIP2 = I(KAPPA1,L1,KAPPA2,L2,1)
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-----------------------------------------------------------------------
       WMAX=200.0D0
       ETA1=1.0D0/DSQRT(E1)
       ETA2=1.0D0/DSQRT(E2)
       W1=ETA2-ETA1
       PI=3.141592653589793D0
       A=DABS(W1)
       B=PI*A
       IF(B-0.01D0)1,1,2
    1  C=3.0D0/(3.0D0-B*(3.0D0-B*(2.0D0-B)))
       C=DSQRT(C)
       GO TO 5
    2  IF(B-14.0D0)4,3,3
    3  C=DSQRT(B+B)
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      GO TO 5
    4 B=B+B
      C1=1.0D0-DEXP(-B)
      C=DSQRT(B/C1)
    5 C=0.5D0*C/DSQRT(ETA1*ETA2)
      C2=ETA1+ETA2
      C1=4.0D0*ETA1*ETA2/(C2*C2)
      L=L1
      IF(L2-L1)6,6,7
    6 L=L2
      T1=ETA1
      ETA1=ETA2
      ETA2=T1
      W1=-W1
    7 C=C*C1**(L+1)
      U0=L+1
      U1=ETA1
      V0=U0
      V1=-ETA2
      W0=1.0D0
      X0=W1/(C2*C2)
      Y2=-ETA2-ETA2
      Y0=-U0*W1+Y2
      Y1=ETA2*W1
      T1=X0/(1.0D0+W1*W1)
      Z0=U0*T1
      Z1=U1*T1
      T=Z0-Z1*W1
      Z1=Z0*W1+Z1
      Z0=T
      Q0=-1.0D0+Z0*Y0-Z1*Y1
      Q1=Z0*Y1+Z1*Y0
      X=W1*X0
    8 U0=U0+1.0D0
      V0=V0+1.0D0
      W0=W0+1.0D0
      IF(W0-WMAX)21,21,20
   20 R8FDIP2=0.0D0
      RETURN
   21 CONTINUE
      Y0=Y0+Y2
      T=Z0*U0-Z1*U1
      Z1=Z0*U1+Z1*U0
      Z0=T
      T=Z0*V0-Z1*V1
      Z1=Z0*V1+Z1*V0
      Z0=T
      T=Z0*W0-Z1*W1
      Z1=Z0*W1+Z1*W0
      Z0=T
      X0=X/(W0*(W0*W0+W1*W1))
      Z0=Z0*X0
      Z1=Z1*X0
```

```
      T0=Z0*Y0-Z1*Y1
      T1=Z0*Y1+Z1*Y0
      Q0=Q0+T0
      Q1=Q1+T1
      T1=T0*T0+T1*T1
      T0=Q0*Q0+Q1*Q1
      IF(T0-1.0D24*T1)8,8,9
    9 J1=0
      J2=L+1
      P=ARGAM(J1,W1)+ARGAM(L,ETA1)-ARGAM(J2,ETA2)
      IW0=W0
      IF(A-1.0D-40)11,11,10
   10 P=P+W1*DLOG(C2/A)
   11 P0=DCOS(P)
      P1=DSIN(P)
      T=P0*Q0-P1*Q1
      Q1=P0*Q1+P1*Q0
      Q0=T
      R8FDIP2=C*Q1
      RETURN
     END
     INTEGER             L1,          L2
     REAL*8              E1,          E2
```