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1: C      program orbitl.for
2: C      Sep. 20, 2005
3: C      COMPUTES MIE SCATTERING BY a modified Luneburg lens
4:      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
5:      integer m
6:      DIMENSION AN(129),r(128),X(128),Y(128)
7:      DIMENSION ex0(128),ey0(128),fx0(128),fy0(128)
8:      DIMENSION ex(140,128),ey(140,128),fx(140,128),fy(140,128)
9:      DIMENSION gx(140),gg(140,128)
10:     DIMENSION TAM(128),TAQ(128),TAD(128),TAP(128)
11:     DIMENSION TBM(128),TBQ(128),TBD(128),TBP(128)
12:     DIMENSION TEM1(64),TEM2(64),TEM3(64),TEM4(64)
13:     DIMENSION TEM5(64),TEM6(64),TEM7(64),TEM8(64)
14:     DIMENSION CTH(361),PI(2,361)
15:     DIMENSION SRP(361),SIP(361),SRM(361),SIM(361),PT(3,361)
16: C
17:     PII=3.1415926536
18:     write(*,100)
19: 100    format(' particle radius in microns=')
20:     read(*,101) a
21:     a2=a*a
22: 101    format(f14.6)
23:     write(*,102)
24: 102    format(' magnitude of focal position/a=')
25:     read(*,101) f
26:     f2=f*f
27:     f2l=f2+1.
28:     write(*,103)
29: 103    FORMAT(' INTEGER MP <=7 FOR 2**MP interfaces=')
30:     READ(*,104) MP
31: 104    FORMAT(I8)
32:     MMAX=2**MP
33:     MMAX1=MMAX+1
34:     ammax=dfloat(mmax)
35:     WRITE(*,105)
36: 105    FORMAT(' WAVELENGTH EXAMINED IN MICRONS=')
37:     READ(*,101) WL
38:     write(*,106)
39: 106    format(' initial angle in degrees=')
40:     read(*,101) agi
41:     write(*,107)
42: 107    format(' FINAL ANGLE IN DEGREES=')
43:     read(*,101) AGF
44:     NMAX=361
45:     AGDEL=(AGF-AGI)/DFLOAT(NMAX-1)
46: C
47:     DO 200 M=1,MMAX
48:     r(m)=dfloat(m)*a/ammax
49: 200    CONTINUE
50:     rave=.5*r(1)
51:     an(1)=f2l/f2-rave*rave/(a2*f2)
52:     an(1)=dsqrt(an(1))
53:     do 201 m=2,mmax
54:     rave=.5*(r(m)+r(m-1))
55:     an(m)=f2l/f2-rave*rave/(a2*f2)
56:     an(m)=dsqrt(an(m))
57: 201    continue
58:     AN(MMAX1)=1.
59:     DO 202 M=1,MMAX
60:     X(M)=2.*PII*AN(M+1)*R(M) /WL
61:     Y(M)=2.*PII*AN(M)*R(M) /WL
62: 202    CONTINUE
63: C
64:     do 211 n=1,NMAX
65:     th=PII*(agi+agdel*Dfloat(n-1))/180.
66:     CTH(n)=DCOS(th)
67:     SRP(N)=0.
68:     SRM(N)=0.
69:     SIP(N)=0.
70:     SIM(N)=0.
71:     PI(1,N)=0.
72:     PI(2,N)=1.
73: 211    continue

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74: C
75:     QLMAX=2.+x(MMAX)+4.315*(x(MMAX)**.3333)
76:     LMAX=ifix(SNGL(QLMAX))
77:     lstart=lmax+15
78: C
79:     DO 203 M=1,MMAX
80:     ex(lstart,m)=0.0d+00
81:     ey(lstart,m)=0.0d+00
82:     DO 215 LL=0,lstart-2
83:     L=lstart-LL
84:     alx=dfloat(L)/x(m)
85:     aly=dfloat(L)/y(m)
86:     ex(L-1,m)=alx-1./(ex(L,m)+alx)
87:     ey(L-1,m)=aly-1./(ey(L,m)+aly)
88: 215 CONTINUE
89:     alx=1./x(m)
90:     aly=1./y(m)
91:     ex0(m)=alx-1./(ex(1,m)+alx)
92:     ey0(m)=aly-1./(ey(1,m)+aly)
93: C
94:     fx0(m)=-dtan(x(m))
95:     fy0(m)=-dtan(y(m))
96:     alx=1./x(m)
97:     aly=1./y(m)
98:     fx(1,m)=-alx+1./(alx-fx0(m))
99:     fy(1,m)=-aly+1./(aly-fy0(m))
100:     DO 216 L=2,lmax
101:     alx=dfloat(L)/x(m)
102:     aly=dfloat(L)/y(m)
103:     fx(L,m)=-alx+1./(alx-fx(L-1,m))
104:     fy(L,m)=-aly+1./(aly-fy(L-1,m))
105: 216 CONTINUE
106: 203 CONTINUE
107: C
108:     DO 219 m=2,mmax
109:     gg0=dtan(x(m-1))/dtan(y(m))
110:     alx=1./x(m-1)
111:     aly=1./y(m)
112:     gg(1,m)=gg0*((alx+fx(1,m-1))/(aly+fy(1,m)))
113:     gg(1,m)=gg(1,m)*((aly+ey(1,m))/(alx+ex(1,m-1)))
114:     DO 217 L=2,lmax
115:     alx=dfloat(L)/x(m-1)
116:     aly=dfloat(L)/y(m)
117:     gg(L,m)=gg(L-1,m)*((alx+fx(L,m-1))/(aly+fy(L,m)))
118:     gg(L,m)=gg(L,m)*((aly+ey(L,m))/(alx+ex(L,m-1)))
119: 217 CONTINUE
120: 219 CONTINUE
121: C
122:     gx0=-dtan(x(mmax))
123:     alx=1./x(mmax)
124:     gx(1)=gx0*((alx+fx(1,mmax))/(alx+ex(1,mmax)))
125:     DO 218 L=2,lmax
126:     alx=dfloat(L)/x(mmax)
127:     gx(L)=gx(L-1)*((alx+fx(L,mmax))/(alx+ex(L,mmax)))
128: 218 CONTINUE
129: C
130:     DO 204 L=1,LMAX
131:     q=Dfloat(L)
132:     Q1=Q+1.
133:     q21=2.*q+1.
134:     QQ1=Q21/Q
135:     QQ2=Q1/Q
136:     QQ3=Q21/(Q*Q1)
137: C
138:     DO 205 M=1,MMAX
139:     TAM(M)=an(m+1)*ey(L,m)-an(m)*ex(L,m)
140:     TAQ(M)=an(m+1)*fy(L,m)-an(m)*fx(L,m)
141:     TAD(M)=an(m+1)*ey(L,m)-an(m)*fx(L,m)
142:     TAP(M)=an(m+1)*fy(L,m)-an(m)*ex(L,m)
143:     TBM(M)=an(m)*ey(L,m)-an(m+1)*ex(L,m)
144:     TBQ(M)=an(m)*fy(L,m)-an(m+1)*fx(L,m)
145:     TBD(M)=an(m)*ey(L,m)-an(m+1)*fx(L,m)
146:     TBP(M)=an(m)*fy(L,m)-an(m+1)*ex(L,m)

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147:
148: 205 CONTINUE
149: C
150: DO 206 J=1,MP
151: JP2=2**(MP-J)
152: ijl = 2** (j-1)
153: C
154: DO 207 K=1,JP2
155: K2=2*K
156: K21=K2-1
157: kk=ijl*k21+1
158: grat=gg(L,kk)
159: TEM1(K)=TAD(K21)*TAM(K2)-TAM(K21)*TAP(K2)*grat
160: TEM2(K)=TAQ(K21)*TAD(K2)-TAP(K21)*TAQ(K2)*grat
161: TEM3(K)=TAD(K21)*TAD(K2)-TAM(K21)*TAQ(K2)*grat
162: TEM4(K)=TAQ(K21)*TAM(K2)-TAP(K21)*TAP(K2)*grat
163: TEM5(K)=TBD(K21)*TBM(K2)-TBM(K21)*TBP(K2)*grat
164: TEM6(K)=TBQ(K21)*TBD(K2)-TBP(K21)*TBQ(K2)*grat
165: TEM7(K)=TBD(K21)*TBD(K2)-TBM(K21)*TBQ(K2)*grat
166: TEM8(K)=TBQ(K21)*TBM(K2)-TBP(K21)*TBP(K2)*grat
167: 207 CONTINUE
168: C
169: DO 208 K=1,JP2
170: TAM(K)=TEM1(K)
171: TAQ(K)=TEM2(K)
172: TAD(K)=TEM3(K)
173: TAP(K)=TEM4(K)
174: TBM(K)=TEM5(K)
175: TBQ(K)=TEM6(K)
176: TBD(K)=TEM7(K)
177: TBP(K)=TEM8(K)
178: 208 CONTINUE
179: 206 CONTINUE
180: C
181: tam(1)=tam(1)*gx(L)
182: tbm(1)=tbm(1)*gx(L)
183: ADEN=TAM(1)*TAM(1)+TAD(1)*TAD(1)
184: AR=TAM(1)*TAM(1)/ADEN
185: AI=-TAM(1)*TAD(1)/ADEN
186: BDEN=TBM(1)*TBM(1)+TBD(1)*TBD(1)
187: BR=TBM(1)*TBM(1)/BDEN
188: BI=-TBM(1)*TBD(1)/BDEN
189: ABRP=QQ3*(AR+BR)
190: ABIP=QQ3*(AI+BI)
191: ABRM=QQ3*(AR-BR)
192: ABIM=QQ3*(AI-BI)
193: C
194: DO 212 N=1,NMAX
195: TA=Q*CTH(N)*PI(2,N)-Q1*PI(1,N)
196: PITAP=PI(2,N)+TA
197: PITAM=PI(2,N)-TA
198: SRP(N)=SRP(N)+ABRP*PITAP
199: SRM(N)=SRM(N)+ABRM*PITAM
200: SIP(N)=SIP(N)+ABIP*PITAP
201: SIM(N)=SIM(N)+ABIM*PITAM
202: TEMP=PI(2,N)
203: PI(2,N)=QQ1*CTH(N)*PI(2,N)-QQ2*PI(1,N)
204: PI(1,N)=TEMP
205: 212 CONTINUE
206: 204 CONTINUE
207: C
208: do 213 N=1,NMAX
209: S1R=.5*(SRP(N)+SRM(N))
210: S2R=.5*(SRP(N)-SRM(N))
211: S1I=.5*(SIP(N)+SIM(N))
212: S2I=.5*(SIP(N)-SIM(N))
213: pt(1,n)=S1R*S1R+S1I*S1I
214: pt(2,n)=S2R*S2R+S2I*S2I
215: pt(3,n)=.5*(pt(1,n)+pt(2,n))
216: 213 continue
217: C
218: OPEN(UNIT=1,FILE='OUT.DAT')
219:

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220:      DO 210 N=1,NMAX
221:      TH=AGI+AGDEL*DFLOAT(N-1)
222:      C
223:      WRITE(1,998) TH,PT(1,N),PT(2,N),PT(3,N)
224: 998    FORMAT(F14.1,3E15.5)
225: 210    CONTINUE
226:      CLOSE(UNIT=1,STATUS='KEEP')
227: 400    continue
228:      end
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