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Course:B.Sc(H)Physics,Sem5

Roll No.-081

AIM:Solve the s wave radial Schrodinger equation for a particle mass m under the harmonic oscillator potential.

SOURCE CODE:

clc;

clear;

clf;

m=940; h=197.3;b1=0;b2=10;b3=30;k=100

n=1200

A=eye(n,n)

A=A\*(-2)

for i=1:n-1

A(i+1,i)=1

A(i,i+1)=1

end

r=linspace(0,20,n)

V1=zeros(n,n)

for i=1:n

V1(i,i)=(k\*((r(i))^2))/2+(b1\*((r(i))^3))/3;

end

V2=zeros(n,n)

for i=1:n

V2(i,i)=(k\*((r(i))^2))/2+(b2\*((r(i))^3))/3;

end

V3=zeros(n,n)

for i=1:n

V3(i,i)=(k\*((r(i))^2))/2+(b3\*((r(i))^3))/3;

end

d=20/n

disp(d)

B1=(-(h^2)/(2\*m\*d^2))\*A+V1

B2=(-(h^2)/(2\*m\*d^2))\*A+V2

B3=(-(h^2)/(2\*m\*d^2))\*A+V3

[u1,E1]=spec(B1)

[u2,E2]=spec(B2)

[u3,E3]=spec(B3)

*//disp(diag(E))*

disp("Ground state energy for b=0,10,30:")

disp([E1(1,1) E2(1,1) E3(1,1)])

subplot(3,1,1)

a=gca()

a.x\_location="origin"

a.y\_location="origin"

plot(r',[u1(:,1)],'linewidth',2)

xlabel('r','fontsize',3)

ylabel('u(r)','fontsize',3)

title("b=0")

subplot(3,1,2)

a=gca()

a.x\_location="origin"

a.y\_location="origin"

plot(r',[u2(:,1)],'linewidth',2)

xlabel('r','fontsize',3)

ylabel('u(r)','fontsize',3)

title("b=10")

subplot(3,1,3)

a=gca()

a.x\_location="origin"

a.y\_location="origin"

plot(r',[u3(:,1)],'linewidth',2)

xlabel('r','fontsize',3)

ylabel('u(r)','fontsize',3)

title("b=30")

OUTPUT:

Ground state energy for b=0,10,30:

95.104808 98.716701 105.17302

