Hjelpeark FYS2140

TUSL 1D

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\Psi(x,t)+V(x)\Psi(x,t)=E\Psi(x,t)$$

TASL 1D

$$-\frac{\hbar^2}{2m}\frac{\partial^2}{\partial x^2}\Psi(x,t)+V(x)\Psi(x,t)=i\hbar\frac{\partial}{\partial t}\Psi(x,t)$$

Tidsavhengig del

$$\phi(t)=e^{-\frac{iE_nt}{\hbar}}$$

3D:

$$\frac{\partial^2}{\partial x^2}\to\nabla^2$$

$$\nabla^2=\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\frac{\partial}{\partial r}\right)+\frac{1}{r^2 sin\theta}\frac{\partial}{\partial\theta}\left(sin\theta\frac{\partial}{\partial\theta}\right)+\frac{1}{r^2\sin^2\theta}\frac{\partial^2}{\partial\phi^2}$$

$$\hat{L}_z\psi_{mlm_l}=\hbar m_l\psi_{mlm_l}$$

$$\hat{L}^2\psi_{mlm_l}=\hbar l(l+1)\psi_{mlm_l}$$

Konstanter

$$m_e=0.511MeV/c^2$$

$$k_e=\frac{1}{4\pi\varepsilon_0}=$$

$$m_p=938MeV/c^2$$

$$\hbar c=197.3\ eV\ nm$$

$$hc=1240\ eV\ nm$$

Operatorer

$$\hat{p}=-i\hbar\frac{\partial}{\partial x}$$

$$\hat{L}_x=i\hbar\left(sin\phi\frac{\partial}{\partial\theta}+cot\theta\ cos\phi\frac{\partial}{\partial\phi}\right)$$

$$\hat{L}_y=i\hbar\left(-cos\phi\frac{\partial}{\partial\theta}+cot\theta\ sin\phi\frac{\partial}{\partial\phi}\right)$$

$$\hat{L}_z=-i\hbar\frac{\partial}{\partial\phi}$$

$$\hat{L}^2=-\hbar^2\left[\frac{1}{sin\theta}\frac{\partial}{\partial\theta}\left(sin\theta\frac{\partial}{\partial\theta}\right)+\frac{1}{\sin^2\theta}\frac{\partial^2}{\partial\phi^2}\right]$$

$$a_\pm=\frac{1}{\sqrt{2\hbar m\omega}}[\mp i\hat{p}+m\omega x]$$

Sfæriske harmoniske for $l=1$

$$Y_1^{-1}=\sqrt{\frac{3}{8\pi}}sin\theta e^{-i\phi}$$

$$Y_1^0=\sqrt{\frac{3}{4\pi}}cos\theta$$

$$Y_1^1=\sqrt{\frac{3}{8\pi}}sin\theta e^{i\phi}$$

Sfærisk harmonisk for $l=0$:

$$Y_0^0=\frac{1}{\sqrt{4\pi}}$$

HO-potensialet

$$V(x)=\frac{1}{2}m\omega^2x^2$$

$$\psi_n(x)=\frac{1}{\sqrt{n!}}(a_+)^n\psi_0(x)$$

$$\psi_0(x)=\left(\frac{m\omega}{\pi\hbar}\right)^{\frac{1}{4}}e^{\frac{m\omega}{2\hbar}x^2}$$

Energi

$$E_n=\hbar\omega\left(n+\frac{1}{2}\right)$$

Uendelig brønn

$$\psi_n(x)=\sqrt{\frac{2}{a}}\sin\left(\frac{n\pi}{a}x\right)$$

Energi

$$E_n=\frac{n^2\pi^2\hbar^2}{2ma^2}$$

Coulomb-potensialet

$$V(r)=-k_e\frac{e^2}{r}$$

Bohrs atommodell

$$E_n=-\frac{k_e^2m_ee^4}{2\hbar^2}\cdot\frac{1}{n^2}=\frac{k_e^2e^2}{2a_0}\cdot\frac{1}{n^2}$$

Symmetrisk potensiale: Et sentralsymmetrisk potensiale er et potensiale som kun avhenger av avstanden til et gitt punkt (origo), og ikke retningen til et aksesystem. Coulombpotensialet er et eksempel på et slikt potensial.

Paulis ekskusjonsprinsipp: Sier at to identiske fermioner ikke kan befinne seg i samme tilstand

Fotoelektrisk effekt … (Röntgen)

Comptonspredning