Quantum Chemistry

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Aug 2023

Explain the shape of electron movement.

$$\nabla^2\Psi = \frac{1}{c^2}\frac{\partial^2\Psi}{\partial t^2} \tag{1}$$

$$\nabla^2\phi + \frac{2m}{\hbar^2}(E-V)\phi = 0 \tag{2}$$

$$\hat{H}\Psi = i\hbar\frac{\partial\Psi}{\partial t} \tag{3}$$

$$\frac{\partial^2\phi_{tr}}{\partial X^2} + \frac{\partial^2\phi_{tr}}{\partial Y^2} + \frac{\partial^2\phi_{tr}}{\partial Z^2} + \frac{2M}{\hbar^2}E_{tr}\phi_{tr} = 0 \tag{4}$$

$$\phi_T = \phi_{tr}(X,Y,Z)\phi(x,y,z) \tag{5}$$

$$\nabla^2\phi + \frac{2\mu}{\hbar^2}(E + \frac{Ze^2}{r})\phi = 0 \tag{6}$$

$$\phi = \phi(r,\theta,\phi) = R(r)\Theta(\theta)\Phi(\phi) \tag{7}$$

$$\frac{d^2\Phi}{d\phi^2} + m^2\Phi = 0, m = 0, \pm1, \pm2\ldots \tag{8}$$

$$\Phi_m(\phi) = \frac{1}{\sqrt{2\pi}}exp(im\phi) \tag{9}$$

$$\Theta_{lm}(\theta) = (-1)^{\frac{m+|m|}{2}}\sqrt{\frac{(2l+1)(l-|m|)!}{2(l+|m|)!}}P_l^{|}m|(cos\theta) \tag{10}$$

$$R_{nl}(r) = -\sqrt{\frac{2Z}{na_0}^3\frac{(n-l-1)!}{2n((n+l)!)^3}}exp(-\rho/2)\rho^l L_{n+l}^{2l+1}(\rho) \tag{11}$$

$$\rho = \frac{2Z}{na_0}r, a_0 = \frac{\hbar^2}{\mu e^2} \tag{12}$$

$$\begin{aligned} &n = 1,2,3,4\ldots \\ &l = 0,1,2,3,\ldots,n-1 \\ &m = 0,\pm1,\pm2,\ldots,\pm l \end{aligned} \tag{13}$$

$$\phi_{1s} = \frac{1}{\sqrt{\phi}}(\frac{Z}{a_0})^{\frac{3}{2}}e^{-\frac{Zr}{a_0}}, n=1, l=0, m=0 \tag{14}$$