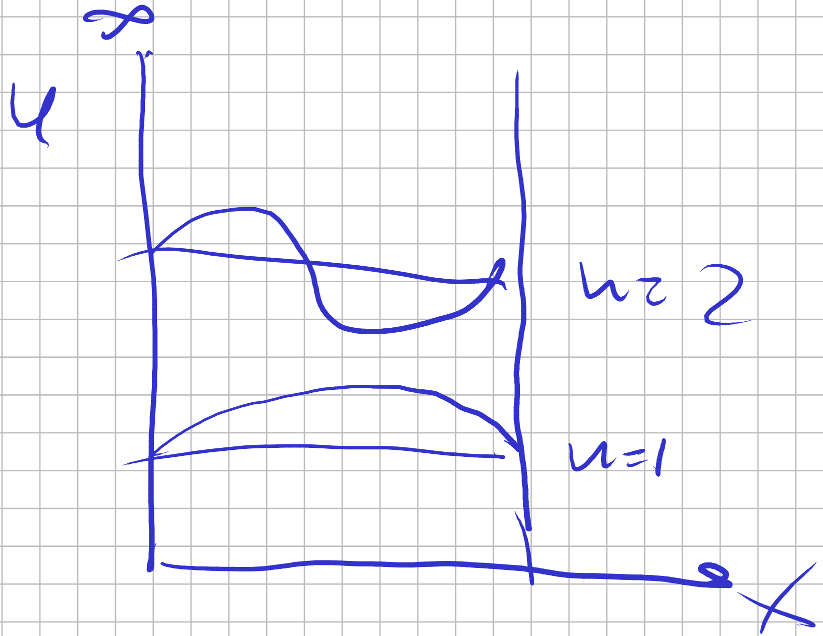


$$\psi = \sqrt{\frac{2}{l}} \sin\left(\frac{n\pi x}{l} \ldots\right)$$

$$|\psi|^2$$

$$\hat{H}\psi = E\psi \qquad -\frac{\hbar^2}{2m}\nabla^2$$

$$\underbrace{-\frac{1}{2}\frac{\partial^2}{\partial x^2}}_{\hat{T}}\psi = E\psi$$

$\hbar = 1$

$m = 1$

$$\psi^* \psi = e^{-i\alpha} e^{i\alpha} \ldots$$

$$\rho(x, y, z)$$

$$+\frac{e^2}{r} = 4$$

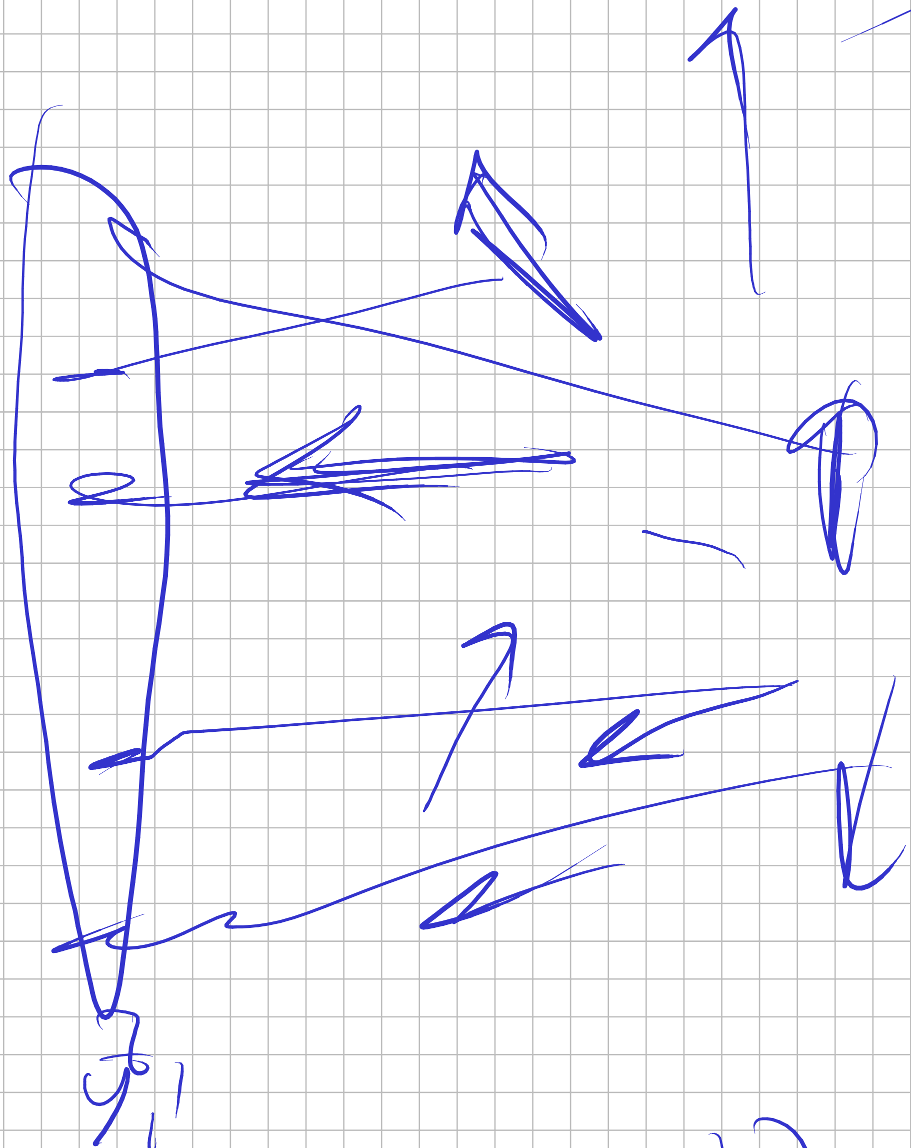
$$\hat{P}\hat{H}\psi = \hat{P}E\psi$$

$$\boxed{\hat{P}\hat{H} = \hat{H}\hat{P}}$$

$$+\frac{\overset{1}{e^2}}{|x_1 - x_2|} = \frac{1}{|x_1 - x_2|}$$

$$-\frac{1}{2}\frac{\partial^2}{\partial x_1^2}\Phi(x_1,x_2) - \frac{1}{2}\frac{\partial^2 \Phi(x_1,x_2)}{\partial x_2^2} + \frac{\Phi(x_1,x_2)}{|x_2 - x_1|} = E\Phi$$

$$\Phi(x_1,x_2) = \phi_{n_1}(x_1)\,\phi_{n_2}(x_2)$$



α, β

$$\Phi(x_1, \sigma_1) = \varphi(x_1) \cdot \gamma(\sigma_1)$$

$$\Phi(x_1, \sigma_1, x_2, \sigma_2) = A\left(\varphi(x_1, \sigma_1)\, \varphi(x_2, \sigma_2)\right)$$

$$\Phi(x,\sigma_1) = \varphi(x_1)\chi(\sigma_1)$$

$$\boxed{\hat{L}^2\psi = l(l+1)\psi}$$

$m = -l, \dots, 0, \dots +l$

$2l+1$

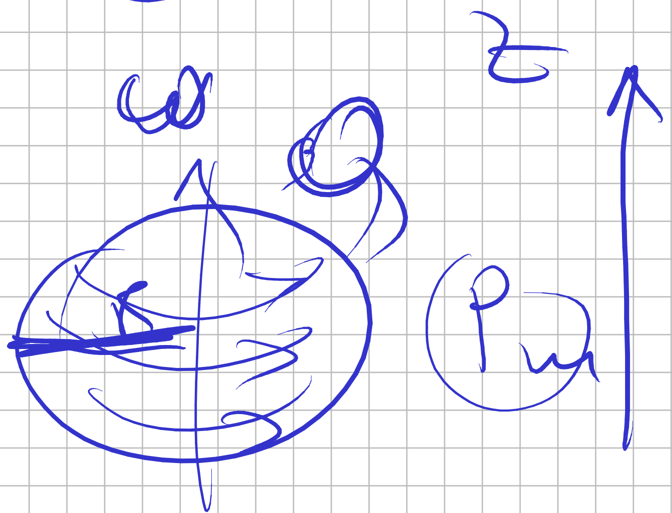
$$\hat{S}^2\chi = s(s+1)\chi$$

$m_s = -s, \dots, 0, \dots +s$

$$\hat{S}_z\chi = \pm\frac{1}{2}\chi$$

$2s+1 = 2 \Rightarrow s = \frac{1}{2}$

$$\vec{P}_m = \gamma \vec{L}$$



$$\vec{P}_m = \frac{1}{2c}\int \vec{r} \times \rho_e \vec{v}\, dV$$

$$\vec{L}_1 = \int \vec{r} \times \rho \cdot \vec{v}\, dV$$

$$L = J\omega = mR^2\omega$$

$$\frac{P_m}{L} = \frac{g}{2c}\frac{Q}{m}$$

$$P_m = \frac{1}{2c} Q \cancel{R^2\omega}$$

$$P_m = \frac{gQ}{2mc}\,\frac{1}{2}\hbar$$

$$\boxed{g=2} \ldots \quad P_m = \frac{e\hbar}{2mc} = \mu_Б$$

$$\hat{S}_z \alpha = +\frac{1}{2}\alpha \qquad \hat{S}_z \beta = -\frac{1}{2}\beta$$

$\gamma = \alpha$ або β

$\vec{B}$

$$\hat{s} = \frac{1}{2}\hat{\sigma}$$

$\vec{p}_m$

$$U = -\vec{p}_m \vec{B}$$

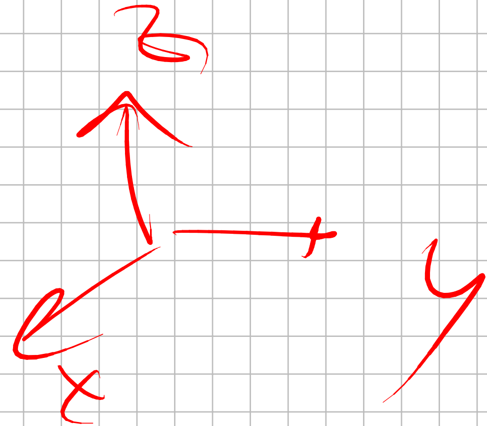
$$\vec{p}_m = \frac{e}{2mc}\hbar\hat{\sigma}$$

$\hat{\sigma}_z \alpha = (+1)\alpha$ $\qquad$ $\hat{\sigma}_z \beta = -1\beta$

z

$\uparrow$ $\qquad$ $\uparrow \alpha$ $\qquad$ $\downarrow \beta$

$\hat{\vec{S}}$



$\hat{\sigma}_x \alpha$

z

$\uparrow$ $\qquad$ $\uparrow^{\alpha}$

$\alpha = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ $\qquad$ $\beta = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$

$$\gamma = \frac{1}{\sqrt{2}}[\alpha(1)\beta(2) - \alpha(2)\beta(1)] = \gamma(1,2)$$

$$\gamma(2,1) = \frac{1}{\sqrt{2}}[\alpha(2)\beta(1) - \alpha(1)\beta(2)] =$$

$$= -\frac{1}{\sqrt{2}}[\alpha(1)\beta(2) - \alpha(2)\beta(1)]$$

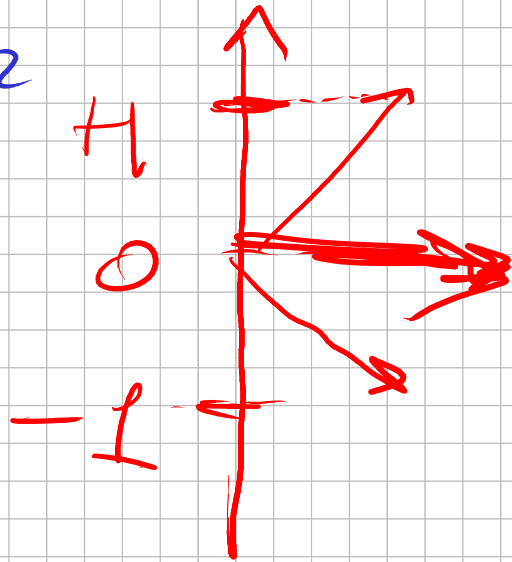
$$\gamma(1,2)$$

$$\gamma(2,1) = -\gamma(1,2)$$

$\uparrow\uparrow$ 1 $\downarrow\downarrow$ 1

$\uparrow\downarrow$

$$\hat{\vec{S}}\gamma = S \qquad \vec{S} = \hat{\vec{S}}_1 + \hat{\vec{S}}_2$$



$$\vec{S} = \frac{1}{2}\left[\hat{\sigma}_x \vec{i} + \hat{\sigma}_y \vec{j} + \hat{\sigma}_z \vec{k}\right]$$

$$\hat{S}_x = \hat{S}_{x_1} + \hat{S}_{x_2} = \frac{1}{2}\left(\hat{\sigma}_{x_1} + \hat{\sigma}_{x_2}\right)$$

$$\hat{S}_x \gamma = \frac{1}{2}\hat{\sigma}_{x_1} \cdot \frac{1}{\sqrt{2}}\left[\alpha(1)\beta(2) - \alpha(2)\beta(1)\right] +$$

$$+ \frac{1}{2}\hat{\sigma}_{x_2} \cdot \frac{1}{\sqrt{2}}\left[\alpha(1)\beta(2) - \alpha(2)\beta(1)\right] =$$

$$= \frac{1}{2\sqrt{2}}\Big[\beta(2)\beta(1) - \alpha(2)\alpha(1) + \alpha(1)\alpha(2) - \beta(2)\beta(1)\Big] = 0$$

$$\hat{S}\gamma = 0\cdot\gamma \qquad 2S+1 = 1, \quad S = 0$$

Single

10155

$\longrightarrow$ стан.

номер частинки $\downarrow$

$$\begin{vmatrix} \varphi_{u_1}(\xi_1) & \varphi_{u_2}(\xi_1) \\ \varphi_{u_1}(\xi_2) & \varphi_{u_2}(\xi_2) \end{vmatrix} \qquad \xi_1 = (x, y, z, \sigma)$$

$$\varphi = \Phi \cdot \gamma$$ – спін-орб

$$\Phi$$ – орб.

$$\frac{1}{\sqrt{2}} \begin{vmatrix} \Phi_1(1)\alpha(1) & \Phi_1(1)\beta(1) \\ \Phi_1(2)\alpha(2) & \Phi_1(2)\beta(2) \end{vmatrix} = \left\{ \begin{array}{l} \overset{-}{A}\cdot\overset{-}{A} = \overset{+}{S} \\ S\cdot A = A \\ A\cdot S = A \\ S\cdot S = S \end{array} \right.$$

N столбцов

N строк

$$\begin{vmatrix} \varphi_1(1)\alpha(1) & \varphi_2(1)\alpha(1) \\ \varphi_1(2)\alpha(2) & \varphi_2(2)\alpha(2) \end{vmatrix} = A \quad = A$$

$$1 = \overset{S}{\alpha(1)\alpha(2)}\left[\varphi_1(1)\varphi_2(2) - \varphi_2(1)\varphi_1(2)\right]$$

сим $\qquad$ анти сим

98

$2 \cdot S + 1 = 3$

$$\overset{(+)}{S} \cdot \overset{(-)}{A} = A$$

$$= \frac{1}{\sqrt{2}} \underbrace{\varphi_1(1)\varphi_1(2)}_{\text{симметр}} \underbrace{\left[\alpha(1)\beta(2) - \beta(1)\alpha(2)\right]}_{\text{антисимметр}}$$

синглет

3

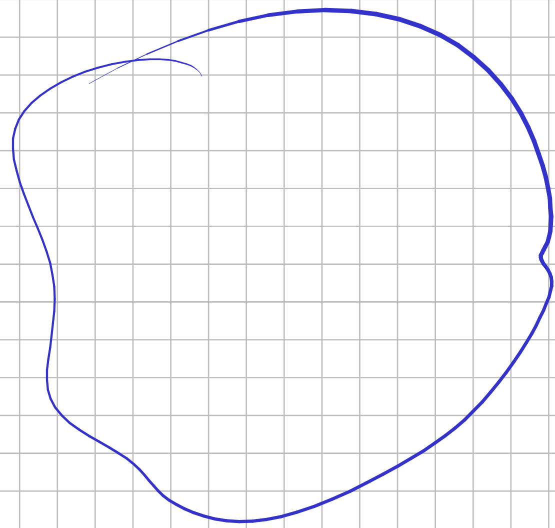
N столцы

$$\begin{vmatrix} \varphi_1(1)\alpha(1) & \varphi_2(1)\beta(1) \\ \varphi_1(2)\alpha(2) & \varphi_2(2)\beta(2) \end{vmatrix} =$$

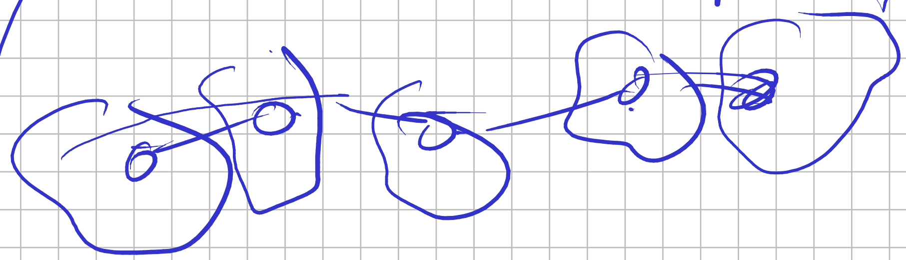
N час

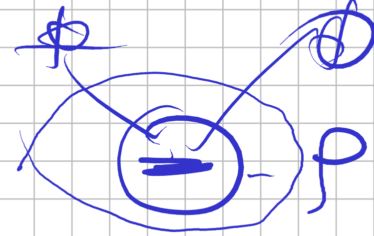
$$= \varphi_1(1)\alpha(1)\,\varphi_2(2)\beta(2) - \varphi_2(1)\beta(1)\,\varphi_1(2)\alpha(2)$$

$$\begin{vmatrix} \varphi_1(1)\,\beta(1) \\ \varphi_1(2)\,\beta(2) \end{vmatrix}$$



$$\Phi(x, y, z) = C_1 \chi_1 + C_2 \chi_2$$



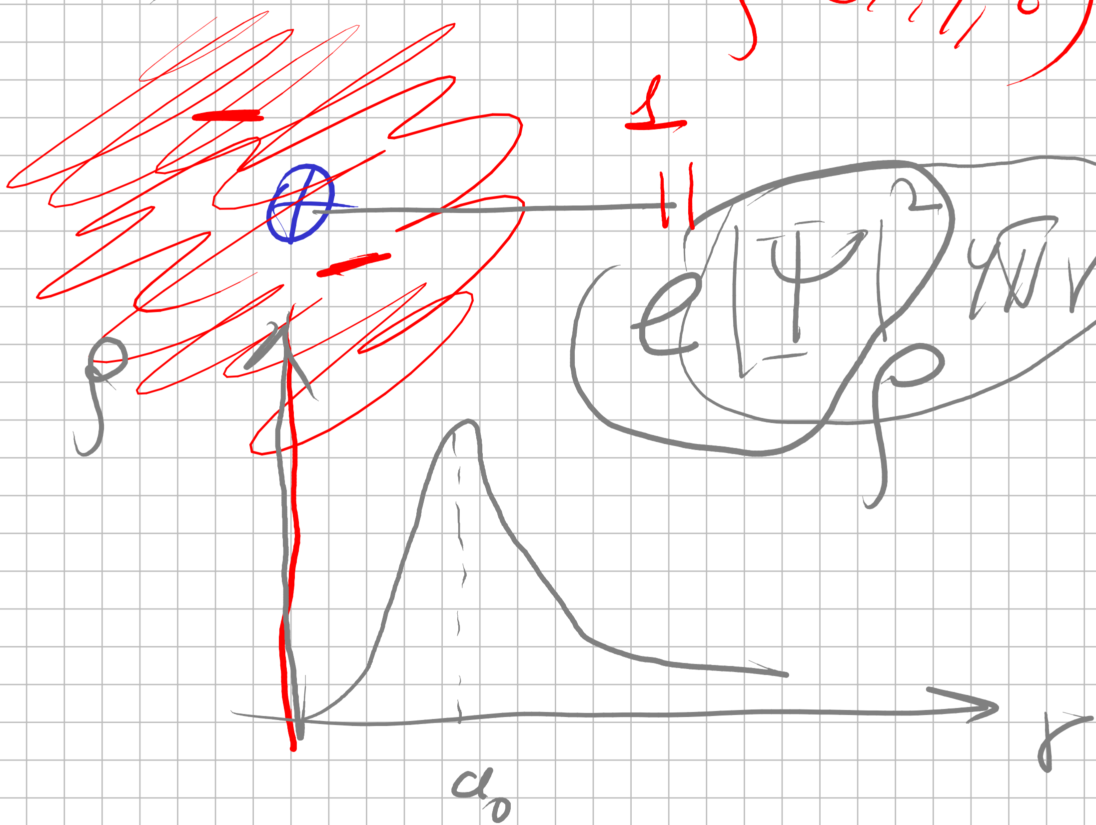


$$|\Phi(\xi_1, \xi_2)|^2$$

$\int \psi$

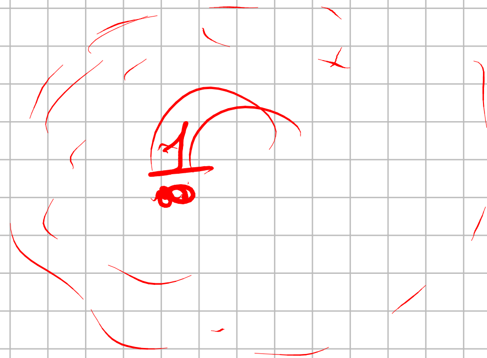
1s

$\rho(x, y, z)$



$$\frac{1}{\|} \; e|\Psi|^2 4\pi r^2 dr$$

ρ



$$\rho = N_e \int |\Phi|^2 dV_2 \, d\sigma_1 d\sigma_2$$

$$\rho(x_1, y_1, z_1) = \int$$

$n=1$ $\uparrow\downarrow$

$$\rho(x,y,z) = 2|\varphi(x,y,z)|^2$$ — сингл

$$\rho(x,y,z) = |\varphi_1|^2 + |\varphi_2|^2$$

$$\langle \alpha | \alpha \rangle = 1$$

$$\boxed{\langle \alpha | \beta \rangle = 0}$$

$$\langle \beta | \beta \rangle = 1$$