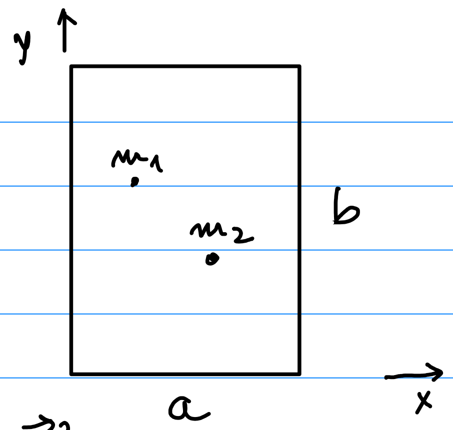


$$\hat{H} = \frac{\vec{p}_1^{\,2}}{2m_1} + \frac{\vec{p}_2^{\,2}}{2m_2} = \underline{-\frac{\hbar^2}{2m_1}\left(\frac{\partial^2}{\partial x_1^2} + \frac{\partial^2}{\partial y_1^2}\right)} \underline{-\frac{\hbar^2}{2m_2}\left(\frac{\partial^2}{\partial x_2^2} + \frac{\partial^2}{\partial y_2^2}\right)}$$

$$\hat{H}\Psi(x_1, y_1; x_2, y_2) = E\,\Psi(x_1, y_1; x_2, y_2)$$

$$\Psi(x_1 y_1; x_2, y_2) = F(x_1, y_1)\, G(x_2, y_2)$$

$$-\frac{\hbar^2}{2m_1} G(x_2, y_2)\left[\frac{\partial^2 F(x_1, y_1)}{\partial x_1^2} + \frac{\partial^2 F(x_1, y_1)}{\partial y_1^2}\right] - \frac{\hbar^2}{2m_2} F(x_1, y_1)\left[\frac{\partial^2 G(x_2, y_2)}{\partial x_2^2} + \frac{\partial^2 G(x_2, y_2)}{\partial y_2^2}\right]$$

$$= E\, F(x_1, y_1)\, G(x_2, y_2) \quad / : F \cdot G$$

$$\underbrace{-\frac{\hbar^2}{2m_1}\frac{1}{F}\left(\frac{\partial^2 F}{\partial x_1^2} + \frac{\partial^2 F}{\partial y_1^2}\right)}_{\text{ovisi samo o } x_1, y_1} \underbrace{-\frac{\hbar^2}{2m_2}\frac{1}{G}\left(\frac{\partial^2 G}{\partial x_2^2} + \frac{\partial^2 G}{\partial y_2^2}\right)}_{\text{ovisi samo o } x_2, y_2} = E$$

E_1 $\qquad$ E_2 $\qquad$ $E = E_1 + E_2$

$$-\frac{\hbar^2}{2m_1}\left(\frac{\partial^2 F}{\partial x_1^2} + \frac{\partial^2 F}{\partial y_1^2}\right) = E_1 F \qquad -\frac{\hbar^2}{2m_2}\left(\frac{\partial^2 G}{\partial x_2^2} + \frac{\partial^2 G}{\partial y_2^2}\right) = E_2 G$$

$\Psi(x_1, 0; x_2, y_2) = 0$ — donji zid - prva čestica

$\Psi(0, y_1; x_2, y_2) = 0$ — lijevi zid - prva čestica

$\Psi(x_1, b; x_2, y_2) = 0$ — gornji zid - prva čestica

$\Psi(a, y_1; x_2, y_2) = 0$ — desni zid - prva čestica

$\Psi(x_1, y_1; x_2, 0) = 0$ — donji zid - druga čestica

$\Psi(x_1, y_1; 0, y_2) = 0$ — lijevi zid - druga čestica

$\Psi(x_1, y_1; x_2, b) = 0$ — gornji zid - druga čestica

$\Psi(x_1, y_1; a, y_2) = 0$ — desni zid - druga čestica

$$F(x_1, y_1) = F_a(x_1) F_b(y_1) \qquad G(x_2, y_2) = G_a(x_2) G_b(y_2)$$

$$-\frac{\hbar^2}{2m_1} F_a'' = E_{1,a} F_a \qquad E_1 = E_{1,a} + E_{1,b} \qquad -\frac{\hbar^2}{2m_2} G_a'' = E_{2,a} G_a \qquad E_2 = E_{2,a} + E_{2,b}$$

$$-\frac{\hbar^2}{2m_1} F_b'' = E_{1,b} F_b \qquad -\frac{\hbar^2}{2m_2} G_b'' = E_{2,b} G_b$$

$$E = E_1 + E_2 = E_{1,a} + E_{1,b} + E_{2,a} + E_{2,b}$$

$$F_a(0) = 0 \quad F_a(a) = 0 \qquad G_a(0) = 0 \quad G_a(a) = 0$$

$$F_b(0) = 0 \quad F_b(b) = 0 \qquad G_b(0) = 0 \quad G_b(b) = 0$$

$$F_a(x_1) = \sqrt{\frac{2}{a}} \sin\left(\frac{n_{1,a}\pi x_1}{a}\right) \qquad G_a(x_2) = \sqrt{\frac{2}{a}} \sin\left(\frac{n_{2,a}\pi x_2}{a}\right)$$

$$F_b(y_1) = \sqrt{\frac{2}{b}} \sin\left(\frac{n_{1,b}\pi y_1}{b}\right) \qquad G_b(y_2) = \sqrt{\frac{2}{b}} \sin\left(\frac{n_{2,b}\pi y_2}{b}\right)$$

$$\psi(x_1, y_1; x_2, y_2) = \frac{2}{a} \cdot \frac{2}{b} \sin\left(\frac{n_{1,a}\pi x_1}{a}\right) \sin\left(\frac{n_{1,b}\pi y_1}{b}\right) \cdot \sin\left(\frac{n_{2,a}\pi x_2}{a}\right) \sin\left(\frac{n_{2,b}\pi y_2}{b}\right)$$

$$\int_0^a dx_1 \int_0^b dy_1 \int_0^a dx_2 \int_0^b dy_2 \left|\psi(x_1, y_1; x_2, y_2)\right|^2 = 1$$

$$E_{1,a} = \frac{\hbar^2\pi^2}{2m_1 a^2} n_{1,a}^2 \qquad E_{1,b} = \frac{\hbar^2\pi^2}{2m_1 b^2} n_{1,b}^2 \qquad E_{2,a} = \frac{\hbar^2\pi^2}{2m_2 a^2} n_{2,a}^2 \qquad E_{2,b} = \frac{\hbar^2\pi^2}{2m_2 b^2} n_{2,b}^2$$

$$E(n_{1,a}; n_{1,b}; n_{2,a}; n_{2,b}) = \frac{\hbar^2\pi^2}{2}\left[\frac{1}{m_1}\left(\frac{n_{1,a}^2}{a^2} + \frac{n_{1,b}^2}{b^2}\right) + \frac{1}{m_2}\left(\frac{n_{2,a}^2}{a^2} + \frac{n_{2,b}^2}{b^2}\right)\right]$$

Osnovno stanje $n_{1,a} = n_{1,b} = n_{2,a} = n_{2,b} = 1$ $\qquad b \gg a$

$m_2 \gg m_1$

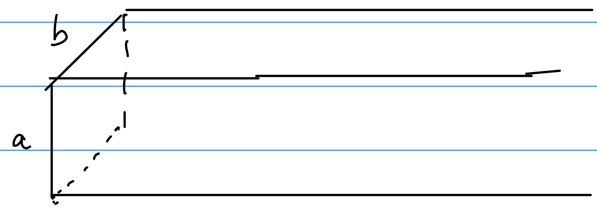
$$\int_0^a dx_1 \int_0^b dy_1 \int_0^a dx_2 \int_0^b dy_2 \, \psi^*_{n_{1,a}; n_{1,b}; n_{2,a}; n_{2,b}}(x_1, y_1; x_2, y_2) \cdot \psi^*_{n'_{1,a}; n'_{1,b}; n'_{2,a}; n'_{2,b}}(x_1, y_1; x_2, y_2) =$$

$$= \delta_{n_{1,a}; n'_{1,a}} \delta_{n_{1,b}; n'_{1,b}} \delta_{n_{2,a}; n'_{2,a}} \delta_{n_{2,b}; n'_{2,b}}$$

$$|0\rangle \equiv \Psi_{1,1,1,1}(x_1, y_1; x_2, y_2) \qquad \langle 0|0\rangle = 1$$

$$|1\rangle \equiv \Psi_{1,1,1,2}(x_1, y_1; x_2, y_2) \qquad \langle 1|1\rangle = 1$$

$$\langle 0|1\rangle = \langle 1|0\rangle^* = 0$$



k_1, k_2 $\qquad E_{n_1,a;\, n_1,b;\, k_1;\, n_2,a;\, n_2,b;\, k_2}$

$$\frac{\hbar^2 k_1^2}{2m_1} + \frac{\hbar^2 k_2^2}{2m_2}$$

$$e^{ik_1 z_1} \cdot e^{ik_2 z_2}$$