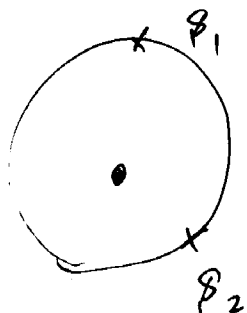


3-4 2体系のスピ2

28

He-原子 : 電子が2個

1s状態に入, 2, 3



$\left\{ \begin{array}{l} \text{電子 1} : S_1 \\ \text{電子 2} : S_2 \end{array} \right.$

• 全スピ2 :

$$S = S_1 + S_2$$

足し算

$\left\{ \begin{array}{l} \text{並べ方 (2x2)} \\ \text{行列の足し算 (2x2)} \end{array} \right.$

• 固有関数

$$\left\{ \begin{array}{l} \text{電子 1} : \\ \text{電子 2} : \end{array} \right. \left\{ \begin{array}{l} S_1^2 u_1 = \frac{3}{4} \hbar^2 u_1, S_{1z} u_1 = \frac{\hbar}{2} u_1 \\ S_1^2 v_1 = \frac{3}{4} \hbar^2 v_1, S_{1z} v_1 = -\frac{\hbar}{2} v_1 \\ S_2^2 u_2 = \frac{3}{4} \hbar^2 u_2, S_{2z} u_2 = \frac{\hbar}{2} u_2 \\ S_2^2 v_2 = \frac{3}{4} \hbar^2 v_2, S_{2z} v_2 = -\frac{\hbar}{2} v_2 \end{array} \right.$$

$$\left\{ \begin{array}{l} u_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}_1 \\ v_1 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}_1 \end{array} \right. \left\{ \begin{array}{l} u_2 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}_2 \\ v_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}_2 \end{array} \right.$$

• S^2, S_z の固有関数

$S = S_1 + S_2$

- 本問-9 は足し算
- 固有関数は掛け算

•
$$\begin{cases} \Psi_{1,1} = u_1 u_2 \\ \Psi_{1,-1} = v_1 v_2 \\ \Psi_{1,0} = \frac{1}{\sqrt{2}} [u_1 v_2 + u_2 v_1] \\ \Psi_{0,0} = \frac{1}{\sqrt{2}} [u_1 v_2 - u_2 v_1] \end{cases}$$

$$\begin{cases} S^2 \Psi_{1,1} = 2\hbar^2 \Psi_{1,1}, & S_z \Psi_{1,1} = \hbar \Psi_{1,1} \\ S^2 \Psi_{1,-1} = 2\hbar^2 \Psi_{1,-1}, & S_z \Psi_{1,-1} = -\hbar \Psi_{1,-1} \\ S^2 \Psi_{1,0} = 2\hbar^2 \Psi_{1,0}, & S_z \Psi_{1,0} = 0 \end{cases}$$

$$S^2 \Psi_{0,0} = 0, \quad S_z \Psi_{0,0} = 0$$

• [2.2] $S^2 \Psi = S(S+1) \hbar^2 \Psi$

この S を粒子系の $2\ell+1$ とし。

$$\begin{cases} S=1 & : \Psi_{1,1}, \Psi_{1,-1}, \Psi_{1,0} \quad (\text{対称}) \\ S=0 & : \Psi_{0,0} \quad (\text{反対称}) \end{cases}$$