

$J \leftarrow L \text{ と } S$ (スピンの軌道相互作用による準位)

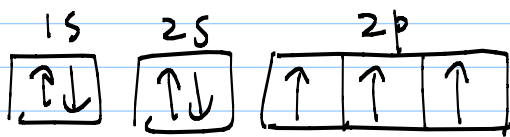
多重度 S に対し $M_S = -S, \dots, 0, \dots, +S$
 $2S+1$ 重

$l \rightarrow m = -l, \dots, 0, \dots, +l$
 $2l+1$

$\uparrow \dots S = \frac{1}{2} \rightarrow M_S = -\frac{1}{2}, +\frac{1}{2}$ 二重項

$\uparrow\downarrow \dots S = 0 \rightarrow M_S = 0$ 一重項

$\uparrow\uparrow \dots S = 1 \rightarrow M_S = -1, 0, 1$ 三重項



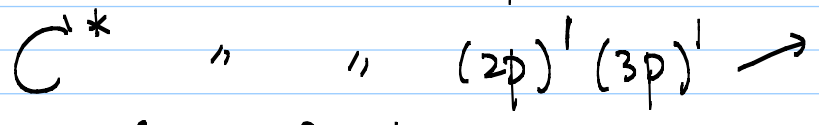
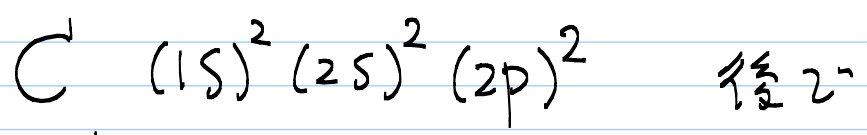
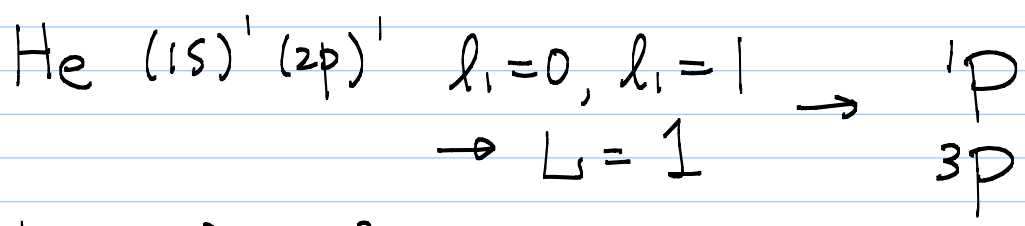
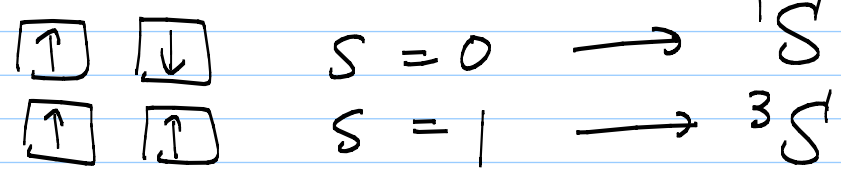
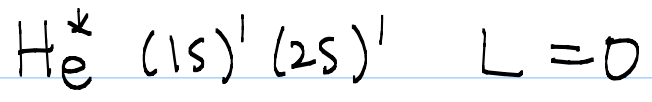
$S = \frac{3}{2} \rightarrow M_S = -\frac{3}{2}, -\frac{1}{2}, \frac{1}{2}, \frac{3}{2}$

$2S+1 = 4$ 四重項

例として

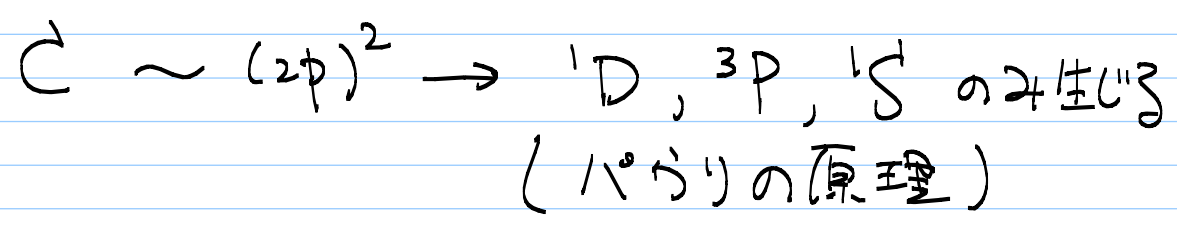
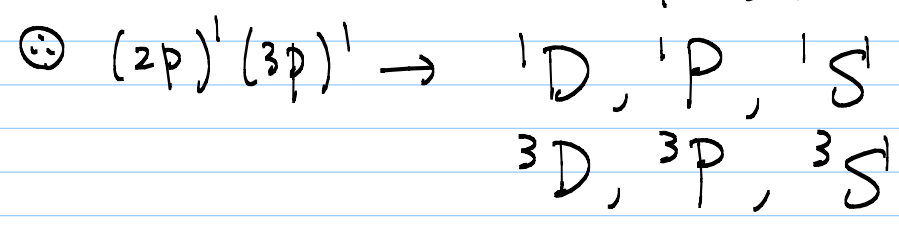
$He (1s)^2 \quad \left. \begin{array}{l} l_1 = 0, l_2 = 0 \\ L = l_1 + l_2 = 0 \end{array} \right\} 1S$

→ $S = 0$)

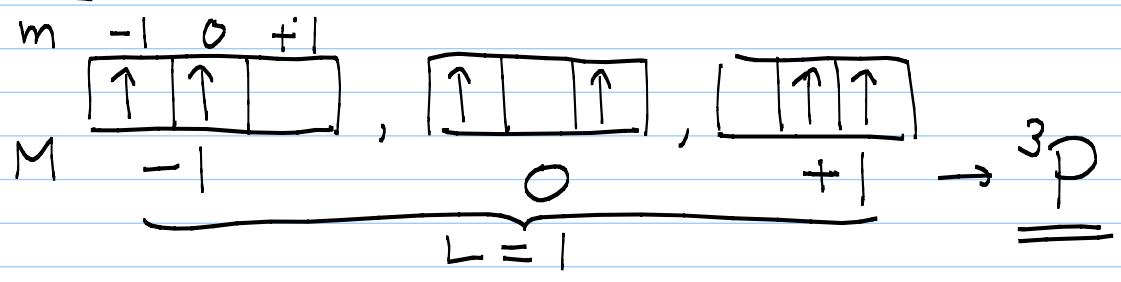


$l_1 = 1, l_2 = 1 \rightarrow L = 2, 1, 0 \Rightarrow D, P, S$
 (- 般に $L = l_1 + l_2, l_1 + l_2 - 1, \dots, |l_1 - l_2|$)

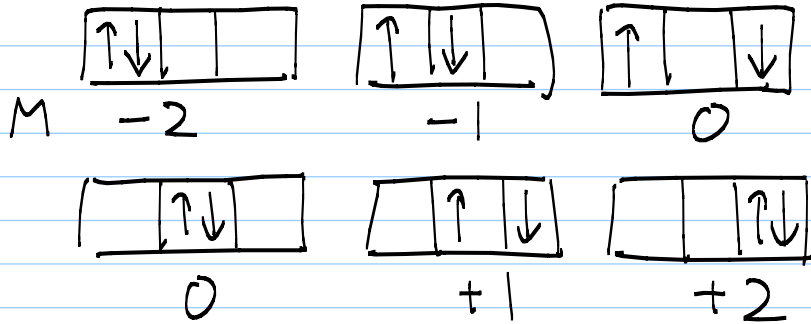
($l_1 = 1, l_2 = 2 \rightarrow L = 3, 2, 1$
 $\quad \quad \quad F, D, P$)



$S = 1$ のとき



$S=0$ のとき



→ $M = \underbrace{-2, -1, 0, +1, +2}_{^1D}, \underbrace{0}_{^1S}$

$J = L + S, L + S - 1, \dots, |L - S|$

$\text{Na } [\text{Ne}] (3s)^1 \quad L=0, S=\frac{1}{2} \rightarrow J=\frac{1}{2}$

$\text{Na } [\text{Ne}] (3p)^1 \quad L=1, S=\frac{1}{2} \quad ^2S_{1/2}$

→ $J = \frac{3}{2}, \frac{1}{2} \rightarrow ^2P_{3/2}, ^2P_{1/2}$

フント (Hund) 則 (最低エネルギー - 項) を決める

① 高い S

② 高い L

③ $\left\{ \begin{array}{l} \text{低い } J \text{ (半分以下占有)} \\ \text{高い } J \text{ (~ 以上 ~)} \end{array} \right. \quad \begin{array}{l} \uparrow \uparrow \square \\ \uparrow \downarrow \uparrow \uparrow \end{array}$

(131) $\sim (4p)^1 (3d)^1 \quad l_1=1, l_2=2$

→ ~~4p~~ F, D, P

$S=1, 0 \rightarrow$ J E 考 2 3 2

$^1P_1, ^1D_2, ^1F_3$

$^3P_{2,1,0}, ^3D_{3,2,1}, ^3F_{4,3,2}$

基底状態 = 3F_2

試験向レポート → 7月18日(水)

ハリケル原子