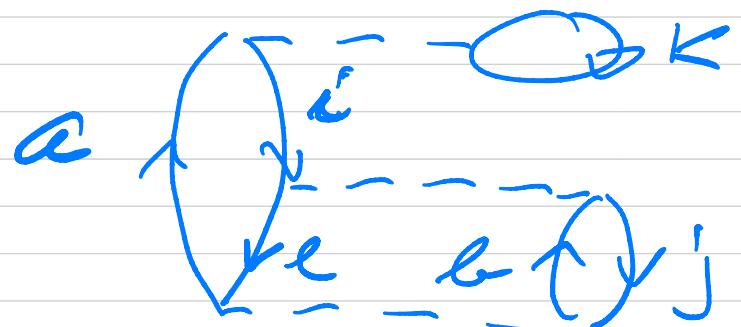


FYS4480/9480,
Lecture November 8,
2024

Examples

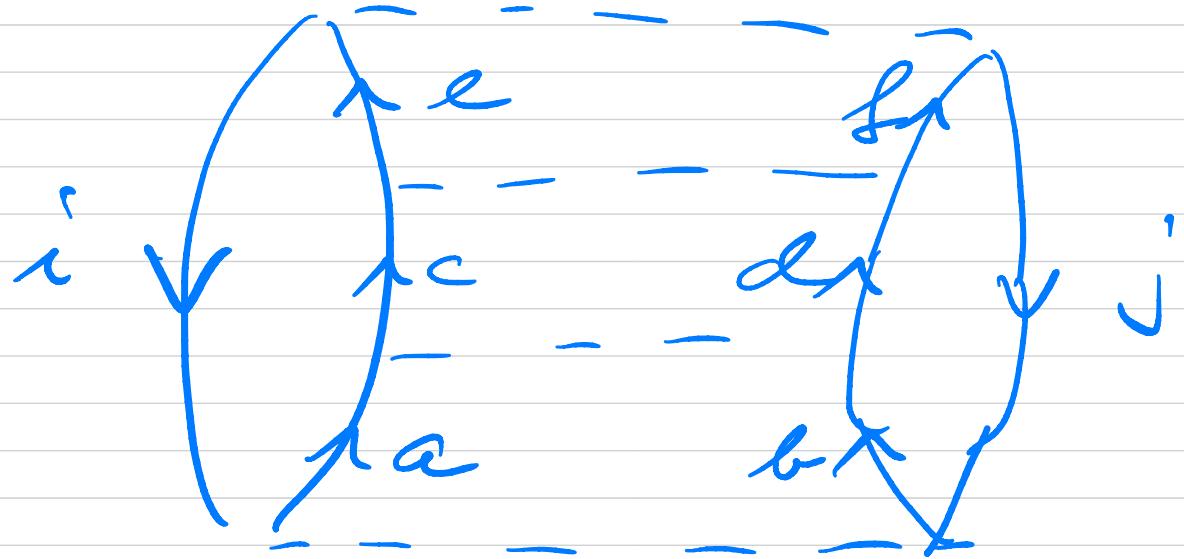


$$m_n = 4$$

$$m_e = 3$$

$$m_{ep} = 1/2$$

$$-\frac{1}{Z} \sum_{ijkl} \frac{\langle ikl|v|ak \rangle \langle ej|v|ib \rangle \langle ab|v|ej \rangle}{(E_e + E_j - E_a - E_b)(E_i - E_a)}$$



$$m_h = 2 \quad m_e = 2 \quad (-1)^{m_e + m_h} = 1$$

$$m_{ep} = 1+1+1+1 = 4 = \left(\frac{1}{2}\right)^4 = \frac{1}{16}$$

$$+\frac{1}{16} \sum_{ij} \underbrace{\underbrace{\langle ij | v | ef \rangle \langle ef | v | cd \rangle \langle cd | v | ab \rangle}_{\text{at } cd} \times \langle ab | v | ij \rangle}_{\text{ef}} \frac{(\varepsilon_i + \varepsilon_j - \varepsilon_a - \varepsilon_b)(\varepsilon_i + \varepsilon_j - \varepsilon_c - \varepsilon_d) \times}{\varepsilon_f (\varepsilon_i + \varepsilon_j - \varepsilon_e - \varepsilon_f)}$$

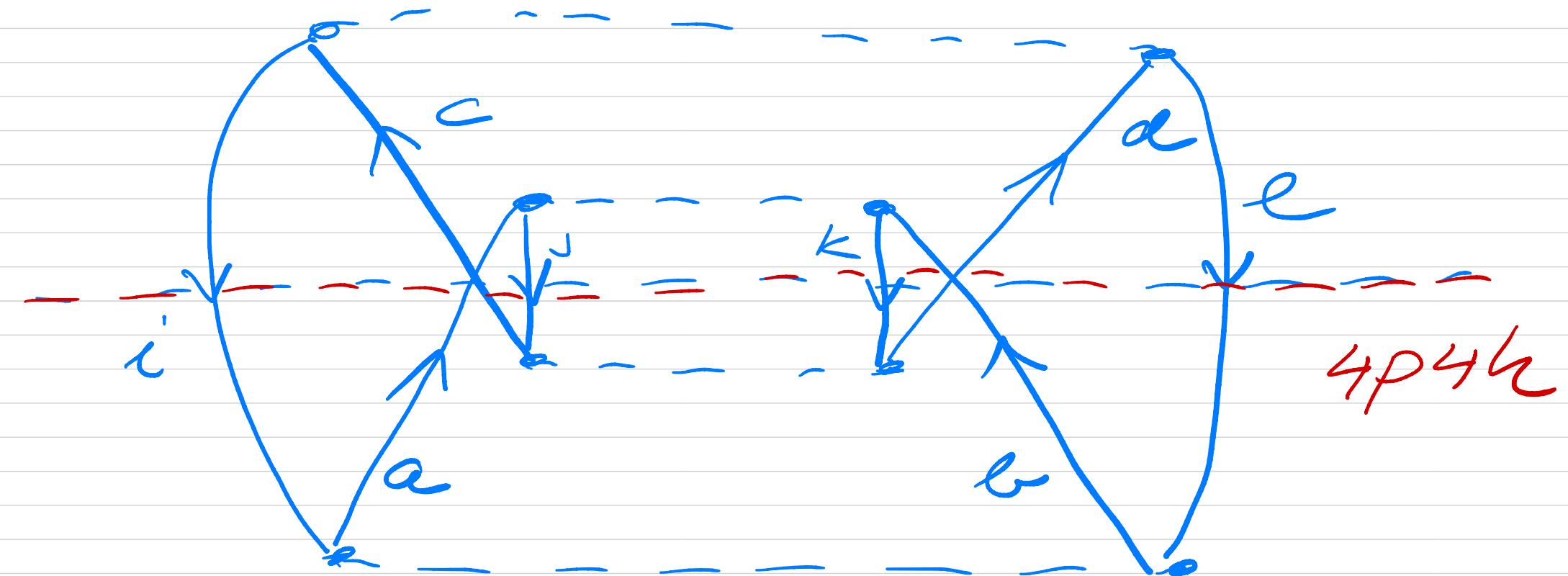
$$a_f \alpha_i \cdots \alpha_k$$

$$m_h = 3$$

$$m_e = 3$$

$$m_{ep} = 0$$

$$+ \sum_{a_{ijk}} \frac{\langle i k | v | a k \rangle \langle a j | v | i j \rangle}{\epsilon_i - \epsilon_q}$$



$$n_h = 4 \quad m_e = 0$$

$$n_{ep} = 4 \Rightarrow \frac{1}{16}$$

$$\frac{1}{16} \sum_{\substack{abcd \\ ijke}} \langle iel/v/ca \rangle \langle gk/v/ab \rangle \langle cd/v/jk \rangle$$
$$x \langle ab/v/ie \rangle$$

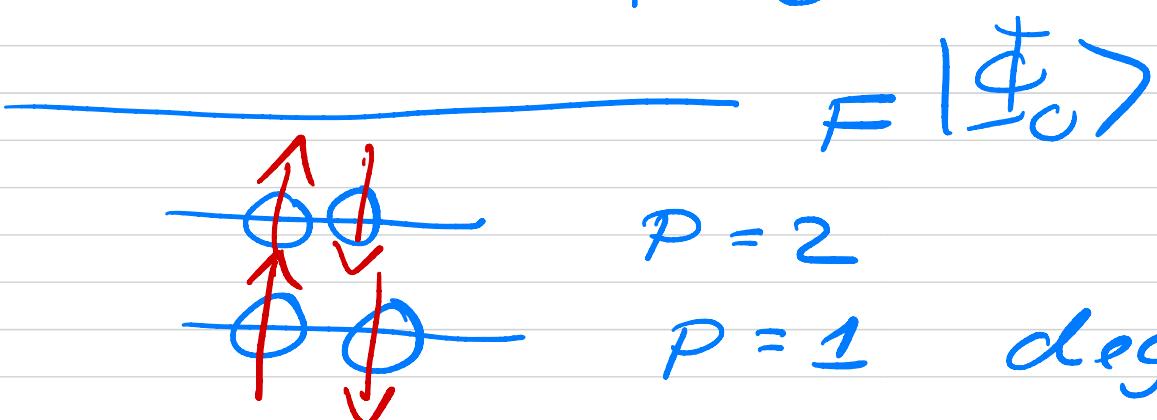
1

$$\times \frac{1}{(\varepsilon_i + \varepsilon_l - \varepsilon_a - \varepsilon_r)(\varepsilon_i + \varepsilon_j + \varepsilon_k + \varepsilon_l - \varepsilon_a - \varepsilon_b - \varepsilon_c - \varepsilon_d)}$$

$$\times (\varepsilon_i + \varepsilon_l - \varepsilon_c - \varepsilon_d)$$

$n = 8$ sp states $N = 4$

$\underline{\quad}$ $P = 4$
 $\underline{\quad}$ $P = 3$



configurations
 $= \binom{n}{N} = \frac{n!}{(n-N)! N!}$
 $= 70$

$$[H, S_z] = [H, S] = 0$$

$S_z = 0$ and no broken pairs

$$S_z = \sum_{i=1}^n m_{s_i} = 0$$

$P=4$

$P=3$

$| \pm_1 \rangle$

$P=2$

$P=1$

$2P_2 h$

\downarrow

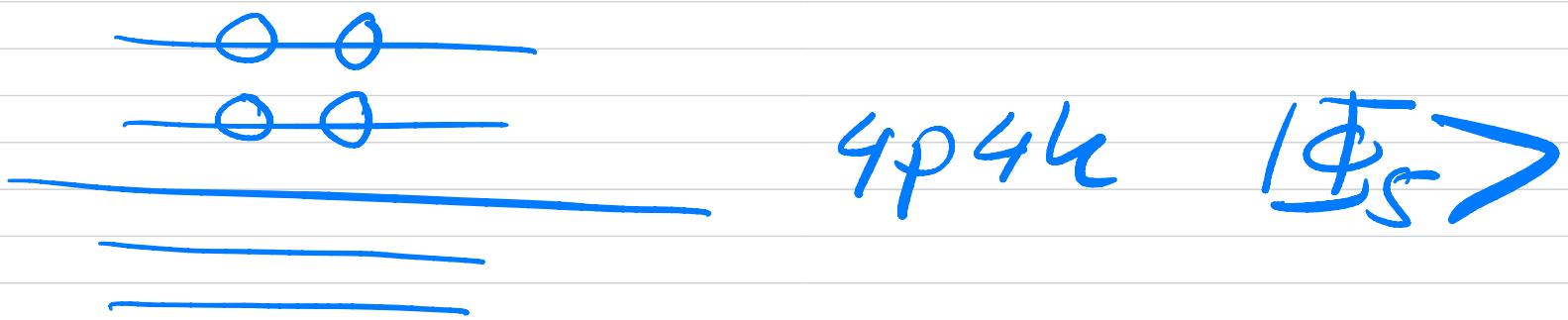
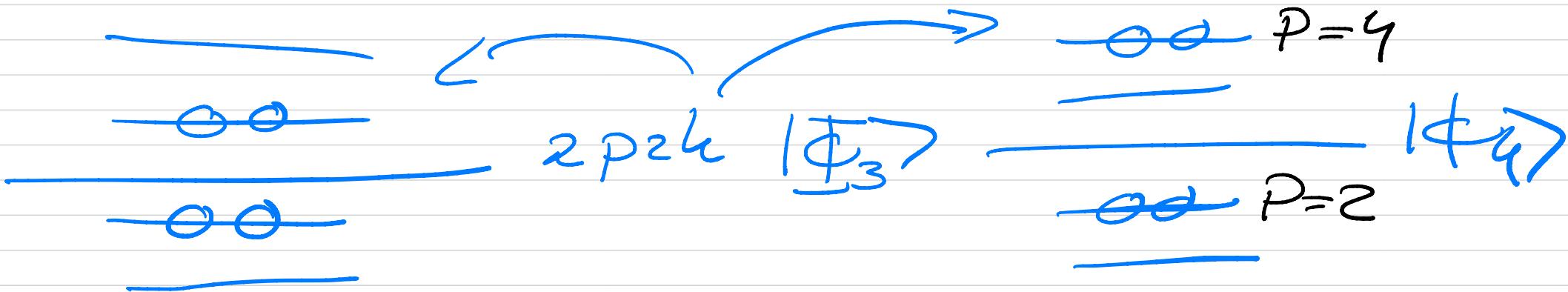
if no
broken pairs

\downarrow

$| \pm_2 \rangle$

\downarrow

$1D_1 h$



FCI HAMILTONIAN MATRIX

$S_z=0$, no broken pairs

open

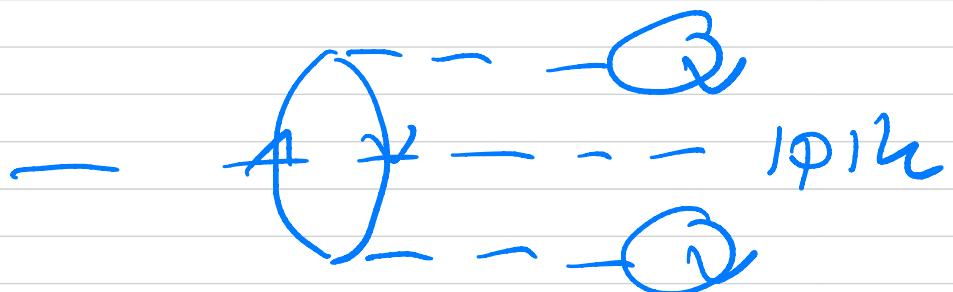
$\langle \psi_0 $	$ \psi_0\rangle$	$ \psi_1\rangle$	$ \psi_2\rangle$	$ \psi_3\rangle$	$ \psi_4\rangle$	$ \psi_5\rangle$	$-4p4l$
$\langle \psi_0 $	X	X	X	X	X	O	
$\langle \psi_1 $	X	X	?	?	O	?	
$\langle \psi_2 $	X	+	X				
$\langle \psi_3 $	X	?	X			?	
$\langle \psi_4 $	X	O		X			
$\langle \psi_5 $	O				X		

$2p2l$

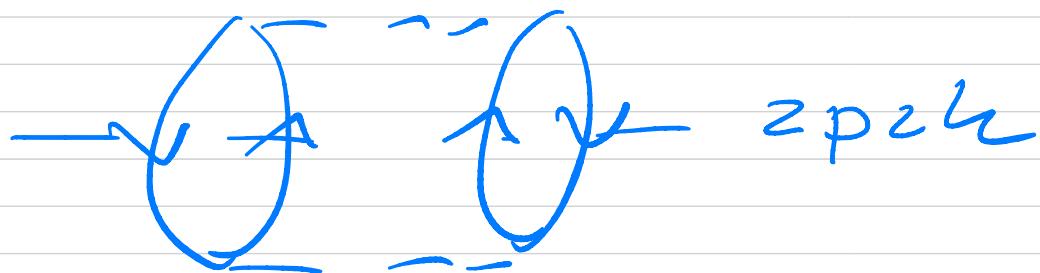
$4p4l$

no broken pairs $S_z = 0$

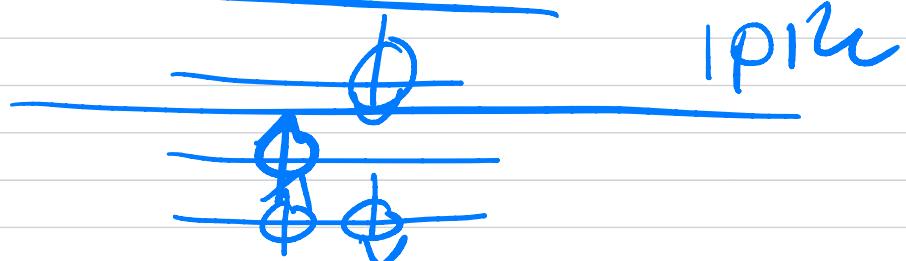
2nd-order



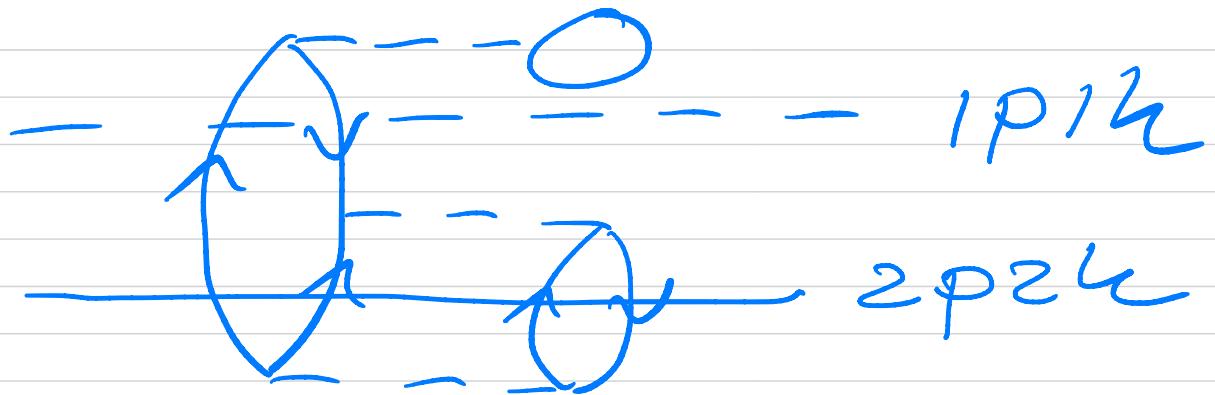
does not contribute



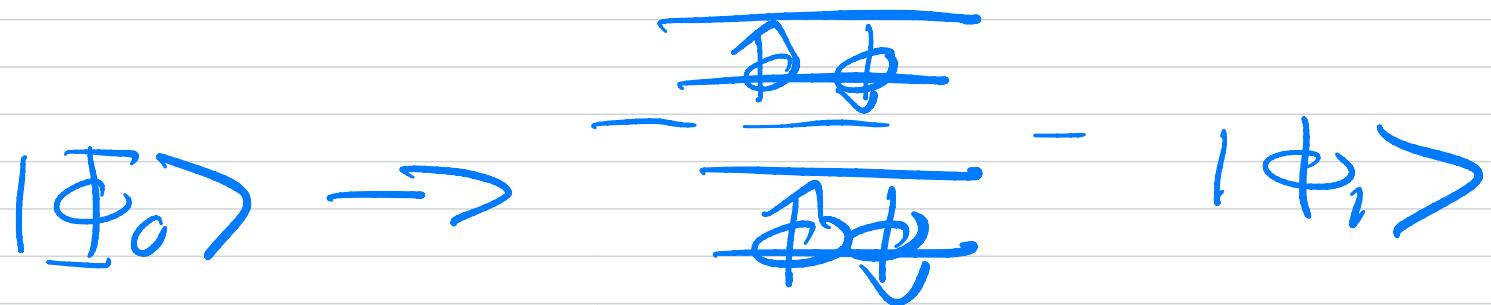
$$\frac{\langle \Phi_0 | + | \Phi_1 \rangle \langle \Phi_1 | + | \Phi_0 \rangle}{e}$$

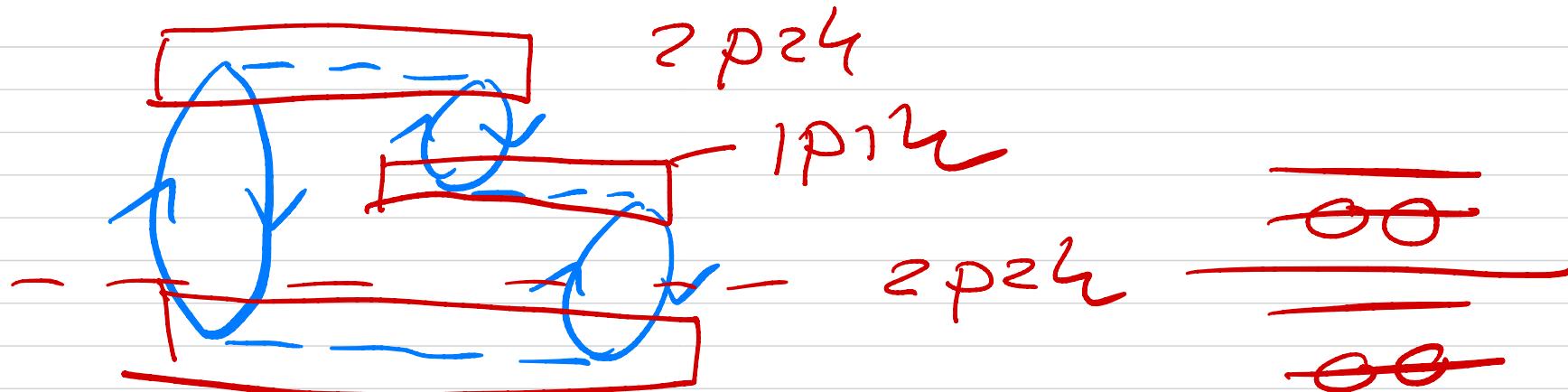


$|\Phi_2\rangle, |\Phi_3\rangle$
 (Φ_4) ~~Φ_5~~



Dets net diagram





does not contribute

