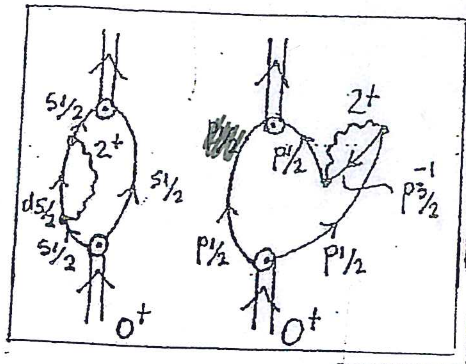
corrected 30/11/17

^{11}Li-halo



MeV	
$\varepsilon_{s1/2} = 1.5$	
$\varepsilon_{p3/2} = -4.7$	
$\varepsilon_{d5/2} = 3.5$	
$\varepsilon_{p1/2} = -1.2$	bare sp

WS potential $R_0 = 1.2A^{1/3}$ fm $= 2.7$ fm

① $U = U_0(+0.4\,E) \rightarrow$ (exchange; Pauli)

$R(^{11}Li) = 4.58 \pm 0.13$ fm

$\mathcal{O} = \left(\frac{R_0}{R}\right)^3 = \left(\frac{2.7}{4.58}\right)^3 \approx 0.2$

$m_k = \frac{m}{(1+\mathcal{O}\times 0.4)} \approx \frac{m}{1.08} \approx 0.93\,m$

$^9_3Li_6$; $U_0 = (-51 + 30\frac{N-Z}{A})$ MeV $= -43$ MeV

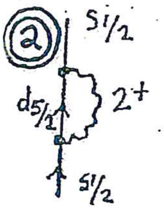
$\hbar\omega_{2^+} = 3.33$ MeV; $\beta_2 = 0.66$

clothing sp $\langle R_0\,\partial U/\partial r\rangle \approx 1.4\,U_0 \approx -60$ MeV; $\langle j\|Y_2\|1/2\rangle \approx ((2j+1)/4\pi)^{1/2} \approx 0.7$

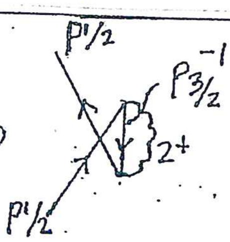
input

$\langle H_c\rangle = \frac{\beta_2}{\sqrt{5}}\langle R_0 \frac{\partial U}{\partial r}\rangle \mathcal{O} \langle j\|Y_2\|1/2\rangle \approx \frac{0.7}{\sqrt{5}} \times (-60\text{ MeV}) \times 0.2 \times 0.7 \approx -3$ MeV.

②



$\begin{pmatrix} (6.8-\lambda) & -3 \\ -3 & (1.5-\lambda) \end{pmatrix} = 0$ MeV



$\begin{pmatrix} (5.6-\lambda) & -3 \\ -3 & (-1.2-\lambda) \end{pmatrix} = 0$; MeV

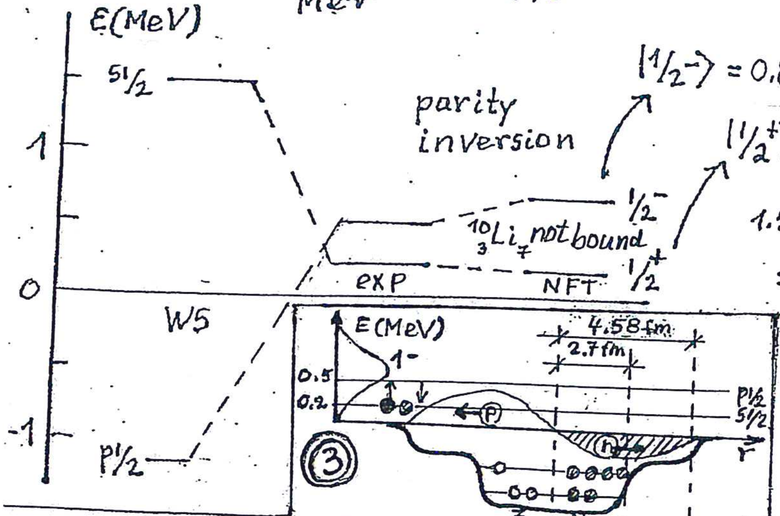
diagonalization

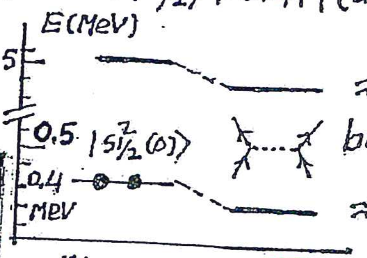
$\tilde{\varepsilon}_{s1/2} = 0.15$ MeV

$\tilde{\varepsilon}_{p1/2} = 0.6$ MeV

$|1/2^-\rangle = 0.86\,|p1/2\rangle + 0.51\,|((p1/2, p^{-1}_{3/2})_{0^+} \otimes 2^+)p1/2; 1/2^-\rangle$

$|1/2^+\rangle = 0.91\,|s1/2\rangle + 0.41\,|(d5/2 \otimes 2^+)\,1/2^+\rangle$



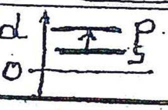


$^{11}_3Li_8$ not bound

$\langle V_p\rangle = G_{scr} = r\,G$

$\langle V_p\rangle = 0.048 \times \frac{25\text{ MeV}}{A} \approx \frac{1\text{ MeV}}{A} \approx 0.1$ MeV (screening)

halo-anti pairing effect, s,p at threshold



scenario pigmy

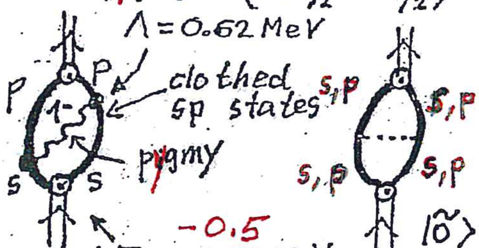
$H_D = K_1\,\vec{D}\cdot\vec{D}$ $\quad K_1 = s K_1^0$; $K_1^0 \sim 5V_1 = $ ~~165~~ → 125 MeV

(screening) $K_1 \sim$ ~~12~~ → 5.6 MeV ($s \approx$ ~~0.07~~ → 0.045)

$(8\%)\text{TRK} = \frac{9}{4\pi}\frac{\hbar^2}{2M}\frac{NZ}{A}e^2$

$\hbar\omega_{pigmy} = ((\varepsilon_{1/2^+} - \varepsilon_{1/2^-})^2 + K_1 \times (2 \times$ ~~0.06~~ → 0.08 $\text{TRK})^2)^{1/2} \approx$ ~~0.8~~ → 0.9 MeV

$\Lambda = 0.62$ MeV $\qquad \Lambda^2 \approx$ ~~0.4~~ → 0,25 MeV²



$E_{corr} \approx 2\tilde{\varepsilon}_{s1/2} + \Delta E_b + \Delta E_i = 0.4 - 0.1 -$ ~~0.95~~ → 0.5 MeV $\approx$ ~~0.7~~ → -0.2 MeV

(no absolute value!!)

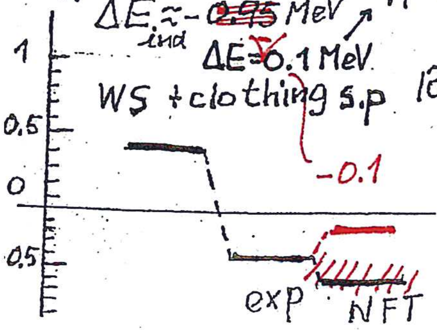
$(E_{corr})_{exp} \approx 0.380$ MeV

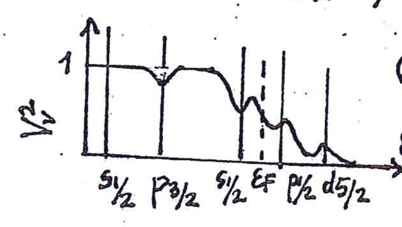
$\Delta E_{ind} \approx$ ~~-0.95~~ → -0.5 MeV

$\Delta E = 0.1$ MeV

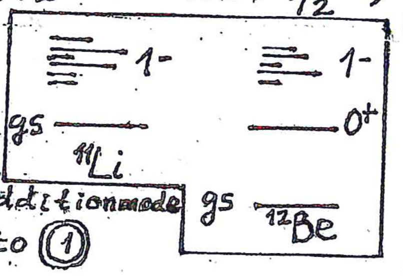
$|\tilde{0}\rangle = |0\rangle_\nu + 0.7\,|(p1/2, p^{-1}_{3/2})_{1^-} \otimes 1^-; 0\rangle + 0.1\,|(s1/2, d5/2)_{2^+} \otimes 2^+; 0\rangle$

$|\tilde{0}\rangle = |0\rangle_\nu = 0.45\,|s1/2^2(0)\rangle + 0.55\,|p1/2^2(0)\rangle + 0.04\,|d5/2^2(0)\rangle$





QRPA symbiotic ε_ν ots trap he pairaddition mode



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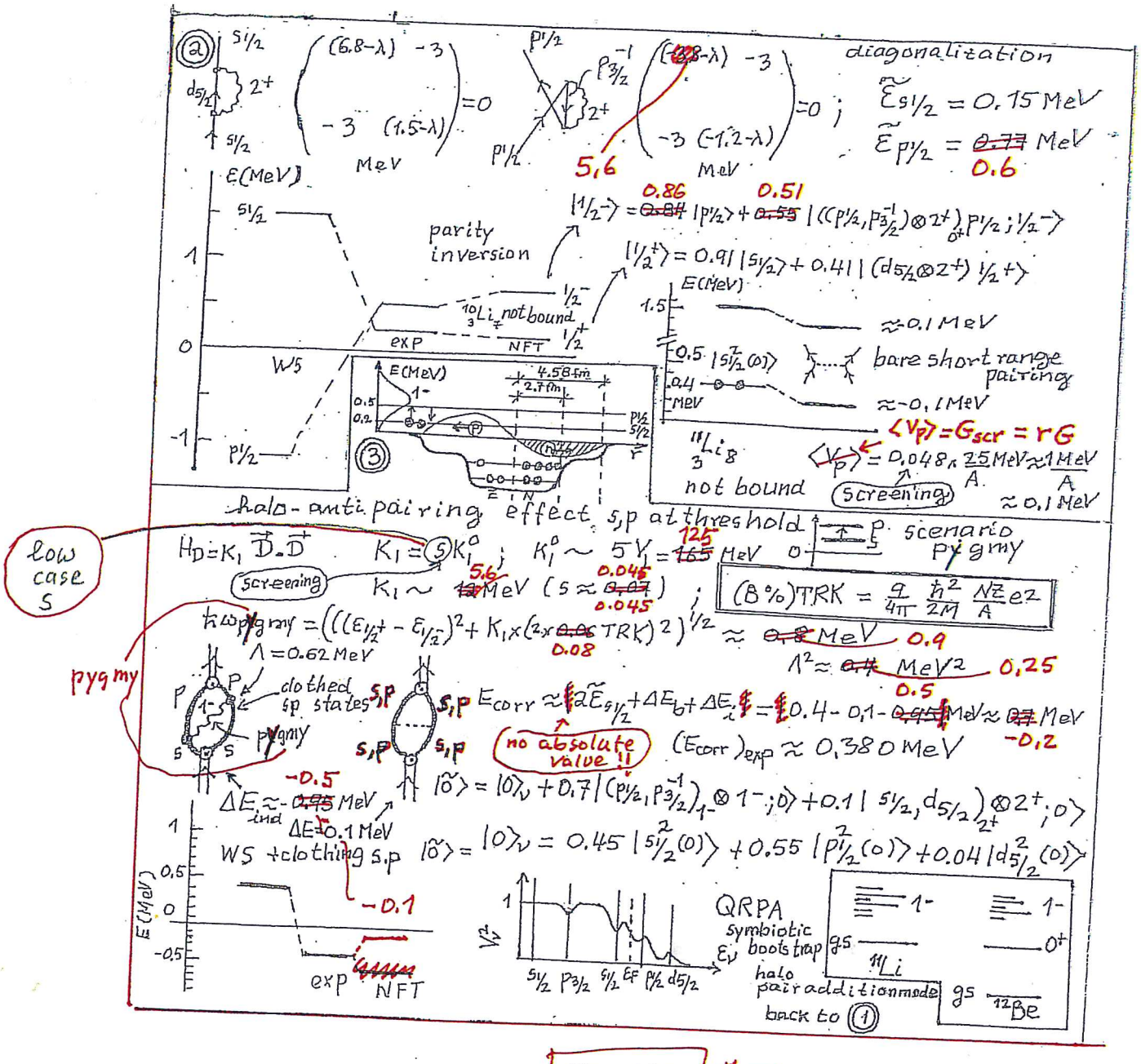
diagonalization
parity inversion
halo-anti pairing effect s,p at threshold
low case s
pygmy
no absolute value !!
back to ①
exp
NFT
WS
WS +clothing s,p
QRPA
symbiotic boostrap
halo pair addition mode
bare short range pairing
screening
not bound
scenario
Figure 1.9.1