Lecture 4

$$(E-H_0)|\Psi\rangle = (V_1+V_2+V_3)|\Psi\rangle$$

Faddeev Decomposition

$$|\Psi\rangle = \frac{1}{E-H_0}(V_1+V_2+V_3)|\Psi\rangle + |\Phi\rangle$$

$$= G_0(V_1+V_2+V_3)|\Psi\rangle + |\Phi\rangle$$

$$= |\Psi_1\rangle + |\Psi_2\rangle + |\Psi_3\rangle + |\Phi\rangle$$

Faddeev Equations

$$|\Psi_1\rangle = G_0 V_1 \left(|\Phi\rangle + |\Psi_1\rangle + |\Psi_2\rangle + |\Psi_3\rangle\right)$$

$$\Rightarrow (1-G_0V_1)|\Psi_1\rangle = G_0V_1|\Phi\rangle + G_0V_1|\Psi_2\rangle + G_0V_1|\Psi_3\rangle$$

$$\Rightarrow |\Psi_1\rangle = \underbrace{\boxed{(1-G_0V_1)^{-1}G_0}}_{= G_1} V_1 \left[|\Phi\rangle + |\Psi_2\rangle + |\Psi_3\rangle\right]$$

$$= G_0 t_1|\Phi\rangle + G_0t_1\underline{|\Psi_2\rangle} + G_0t_1\underline{|\Psi_3\rangle}$$

If $|\Psi_1\rangle = G_0V_1|\Psi\rangle \equiv G_0T_1|\Phi\rangle$ etc.

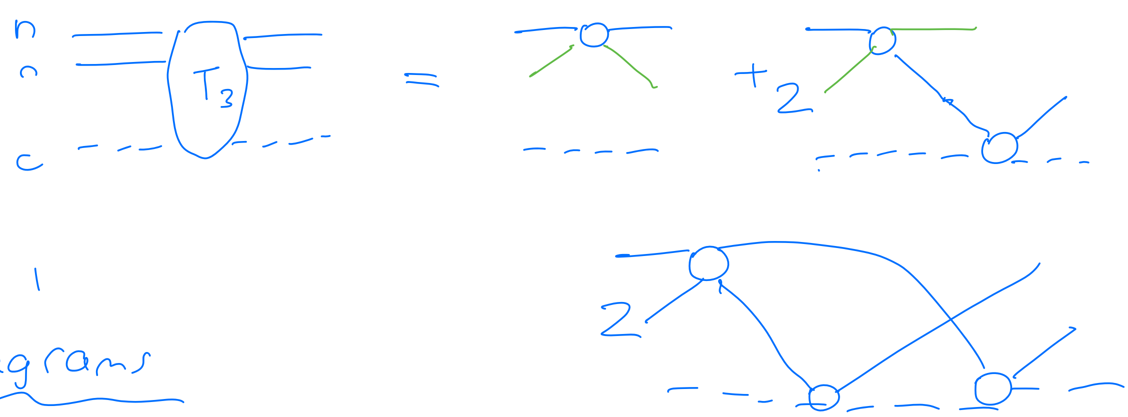
$$\Rightarrow G_0T_1|\Phi\rangle = G_0t_1|\Phi\rangle + G_0t_1G_0T_2|\Phi\rangle + G_0t_1G_0T_3|\Phi\rangle$$

$$\Rightarrow T_i = t_i + t_iG_0T_j + t_iG_0T_k$$

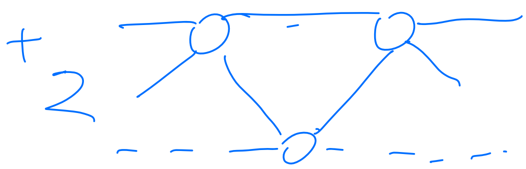
(ijk) cyclic permutation of 1&2&3

& that's the core

Let's say particle 3 is spectator, then

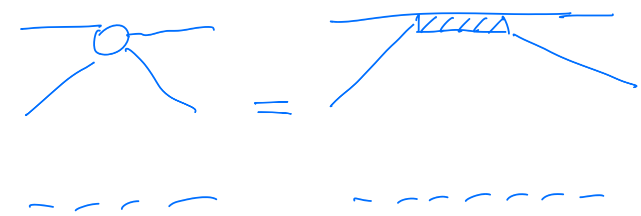


Diagrams

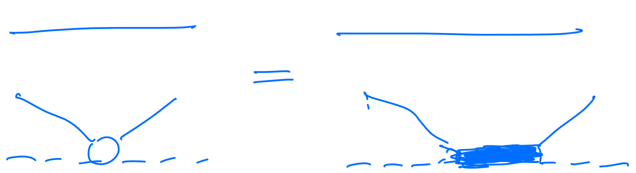


+ . . . . .

EFT

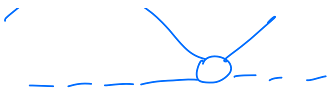


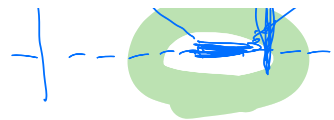
$a_{nn} \simeq -18$ fm



$a_{nc} = 7.75$ fm

First & simplest diagram above that generates scattering is

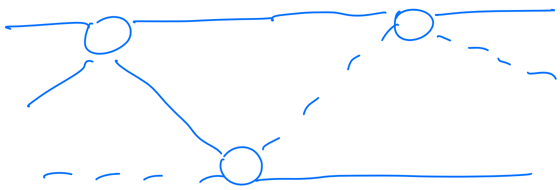




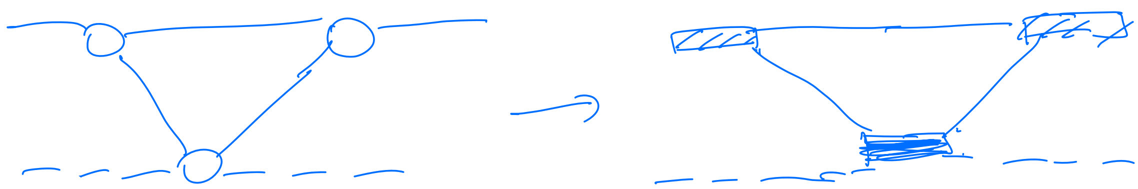
And amputate

$^{19}C - n$

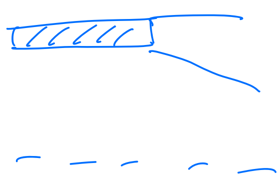
$(nn) - {}^{18}C$



EFT amplitudes
& amputate

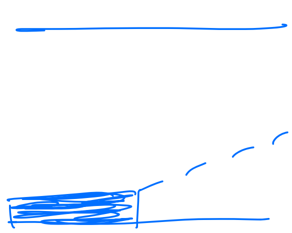


Define $\mathcal{A}_c$: sum of all diagrams
ending in



$\longrightarrow |\Psi_3\rangle$

Define $\mathcal{A}_n$: sum of all diagrams
ending in



$\longrightarrow |\Psi_{1,2}\rangle$

Integral

equations: