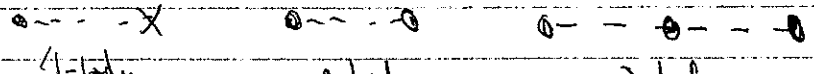
Piazza: many RG-related questions added in anticipation (and already remains a very large backlog that I will chip away at over the next week; prepared).

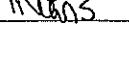
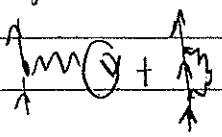
11/12/14

Wednesday 8805 Class

- Recap discussion of spectral densities
- display ⇒ Cipollone_spectral_density_SCGF.pdf
  - ⇒ Lehmann (spectral) representation of one-particle (or single-particle) Green's function (also two-point function)
  - Spectral function is the imaginary part of the Green's function (same as discontinuity)
  - ⇒ pages 5 and 6 of 11/10/14 notes.
  - * Question: What parts of the spectral function are measurable? (eg. with $(e,e'p)$)
- Highlight slides on 2014_ect_3nf_carbone.pdf
  - 4-8 scf-consistency

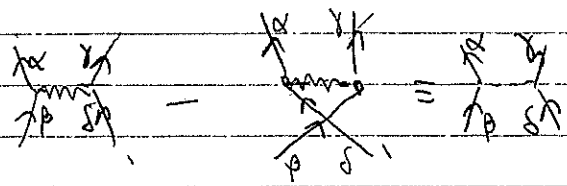
- What vertex ($\Gamma^{4\text{-pt}}$) function is used at the HF level?
- Note the different symbols for the one-body, two-body, and three-body parts of the Hamiltonian:



- Is the 3-body representation general? Eg. is there always an interior point?
- Tricky feature: Interactions are anti-symmetrized, which means  includes Hartree and Fock: 

(we know from $\hat{H} = \ldots + \frac{1}{4}\sum_{\alpha\beta\gamma\delta} V_{\alpha\gamma,\beta\delta}\, a^\dagger_\alpha a^\dagger_\gamma a_\delta a_\beta$ would be $\frac{1}{2}$ otherwise

$$V_{\alpha\gamma,\beta\delta} \equiv \langle \alpha\gamma | V | \beta\delta \rangle - \langle \alpha\gamma | V | \delta\beta \rangle \quad \text{with no factor}$$

That means that we have both: 

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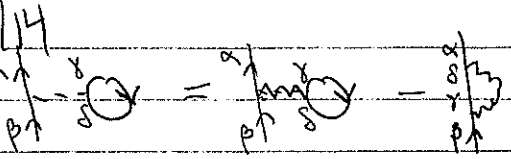
So 

On slide 7 of 2014_ect_3nf_castorc.pdf we see that if we work in the HF approximation, then $\Gamma^{1+pt} \cong 0$ (not included)

- Look at slides 10-16 to see components including 3NF.

- Look at "Kohn sum rule" on 25-30
  - Closed diagrams as in Linked cluster expansion
  - The trick is to get the numerical factors (weights of each diagram) correct. (eg. Symmetry factors)
  - $f(\omega)$ is a Fermi-Dirac function $\Rightarrow$ θ function at Fermi energy for $T=0$.

- Emphasis: self-consistency sums many higher-order effects but in a way that preserves conservation laws $\Rightarrow$ "conserving approximations"

- Now switch gears and talk about interactions.

- Start with NUGS lecture 1
  - Prereq: 4,5
  - Playground: 7 $\Rightarrow$ mention Piazza questions with a similar figure
  - Nuclear Scales and Resolution: 16, 17, 21-47, 53-65

- Then NUGS lecture 2
  - Basics of SRG start on 16
  - Weinberg eigenvalues start on 77

- Lecture 6 47-49 $\Rightarrow$ what parts of wfs can be extracted without assumptions from experiment?