Wednesday 8805 Class

Recap discussion of spectral densities

- Display cipollone_spectral_density_SCF.pdf
  - Lehmann (spectral) representation of one-particle (or single-particle) Greens function (also two-point function)
  - Spectral function is the imaginary part of Re Greens function
  - Same as discontinuity

- Pages 5 and 6 of 11/10/14 notes
- Question: What parts of the spectral function are measurable? (e.g. with CDPE)
- Highlight slides on 2014 ect 3infｃａｌｃｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａｌｃａलcalc.pdf
- 4-8 self-consistency

What vertex (G^{4p7}) function is used at the HF level?

- Note the different symbols for HF one-body, two-body, and three-body parts of HF Hamiltonian

\[ \begin{array}{ccc}
  1\text{-body} & 2\text{-body} & 3\text{-body} \\
\end{array} \]

Is the 3-body representation general? E.g., is there always an interior point?

- Tricky feature: Interactions are anti-symmetrized, which means \( \sum_{\sigma} \) includes Hartree and Fock: \( \Sigma_{\alpha\beta} \theta_{\alpha\beta} \)

We know from \( H = \sum_{\alpha} \frac{1}{2} \sum_{\sigma} V_{\alpha\sigma} \rho_{\alpha\sigma} \sigma_{\alpha} + \rho_{\alpha\sigma} \sigma_{\alpha} \)

- \( \rho_{\alpha\sigma} \) would be \( \rho_{\alpha\sigma} \) otherwise

\( V_{\alpha\sigma, \beta} = \langle \phi^\dagger V \phi^\dagger \phi \beta \rangle - \langle \phi^\dagger V \phi^\dagger \phi \beta \rangle \) with no factor

That means that we have left: \( \rho_{\alpha\sigma} \rho_{\beta\gamma} \)
On slide 7 of 2014_est_3nf_carbonate.pdf we see that if we work in the HF approximation, $\text{Tr} \mathcal{M}_o = 0$ (not included).

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

- Look at "Kotani sum rule" on 95-100:
  - Closed diagrams as in linked cluster expansion
  - The trick is to get the numerical factors (weights of each diagram) correct. (e.g., symmetry factors)
  - $f(w)$ is a Fermi-Dirac function $\equiv 0$ 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 approximation".

- Now switch gears and talk about interactions.

- Start with HUGS lecture 1
  - Problems: 4, 5
  - Playground: 7 $\Rightarrow$ mention huzza questions with a similar figure
  - Nuclear Sizes and Resolution: 16, 17, 21-47, 53-65

- Ten HUGS lecture 2
  - Basics of SRG start on 16
  - Weinberg eigenvalues start on 77

- Lecture 6 47-49 $\Rightarrow$ what parts of 165 can be extracted without assumptions from experiment.