IR fixed point theory

Low energy fixed point Hamiltonian for $J_0 > 0$

$$H^*(\omega) = \sum_{|\Lambda|<\Lambda^*} \hbar v_F \Lambda \hat{n}_{\Lambda,\hat{s},\sigma} + \frac{J^*(\omega)}{2} \sum_{\Lambda,\Lambda'<\Lambda^*,\hat{s}\hat{s}'} \mathbf{S}\cdot c^\dagger_{\mathbf{k}_{\Lambda\hat{s}},\alpha} \boldsymbol{\sigma}_{\alpha\beta} c^\dagger_{\mathbf{k}_{\Lambda'\hat{s}'},\alpha}$$

Hamiltonian containing only zero mode $J_0 > 0$

$$H_0^*(\omega) = \boxed{\frac{\hbar v_F}{N(\Lambda^*)} \sum_{|\Lambda|<\Lambda^*,\hat{s}} \Lambda \sum_{\Lambda,\hat{s}} \hat{n}_{\mathbf{k}_{\Lambda\hat{s}}\sigma}} + \frac{J^*(\omega)}{2} \sum_{\Lambda,\Lambda'<\Lambda^*,\hat{s}\hat{s}'} \mathbf{S}\cdot c^\dagger_{\mathbf{k}_{\Lambda\hat{s}},\alpha} \boldsymbol{\sigma}_{\alpha\beta} c^\dagger_{\mathbf{k}_{\Lambda'\hat{s}'},\alpha}$$

- Zero mode accounts for the low enery physics near FS, and is responsible for the singlet ground state.

- The other non-zero mode are sources of excitation around the ground state.