

# Drawings That We Use in Many-Body Physics

Greg Winther

October 12, 2018

## 1 Slater determinants

Drawing the reference state will result in a drawing of nothing. A single-excited reference state is two vertical arrows

$$\Phi_i^a = \begin{array}{c} | \\ \text{i} \nearrow \\ | \\ | \\ \text{a} \searrow \\ | \end{array} , \quad (1)$$

while the double-excited Slater determinant consists of four vertical arrows,

$$\Phi_{ij}^{ab} = \begin{array}{c} | \\ \text{i} \nearrow \\ | \\ | \\ \text{a} \searrow \\ | \end{array} \begin{array}{c} | \\ \text{j} \nearrow \\ | \\ | \\ \text{b} \searrow \\ | \end{array} . \quad (2)$$

The horizontal positions of the lines have no significance. If we want to indicate a bra or ket form we draw a couple of horizontal lines,

$$|\Phi_i^a\rangle = \{\hat{a}^\dagger \hat{i}\} |0\rangle = \begin{array}{c} | \\ \text{i} \nearrow \\ | \\ \hline \hline \end{array} \begin{array}{c} | \\ \text{a} \searrow \\ | \end{array} , \quad \langle \Phi_i^a| = \langle 0| \{\hat{i}^\dagger \hat{a}\} = \begin{array}{c} \hline \hline \\ | \\ \text{i} \nearrow \\ | \\ \text{a} \searrow \\ | \end{array} , \quad (3)$$