Notes for exact diagonalization

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$$M = P^{\mathrm{T}} \cdot O \cdot P$$

$$\mathrm{Op_T} = \sum_{s=1}^{N_{\mathrm{FL}}} g_s \sum_{\sigma=1}^{N_{\mathrm{SUN}}} \sum_{i,j} M_{i,j}^{s} c_{i\sigma s}^{\dagger} c_{j\sigma s}$$

$$\begin{aligned}
\mathrm{Op_V} &= \left[\sum_{s=1}^{N_{\mathrm{FL}}} g_s \sum_{\sigma=1}^{N_{\mathrm{SUN}}} \left(\sum_{i,j} M_{i,j}^{s} c_{i\sigma s}^{\dagger} c_{j\sigma s} + \alpha_s \right) \right]^2 \\
&= \sum_{s\sigma s'\sigma'} \sum_{ijkl} g_s g_{s'} M_{i,j}^{s} M_{k,l}^{s'} c_{i\sigma s}^{\dagger} c_{j\sigma s} c_{k\sigma' s'}^{\dagger} c_{l\sigma' s'} \\
&\quad + \sum_{s\sigma s'} \sum_{ij} 2 N_{\mathrm{SUN}} g_s g_{s'} \alpha_{s'} M_{i,j}^{s} c_{i\sigma s}^{\dagger} c_{j\sigma s} \\
&\quad + N_{\mathrm{SUN}}^2 \left(\sum g_s \alpha_s \right)^2
\end{aligned}$$

$$H = \frac{1}{-\Delta\tau} \left(\sum \mathrm{Op_T} + \sum \mathrm{Op_V} \right)$$