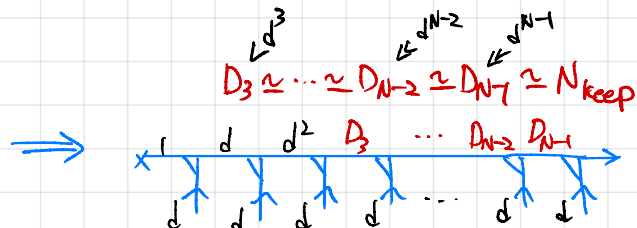
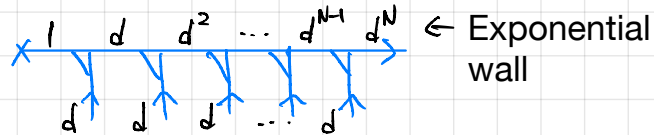
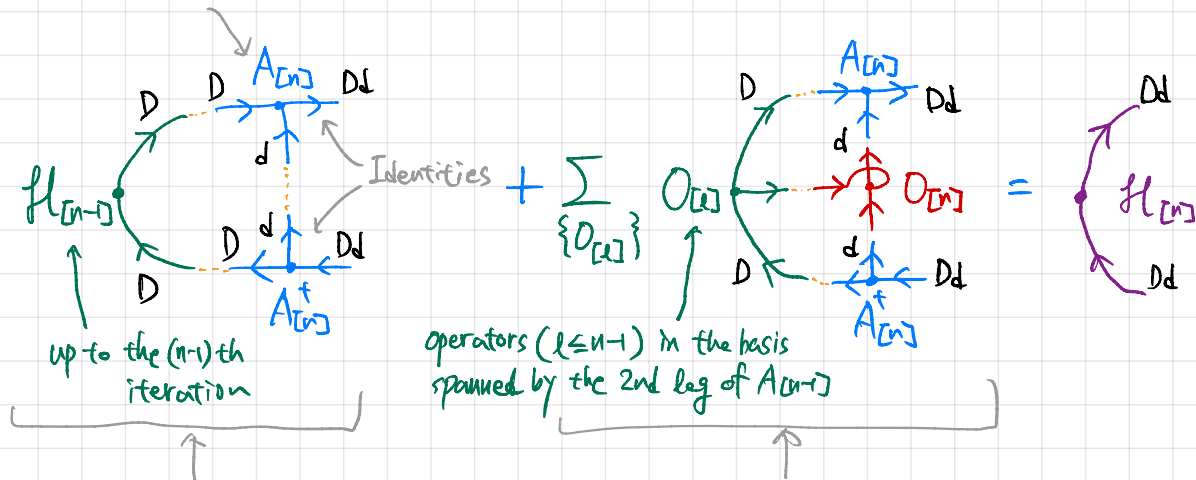


Iterative diagonalization



At each iteration of computing matrix elements of the Hamiltonian (“along the zipper”):

(1) Define the identity tensor



(2) Expand the Hamiltonian in the new basis for the n-th iteration

(3) Add terms (e.g., particle hopping, spin-spin interaction)

(4) Diagonalize the Hamiltonian

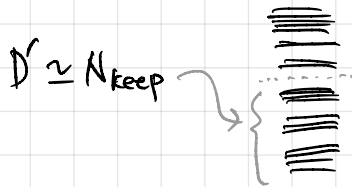
Discarded:

Kept:

$$H_{\text{eff}} = U_{\text{eff}} E_{\text{eff}} U_{\text{eff}}^\dagger$$

$$H_{\text{eff}} = E_{\text{eff}} = U_{\text{eff}}^\dagger \text{ (circuit) } U_{\text{eff}}$$

(5) Truncate the Hilbert space



$$H_{\text{eff}} = E_{\text{eff}} = U_{\text{eff}}^\dagger \text{ (circuit) } U_{\text{eff}} + E_{\text{eff}} = U_{\text{eff}}^\dagger \text{ (circuit) } U_{\text{eff}}$$

Note: Keep degenerate states (e.g., belonging to the same symmetry multiplet) together (or discard them together), not to artificially break the symmetry of the system

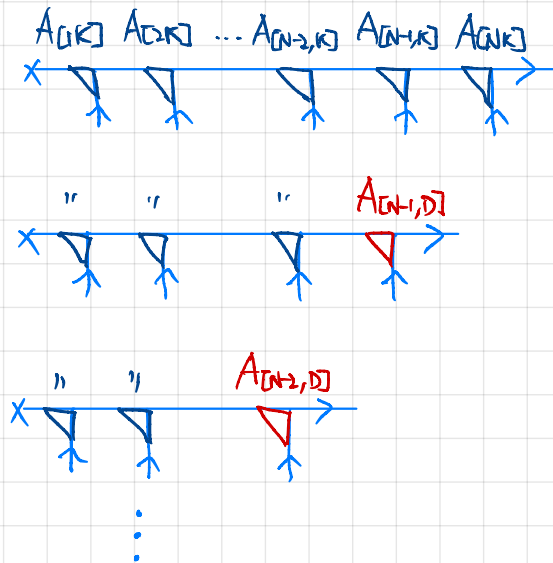
(6) Update isometries

To be used for the next iteration

$$H_{\text{eff}} = E_{\text{eff}} = U_{\text{eff}}^\dagger \text{ (circuit) } U_{\text{eff}}$$

Also to be used for complete basis, tangent space, ...

Result:



For constructing the complete basis of energy eigenstates in the numerical renormalization group (NRG)

Initialization of the variational ground-state search in the density-matrix renormalization group (DMRG)