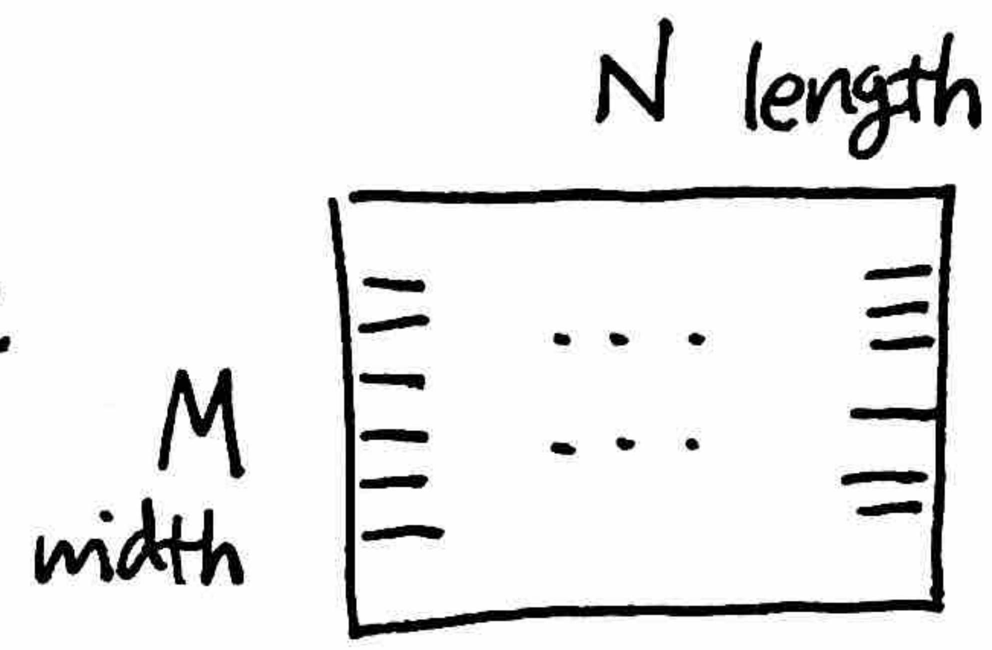
Chalker-Coddington Model

- randomness in link phases alone
- Square network



eigenvalues of $T^{\dagger}T$ for system of length N 'slices' be $\{\gamma_i(N)\}$

$$\gamma_1(N) \geq \gamma_2(N) \geq \ldots \geq \gamma_M(N)$$

$$\{z_i\} \xrightarrow[T]{} \{z_i'\} \quad i = 1, 2, \ldots, M$$

M even

$$z_i' = T_{ij} z_j$$

calculate $\xi_M(\theta) = \left[(1/4N)\ln(\gamma_{M/2}(N))\right]^{-1}$ for large N

$$T = U_1 U_2 \ldots U_N$$ transfer matrices $\{U_\alpha\}$

largest systems studied:

$$\left.\begin{matrix} M = 128 \\ N = 10^5 \end{matrix}\right\}$$

$$U_\alpha = A_\alpha B C_\alpha D$$

$$[A_\alpha]_{ij} = \delta_{ij} e^{i\varphi_j(\alpha)}$$

$\{\varphi_j(\alpha)\}$ independent random variables uniformly distributed in $[0, 2\pi)$

C_α - identical form with independent phases

$$B_{ii} = \cosh\theta' \quad i = 1, 2, \ldots, M$$

$$B_{2i,2i-1} = B_{2i-1,2i} = \sinh\theta' \quad i = 1, \ldots, M/2$$

otherwise $B_{ij} = 0$

$$D_{ii} = \cosh\theta \quad i = 2, 3, \ldots, M-1$$

$$D_{2i+1,2i} = D_{2i,2i+1} = \sinh\theta \quad i = 1, \ldots, M/2 - 1$$

otherwise $D_{ij} = 0$

cylindrical

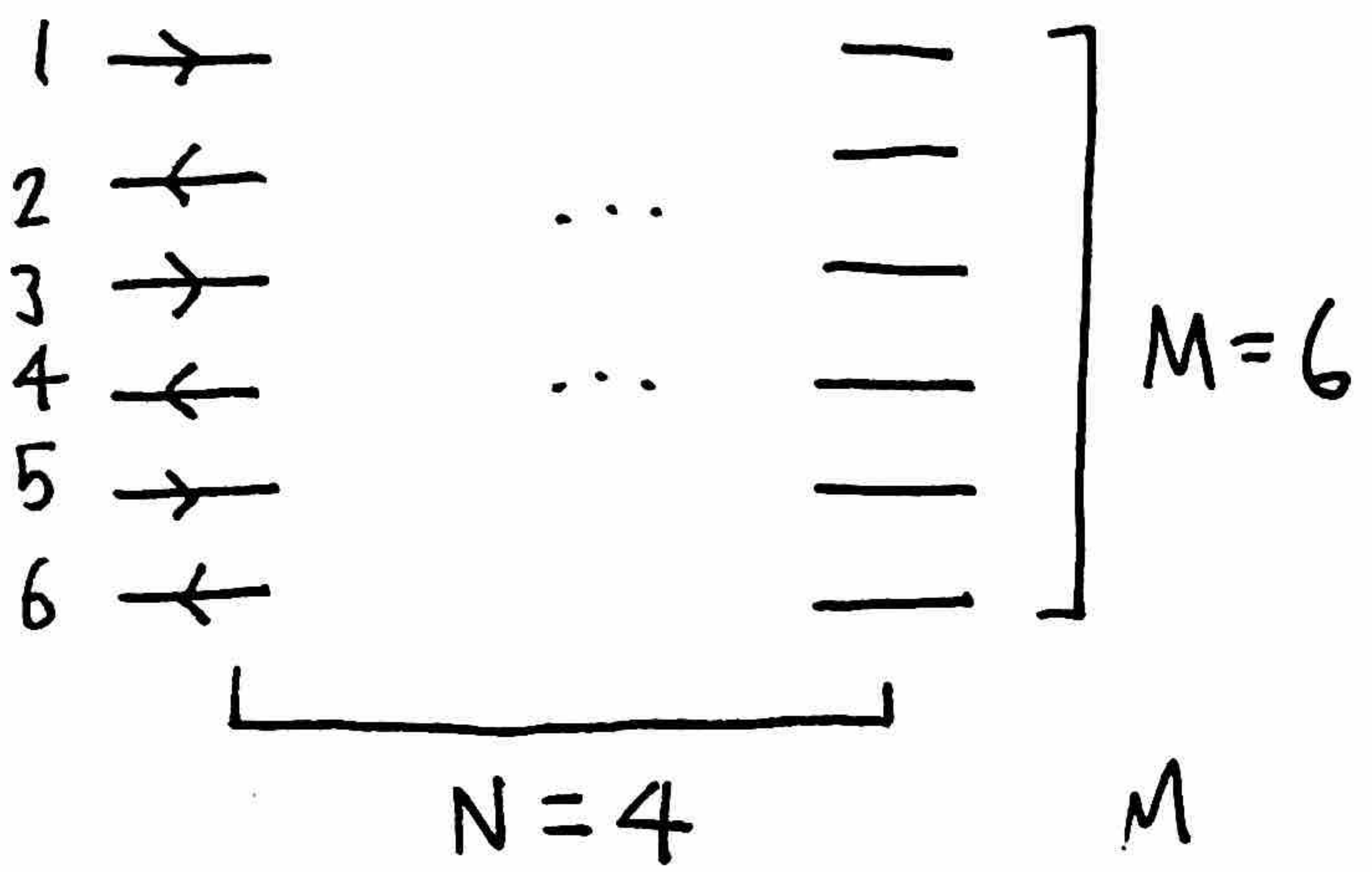
$$D_{11} = D_{MM} = \cosh\theta$$

$$D_{1M} = D_{M1} = \sinh\theta$$

strip

$$D_{11} = D_{MM} = 1$$

Example



$U_1 = A_1 B C_1 D$

$$B = \begin{pmatrix} \cosh\theta' & \sinh\theta' & 0 & 0 & 0 & 0 \\ \sinh\theta' & \cosh\theta' & 0 & 0 & 0 & 0 \\ 0 & 0 & \cosh\theta' & \sinh\theta' & 0 & 0 \\ 0 & 0 & \sinh\theta' & \cosh\theta' & 0 & 0 \\ 0 & 0 & 0 & 0 & \cosh\theta' & \sinh\theta' \\ 0 & 0 & 0 & 0 & \sinh\theta' & \cosh\theta' \end{pmatrix}$$

M

$$A_1 = \begin{pmatrix} e^{i\varphi_1(1)} & 0 & 0 & 0 & 0 & 0 \\ 0 & e^{i\varphi_2(1)} & 0 & 0 & 0 & 0 \\ 0 & 0 & e^{i\varphi_3(1)} & 0 & 0 & 0 \\ 0 & 0 & 0 & e^{i\varphi_4(1)} & 0 & 0 \\ 0 & 0 & 0 & 0 & e^{i\varphi_5(1)} & 0 \\ 0 & 0 & 0 & 0 & 0 & e^{i\varphi_6(1)} \end{pmatrix}$$

M

$$D = \begin{pmatrix} \cosh\theta & 0 & 0 & 0 & 0 & \sinh\theta \\ 0 & \cosh\theta & \sinh\theta & 0 & 0 & 0 \\ 0 & \sinh\theta & \cosh\theta & 0 & 0 & 0 \\ 0 & 0 & 0 & \cosh\theta & \sinh\theta & 0 \\ 0 & 0 & 0 & \sinh\theta & \cosh\theta & 0 \\ \sinh\theta & 0 & 0 & 0 & 0 & \cosh\theta \end{pmatrix}$$

$$C_1 = \begin{pmatrix} e^{i\Phi_1(1)} & 0 & 0 & 0 & 0 & 0 \\ 0 & e^{i\Phi_2(1)} & 0 & 0 & 0 & 0 \\ 0 & 0 & e^{i\Phi_3(1)} & 0 & 0 & 0 \\ 0 & 0 & 0 & e^{i\Phi_4(1)} & 0 & 0 \\ 0 & 0 & 0 & 0 & e^{i\Phi_5(1)} & 0 \\ 0 & 0 & 0 & 0 & 0 & e^{i\Phi_6(1)} \end{pmatrix}$$

cylindrical geometry

$T = U_1 U_2 \dots U_{N-1} U_N$

$U_\alpha = A_\alpha B C_\alpha D$

random matrices

$T = A_1 B C_1 D A_2 B C_2 D \dots A_N B C_N D$

compute once