

$$P_D[U_{\mathbf{x}}, U_{\mathbf{x}}^\dagger] = \text{Tr} U_{\mathbf{x}_1}^{w_1} \text{Tr} U_{\mathbf{x}_2}^{w_2} \dots \text{Tr} U_{\mathbf{x}_n}^{w_n} \text{Tr} U_{\mathbf{y}_1}^{\dagger w'_1} \text{Tr} U_{\mathbf{y}_2}^{\dagger w'_2} \dots \text{Tr} U_{\mathbf{y}_m}^{\dagger w'_m}$$