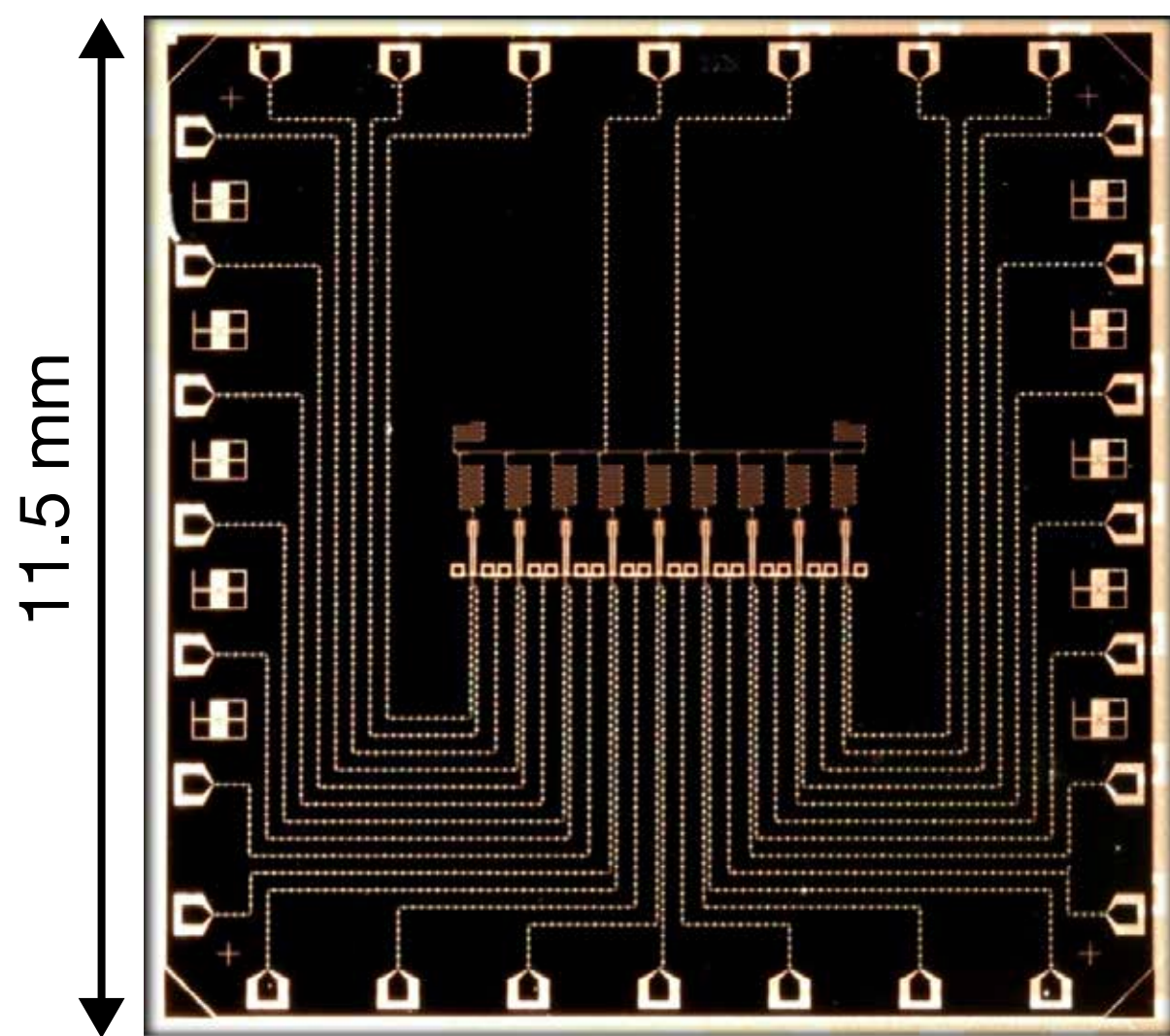
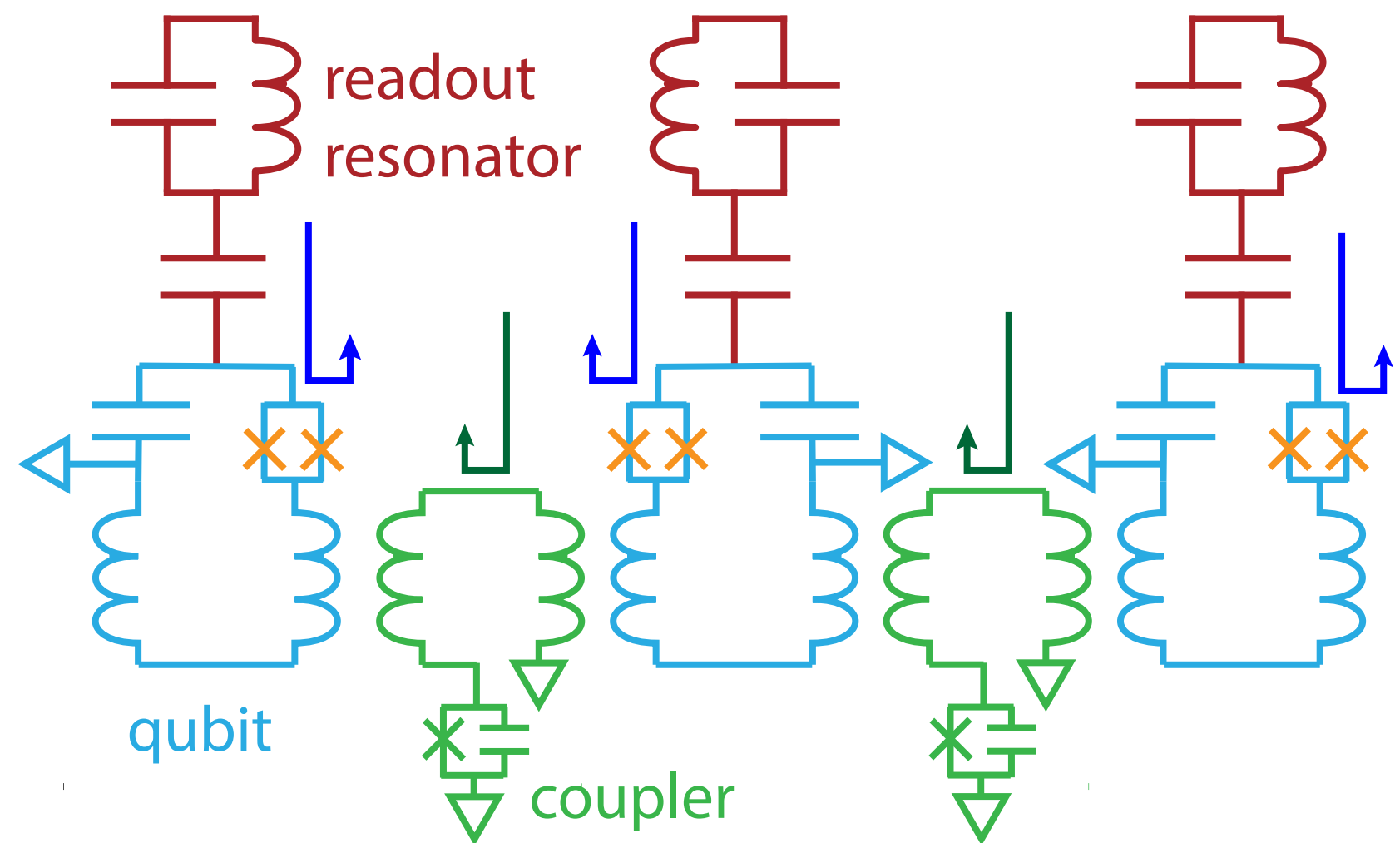


a)



b)



$$\begin{aligned}
 \mathbf{H}_{\text{Bose - Hubbard}} = & \underbrace{\sum_i^{N_{\text{coupler}}} g_{i,i+1} \left(a_i^\dagger a_{i+1} + a_i a_{i+1}^\dagger \right)}_{\text{coupling (hopping)}} + \underbrace{\sum_i^{N_{\text{qubit}}} h_i n_i}_{\text{frequency detuning}} + \underbrace{\frac{U}{2} \sum_i^{N_{\text{qubit}}} n_i (n_i - 1)}_{\text{qubit nonlinearity}}
 \end{aligned}$$