

$$UU^\dagger = \begin{pmatrix} 0 & U_- \\ U_+ & 0 \end{pmatrix} \begin{pmatrix} 0 & U_+ \\ U_- & 0 \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$