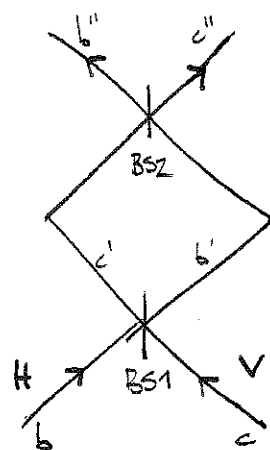


Input  $|HV\rangle_{bc}$

SSM



SSM: identity  $\mathbb{1}$

$$|HV\rangle_{bc} = b_H^+ c_V^+ |0\rangle$$

$$\begin{aligned} \xrightarrow{BS1} & \frac{1}{\sqrt{2}} (b_H^+ + i c_H^+) \frac{1}{\sqrt{2}} (c_V^+ + i b_V^+) |0\rangle \\ &= \frac{1}{2} [b_H^+ c_V^+ + i c_H^+ c_V^+ + i b_H^+ b_V^+ - b_V^+ c_H^+] |0\rangle \\ &= \frac{1}{2} [|HV\rangle_{b'c'} + i |HV\rangle_{c'c'} + i |HV\rangle_{b'b'} - |HV\rangle_{c'b'}] \end{aligned}$$

$$\begin{aligned} b_H^+ |0\rangle &= |H\rangle_b \\ c_H^+ |0\rangle &= |H\rangle_c \\ &\vdots \end{aligned}$$

$\mathbb{1} \rightarrow$  — no change (SSM)

$$\begin{aligned} BS: \quad b_H^+ &\rightarrow \frac{1}{\sqrt{2}} (b_H^{''+} + i c_H^{''+}) \\ c_H^+ &\rightarrow \frac{1}{\sqrt{2}} (c_H^{''+} + i b_H^{''+}) \\ &\vdots \end{aligned}$$

$$\begin{aligned} \xrightarrow{BS2} & \frac{1}{2} \left[ \frac{1}{2} (b_H^{''+} + i c_H^{''+}) (c_V^{''+} + i b_V^{''+}) + \frac{i}{2} (c_H^{''+} + i b_H^{''+}) (c_V^{''+} + i b_V^{''+}) \right. \\ & \quad \left. + \frac{i}{2} (b_H^{''+} + i c_H^{''+}) (b_V^{''+} + i c_V^{''+}) - \frac{1}{2} (b_V^{''+} + i c_V^{''+}) (c_H^{''+} + i b_H^{''+}) \right] |0\rangle \end{aligned}$$

$$\begin{aligned} = & \frac{1}{4} \left[ \cancel{b_H^{''+} c_V^{''+}} + i \cancel{c_H^{''+} c_V^{''+}} + i \cancel{b_H^{''+} b_V^{''+}} - \cancel{b_V^{''+} c_H^{''+}} \right. \\ & + i \cancel{c_H^{''+} c_V^{''+}} - \cancel{b_H^{''+} c_V^{''+}} - \cancel{b_V^{''+} c_H^{''+}} - i \cancel{b_H^{''+} b_V^{''+}} \\ & + i \cancel{b_H^{''+} b_V^{''+}} - \cancel{b_V^{''+} c_H^{''+}} - \cancel{b_H^{''+} c_V^{''+}} - i \cancel{c_H^{''+} c_V^{''+}} \\ & \left. - \cancel{b_V^{''+} c_H^{''+}} - i \cancel{c_H^{''+} c_V^{''+}} - i \cancel{b_H^{''+} b_V^{''+}} + \cancel{b_H^{''+} c_V^{''+}} \right] |0\rangle \end{aligned}$$

$$= - b_V^{''+} c_H^{''+} |0\rangle$$

$$= - |HV\rangle_{b''c''}$$