

1 Introduction

1.1 Beamsplitter

$$\begin{aligned}\hat{c} &= \hat{a}\sqrt{r} + \hat{b}\sqrt{1-r} \\ \hat{d} &= \hat{a}\sqrt{1-r} - \hat{b}\sqrt{r} \\ \hat{a}_H^\dagger \hat{b}_V^\dagger |0\rangle &\rightarrow \frac{1}{2}(\hat{c}_H^\dagger \hat{c}_V^\dagger - \hat{c}_H^\dagger \hat{d}_V^\dagger + \hat{d}_H^\dagger \hat{c}_V^\dagger - \hat{d}_H^\dagger \hat{d}_V^\dagger) |0\rangle \\ \hat{a}^\dagger \hat{b}^\dagger |0\rangle &\rightarrow \frac{1}{\sqrt{2}}(|2\rangle_c - |2\rangle_d)\end{aligned}$$

1.2 two-photon interference

$$\begin{aligned}|\psi\rangle_{in} &= |1\rangle_{a,H} |1\rangle_{b,V} = |H\rangle_a |V\rangle_b = \hat{a}_H^\dagger \hat{b}_V^\dagger |0\rangle \\ |\Psi^+\rangle_{ab} &\rightarrow (\hat{c}_H^\dagger \hat{c}_V^\dagger - \hat{d}_H^\dagger \hat{d}_V^\dagger) |0\rangle \\ |\Psi^-\rangle_{ab} &\rightarrow (\hat{c}_H^\dagger \hat{d}_V^\dagger - \hat{d}_H^\dagger \hat{c}_V^\dagger) |0\rangle \\ |\Phi^\pm\rangle_{ab} &\rightarrow ((\hat{c}_H^\dagger)^2 \pm (\hat{c}_V^\dagger)^2 - (\hat{d}_H^\dagger)^2 \mp (\hat{d}_V^\dagger)^2) |0\rangle\end{aligned}$$

1.3 time measurement

$$N_c = C(T^2 + R^2)(1 - \frac{2RT}{R^2 + T^2} e^{-(\Delta\omega\delta\tau)^2})$$

2 Application

$$\begin{aligned}|\Psi^+\rangle_{ab} &\rightarrow \frac{1}{\sqrt{2}}(|1\rangle_{c,H} |1\rangle_{c,V} - |1\rangle_{d,H} |1\rangle_{d,V}) \\ |\Psi^-\rangle_{ab} &\rightarrow \frac{1}{\sqrt{2}}(|1\rangle_{c,H} |1\rangle_{d,V} - |1\rangle_{d,H} |1\rangle_{c,V}) \\ |\Phi^\pm\rangle_{ab} &\rightarrow \frac{1}{2}(|2\rangle_{c,H} \pm |2\rangle_{c,V} - |2\rangle_{d,H} \pm |2\rangle_{d,V}) \\ |\psi\rangle &= \alpha |0\rangle + \beta |1\rangle + \gamma |2\rangle \\ \rightarrow |\psi'\rangle &= \alpha |0\rangle + \beta |1\rangle - \gamma |2\rangle\end{aligned}$$