

Thus:

$$[\hat{a}_c \hat{a}_v + \hat{a}_d \hat{a}_v, \hat{a}_c^\dagger \hat{a}_h^\dagger + \hat{a}_d^\dagger \hat{a}_h^\dagger] = 0 \Rightarrow$$

$$[\hat{a}_c \hat{a}_v, \hat{a}_c^\dagger \hat{a}_h^\dagger] + [\hat{a}_c \hat{a}_v, \hat{a}_d^\dagger \hat{a}_h^\dagger] + [\hat{a}_d \hat{a}_v, \hat{a}_c^\dagger \hat{a}_h^\dagger] + [\hat{a}_d \hat{a}_v, \hat{a}_d^\dagger \hat{a}_h^\dagger] = 0 \Rightarrow$$

$$|t|^2 + r_v r_h^* = 0;$$

$$t \tilde{r}_h^* + r_v t^* + \tilde{r}_v t^* + t r_h^* = 0;$$

$$\tilde{r}_v \tilde{r}_h^* + |t|^2 = 0.$$