Hong-Ou-Mandel effect on a real beamsplitter

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It is well known that the Hong-Ou-Mandel (HOM) effect is one of the main ones in quantum optics. The effect occurs when two identical single-photon waves enter a $1:1$ beam splitter, one in each input port. When the photons are identical, they will extinguish each other. One of the main elements of the HOM interferometer is a beam splitter with its reflection coefficients — $R = 1/2$ and refraction — $T = 1/2$. In this paper, we consider the general mechanisms of interaction of two photons in a beam splitter based on approaches [1, 2, 3, 4]. The considered problem has an analytical solution, which shows that in the HOM theory of the effect it is necessary to know (including when planning the experiment) not only $R = 1/2$ and $T = 1/2$, but also their root-mean -square fluctuations arising from the dependence on the frequency of the first and the second photon. Under certain conditions, the dependence of fluctuations can be neglected and $R = T = 1/2$ chosen, in this case the developed theory coincides with the previously known results.

References

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