Hong-Ou-Mandel Effect Between Single-Photon Source and Thermal Light

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Abstract: We describe the theory of Hong-Ou-Mandel (HOM) interference, between a single photon source and thermal light and demonstrate the maximum visibility attainable for non-ideal single photon resources.

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Hong-Ou-Mandel effect is the interference between two indistinguishable photons on a beam splitter [1]. We work out the theory of interference between a single photon source (such as quantum dot, heralded photon from SPDC), and weak thermal light, for example sunlight. The classical limit on raw visibility is 50%. We want to calculate the maximum visibility that can be attained for the above scheme.

Most single photon sources are not ideal, hence containing a mixture of 0, 1, and 2 photons where the probability of no photon emitted is much higher than single photon. The thermal source of light emits single photon with a probability weight given by the Boltzmann factor. Hence, the two-photon interference can be demonstrated with high visibility only when both source emit single photons. This in turn would depend on how certain parameters can be tuned to emit single photon with higher probability.

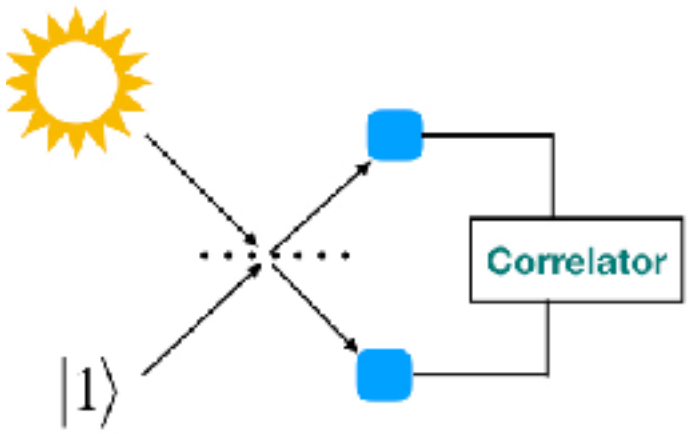

Fig. 1. Interference between the thermal light source and single photon source on a 50/50 beam splitter.