























where the  $\xi_1$  and  $\xi_2$  represent the overall efficiencies and non-linear interaction strengths for the forward and backward emissions, respectively, they are also linearly proportional to the electric field amplitude of each pulse;  $\hat{a}_j^\dagger, \hat{b}_j^\dagger$ , with  $j = \{1, 2\}$  are the creation operators of the forward and backward down-conversion modes. From the above equation we obtain the following state,

$$|\Psi_{SPDC}\rangle = \sqrt{(1 - |\lambda_1|^2)(1 - |\lambda_2|^2)} \sum_{n_1=0}^{\infty} \lambda_1^{n_1} |n_1, n_1\rangle_{a_1, b_1} \sum_{n_2=0}^{\infty} \lambda_2^{n_2} |n_2, n_2\rangle_{a_2, b_2} \quad (11)$$

with  $\lambda_1 = \xi_1 \tau$  and  $\lambda_2 = \xi_2 \tau$ . Therefore, the probability of creating  $n_1$  and  $n_2$  photons from crystal passes 1 and 2 per pulse is given by

$$P(n_1, n_2) = (1 - |\lambda_1|^2)(1 - |\lambda_2|^2) |\lambda_1^{2n_1}| |\lambda_2^{2n_2}|. \quad (12)$$

For independent sources the presence of photons in modes  $a_1$  and  $a_2$  are heralded upon a detection event in modes  $b_1$  and  $b_2$  respectively. Again, using non-number resolving detectors with detection efficiency  $\eta$ , the rate per second of jointly heralding photons in modes  $a_1$  and  $a_2$  is given by

$$C_{coinc} = R \sum_{n_1=1}^{\infty} \sum_{n_2=1}^{\infty} (1 - (1 - \eta)^{n_1})^2 (1 - (1 - \eta)^{n_2})^2 P(n_1, n_2) \quad (13)$$

Similarly to the previous argument for dependent photons, halving the power per pulse while simultaneously doubling the repetition rate gives

$$C_{coinc} = 2R \sum_{n_1=1}^{\infty} \sum_{n_2=1}^{\infty} \frac{(1 - (1 - \eta)^{n_1})^2 (1 - (1 - \eta)^{n_2})^2}{2^{n_1+n_2}} P(n_1, n_2). \quad (14)$$

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