Quantifying entanglement in spatio-temporal and particle-number degree of freedom of quantum fields produced by spontaneous parametric down-conversion

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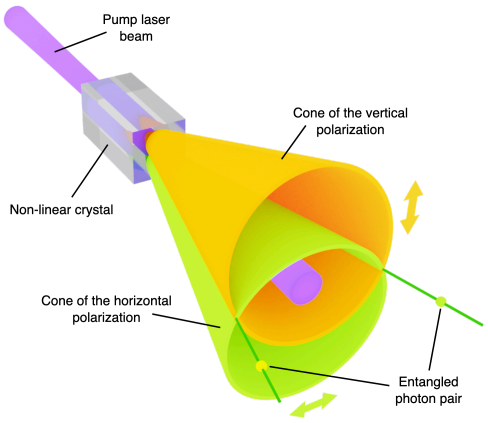
Spontaneous parametric down-conversion is a versatile source of quantum fields. For a high-power input pump, the input state is a two-mode squeezed state which is directly useful for quantum metrology and communication tasks and is also an essential building block for quantum computing.

Meanwhile, in the low-power pump regime, the output quantum field is a photon pair. The produced photon pair presents entanglement in degrees of freedom described by discrete variables; polarization, orbital angular momentum, or continuous variables such as arrival-time, frequency, position and momentum.

This project aims to quantify the entanglement between the spatio-temporal degree of freedom of photon pairs as initiated in [1], and to observe the influence of relativistic effects. From an experimental side, the goal would be to propose realistic optical schemes increasing or suppressing the spatio-temporal entanglement of photon pairs, with and without taking into account relativistic effects.



References:

[1] C. I. Osorio, A. Valencia, and J. P. Torres, Spatiotemporal Correlations in Entangled Photons Generated by Spontaneous Parametric down Conversion, New J. Phys. 10, 113012 (2008).