Contribution ID: **6** Type: **Oral**

Cross-Talk effects on conditional measurements

Monday, 28 September 2020 14:30 (15 minutes)

Photon-number resolving detectors have experienced a wide spread throughout the last decades and proved to be versatile for a large number of applications. In particular, Multi-Pixel Photon Counters (MPPC) have been shown to be promising for Quantum Optics applications [1,2,3]. Unfortunately, these detectors are typically affected by correlated noise, which is especially detrimental for the detection of quantum correlations. The most important source of correlated noise is the Optical Cross-Talk (OCT), i.e. a photon emitted by a decelerating photoelectron fires a neighboring pixel, thus providing a spurious count. We have recently shown [4;5;6;7] that a commercial class of MPPC, i.e. the silicon photomultipliers, allows to detect the nonclassicality of a conditional state even in the presence of the OCT. In particular, we generated a multimode twin-beam state and used the silicon photomultipliers to perform conditional measurements. We successfully revealed the sub-Poissonianity of the conditional state. However, as far as we know, a theoretical description of a conditional measurement in the presence of the OCT is still lacking. Here, we extend the model for the conditional measurements with photon counting introduced in [8] by including the effect of the OCT. We provide the statistics of the number of detected photons for the conditional state and retrieve the analytic expression of the related Fano factor.

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Session Classification: Invited