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High efficiency in Mode Selective Frequency Conversion for Optical Quantum Information Processing NICOLAS QUESADA, Universite de Sherbrooke, J.E. SIPE, University of Toronto — Mode selective Frequency conversion (FC) is an enabling process in many quantum information protocols [1]. Recently, it has been observed that upconversion efficiencies in single-photon, mode-selective FC are limited to around 80% [2]. In this contribution we show that these limits can be understood as time ordering corrections (TOCs) that modify the joint conversion amplitude of the process [3]. Furthermore we show, using a simple scaling argument, that recently proposed cascaded FC protocols [4] that overcome the aforementioned limitations act as "attenuators" of the TOCs. This observation allows us to argue that very similar cascaded architectures can be used to attenuate TOCs in photon generation via spontaneous parametric down-conversion[5]. Finally, by using the Magnus expansion, we argue that the TOCs, which are usually considered detrimental for FC efficiency, can also be used to increase the efficiency of conversion in partially mode selective FC.

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