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Towards the detection of quantum light in the mid-infrared

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Quantum Cascade Laser (QCL) frequency combs could emit nonclassical light and multimode entanglement thanks to a third order nonlinearity that allows for Four Wave Mixing in the device (Faist 2016), which makes them ideal candidates for free-space communication applications. However, in the mid-infrared, the lack of efficient and low-noise detectors compromises enormously the ability to investigate non classical features of light. In addition, the laser gain of the device itself can introduce noise due to the amplification. Having a signature of non classical light, such as squeezing, is a challenging task in these conditions. We demonstrate the possibility of investigating continuous-variable quantum physics in the mid-infrared through a novel Balanced Homodyne Detector (Gabbrielli 2021), tested with QCLs.

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