Contribution ID: **118** Type: **Poster**

Quantum Radiometric Calibration

Friday 10 October 2025 13:30 (30 minutes)

Optical quantum computing, as well as communication and sensing technology based on quantum correlations are in preparation. These require photodiodes for the detection of about 10^16 photons per second with close to perfect quantum efficiency. Already the radiometric calibration is a challenge. The Heisenberg uncertainty principle combined with the measurement of squeezed light represent a quantum approach to radiometric calibration. Here we provide the theoretical description of the quality of this quantum radiometric calibration method and experimentally reduce the largest error contribution by 1.5 orders of magnitude. Unlike all existing methods, ours is in situ and provides both the detection efficiency and the more stringent quantum efficiency directly for the frequencies of the user's detection band. We calibrate two of the most efficient commercially available photodiodes at 1550 nm to a detection efficiency of (97.20 ± 0.37) % using 10-dB-squeezed vacuum
states as the quantum correlation resource. The value is unexpectedly low and not sufficient for optical quantum computing.

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Session Classification: Poster Presentation - DESY Foyer (Building 5)

Track Classification: Poster session