Towards continuous-variable quantum key distribution at GHz rates

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The ability to securely distribute keys at high rates is of crucial importance for the future of practical quantum key distribution (QKD). In state-of-the-art continuous-variable (CV) implementations, raw key rates are limited by the bandwidth of the detectors. With publications showing shot-noise limited homodyne detectors in the GHz regime, CV-QKD with GHz rates may soon be a reality [1]. In addition, by extending concepts from classical coherent communication to quantum communication, the bright phase reference beam (so-called local oscillator) may be deployed directly at the receiver [2].

In this work, we show our progress on implementing a GHz rate CV-QKD setup. We discuss how these high transmission rates increase the robustness against finite-size effects and realistic noise sources (e. g. in the kHz regime) [3, 4]. This is especially relevant for free-space communication channels with fluctuating transmission as the number of statistical samples is limited per transmission bin [5, 6]. We also show the experimental status on implementing a local oscillator, which is situated at the receiver.

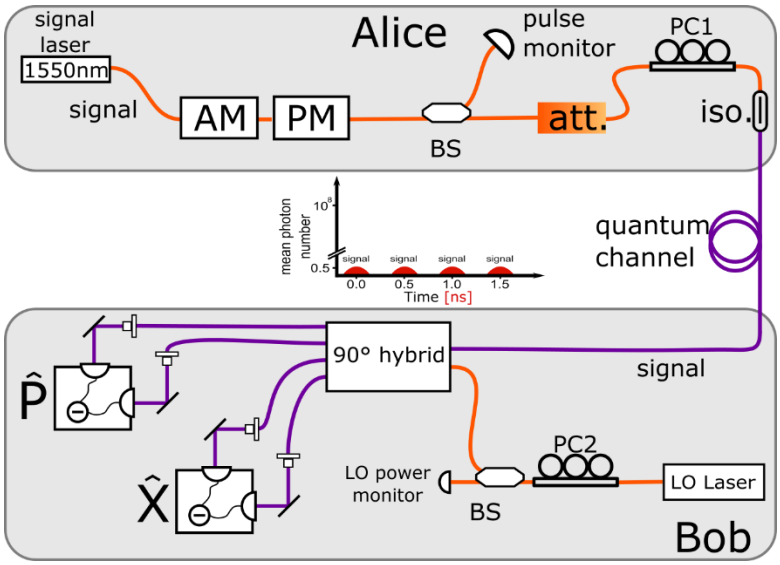

Figure 1: Schematic of our GHz rate CV-QKD setup; Alice prepares a set of coherent states from a given alphabet and sends them with GHz rates to Bob. Bob analyzes these states by performing double homodyne detection. Bob's setup is completely fiber-integrated and uses a freely drifting continuous-wave local oscillator. AM: amplitude modulator, PM: phase modulator, BS: beam splitter, att.: attenuator, PC: polarization controller, iso.: isolator, LO: local oscillator

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