Transmission and distillation of quantum states on a turbulent atmospheric channel

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The transmission of quantum states through atmospheric turbulence is an important task for free-space quantum key distribution. We recently studied scenarios ranging from intra-city links [1] to satellite-to-ground quantum communication [2].

Apart from weak coherent states that are often used in quantum key distribution protocols it is interesting to study the transmission of fragile quantum states in general. To this end we study the distillation of squeezed states of light that have been transmitted through a 1.6 km urban, atmospheric free-space channel [3]. Squeezed states of light are interesting and important non-classical states for quantum information processing and recently have been shown to own advantages for quantum key distribution under certain conditions [4,5]. The atmospheric channel introduces intensity fluctuations through beam wandering and scintillation considering the finite receiving aperture size. This real physical, non-Gaussian noise will unavoidably lead to reduction of squeezing after transmission. We combat this degradation by employing purification and distillation protocols, hence selecting states with high degree of squeezing [3,6].

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