Optical loss is one of the key roadblocks on the way towards large-scale quantum networks, and distributed quantum computing and sensings [1]. Loss-induced errors prevent the realization of the most sophisticated quantum protocols, including device-independent ones. The effects of loss on quantum states can be reduced using probabilistic heralded amplification (HA) [2]. Amplifying the states directly is however not sufficient to overcome loss in quantum communication, because the amplified state is destroyed in cases when HA failed. In our realization of a loss-corrected quantum channel [3], we use HA to prepare a purified copy of entanglement. Upon the success of the operation, we use the purified entanglement as a resource to teleport the quantum state across the channel. We test our channel by using it to transmit entanglement via entanglement swapping through a large amount of loss and demonstrate genuine improved performance over direct transmission through loss, see Fig. 1, obtained without employing post-selection or post-processing of data. Our scheme is fully heralded and integrable into a large-scale quantum repeater network.

Figure 1: Amount of measured entanglement, characterized by concurrence, distributed directly through loss (line) and through the error-corrected quantum channel (dots) as a function of the amplification gain. The amount of added loss on the channel is \( \approx 90\% \).