Complete elimination of information leakage in continuous-variable quantum communication channels

In all lossy communication channels realized to date, information is inevitably leaked to a potential eavesdropper. Here we present a communication protocol that does not allow for any information leakage to a potential eavesdropper in a purely lossy channel. By encoding information into a restricted Gaussian alphabet of squeezed states we show, both theoretically and experimentally, that the Holevo information between the eavesdropper and the intended recipient can be exactly zero in a purely lossy channel while minimized in a noisy channel. This result is of fundamental interest, but might also have practical implications in extending the distance of secure quantum key distribution.