than bi-particle entanglement and we can improve the performance of quantum information processing using single-photon N-mode entangled source like an entangled multi-particle system does. On the other hand, though our single-photon N-mode W-type entangled state is more robust to loss than other type entangled state, this type of entanglement is also sensitive to decoherence inevitably during the practical transmission of long-distance quantum communication and quantum networks. We can "repair" entanglement by using entanglement purification technique [4,25–29].


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