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Efficient quantum key distribution using Fibonacci-number coding with biased basis choice

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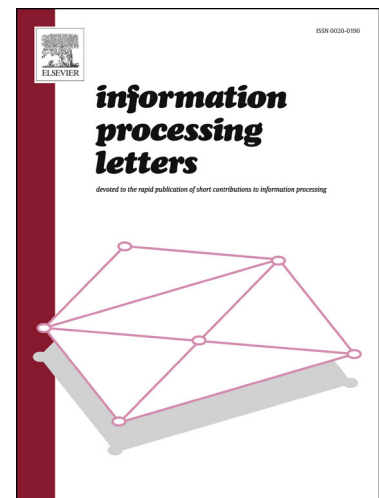
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## Highlights

- We find out that the sources for preparing entangled OAM states based on a Vogel spiral with the same Fibonacci numbers, which can prepare two types of entangled states.
- The distribution of significantly different probabilities to the entangled state photons and measurement bases during both transmission and reception, thus reducing the fraction of discarded data.
- We use the close relations among Lucas sequence, Chebyshev maps and  $k$ -Chebyshev maps to greatly enhance the capacity of per entangled particle for key generation without the limit of spiral and OAM bandwidths.
- We divide the accepted data into different subsets in terms of the types of measurements chosen and estimate an error rate for each subset separately to guarantee the security of our proposed scheme.

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