

Large-scale quantum walks via spin-orbit photonics

We present a photonic platform capable of generating large-scale quantum walks, corresponding to ultra-long dynamics in a Hilbert space spanned by hundreds of optical modes carrying quantized transverse momentum. The platform uses only three spin-orbit optical metasurfaces, dramatically reducing optical losses and decoherence effects. We demonstrate the potential of this method by experimentally showing that in the long time limit, a quantum walk affected by dynamical disorder generates maximal entanglement between two system partitions. This platform represents a powerful resource for cutting-edge quantum optics experiments.

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