

Title: What is quantum in a quantum walk?

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Abstract: We explore intricate interplay between classical and quantum interference in the context of discrete-time quantum walk (DTQW). In the first part, we study multiphoton interference in a simple interferometer to test the quantum-classical nature of the employed optical states with respect to wave and particle pictures. This enable us to demonstrate -- in contrast to the usual notion of wave-particle duality in which the quantum objects exhibit either particle- or wave-like behaviour -- that neither the wave nor the particle picture is sufficient to predict the outcomes of quantum-optical experiments. In the second part, we investigate multiphoton interference in a more general framework of interferometer network suited to DTQW. In particular, by exploiting our well-established time-multiplexed network, we demonstrate the capability to tune quantum interference by controlling classical interference in a Hong-Ou-Mandel-type experiment.