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## **ENTANGLEMENT AND DECOHERENCE**

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The real-world success of quantum computation and communication relies on the longevity of entanglement in multi-particle quantum states. The presence of decoherence in communication channels and computing devices, which stems from the unavoidable interaction between these systems and the environment, degrades the entanglement when the particles propagate or the computation evolves. Decoherence leads to both local dynamics, associated with single-particle dissipation, diffusion, and decay, and to global dynamics, which may provoke the disappearance of entanglement at a finite time. This phenomenon is strikingly different from single-particle dynamics, which occurs asymptotically in time, and constitutes yet another distinct and counter-intuitive trait of entanglement. We have demonstrated it for the first time using an all-optical setup, which allows for the controlled investigation of a variety of fundamental processes in quantum mechanics and quantum information, some of which will be described in this talk.

Host UMD: Luis Orozco