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Experimental investigation of the no-signalling principle in parity-time symmetric theory using an open quantum system. JIAN-SHUN TANG, YI-TAO WANG, YONG-JIAN HAN, CHUAN-FENG LI, GUANG-CAN GUO, Key Laboratory of Quantum Information, University of Science and Technology of China — The experimental progress achieved in parity-time (PT) symmetry in classical optics is the most important accomplishment in the past decade and stimulates many new applications, such as unidirectional light transport and single-mode lasers. However, in the quantum regime, some controversial effects are proposed for PT-symmetric theory, for example, the potential violation of the no-signalling principle. It is therefore important to understand whether PT-symmetric theory is consistent with well-established principles. Here, we experimentally study this no-signalling problem related to the PT-symmetric theory using two space-like separated entangled photons, with one of them passing through a post-selected quantum gate, which effectively simulates a PT-symmetric evolution. Our results suggest that the superluminal information transmission can be simulated when the successfully PT-symmetrically evolved subspace is solely considered. However, considering this subspace is only a part of the full Hermitian system, additional information regarding whether the PT-symmetric evolution is successful is necessary, which transmits to the receiver at maximally light speed, maintaining the no-signalling principle.

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