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Maximizing temporal quantum correlation by approaching an exceptional point

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Quantum correlations, both spatial and temporal, are the central pillars of quantum mechanics. Over the last two decades, a big breakthrough in quantum physics is its complex extension to the non-Hermitian realm, and dizzying varieties of novel phenomena and applications beyond the Hermitian frame work have been uncovered. However, unique features of non-Hermitian quantum correlations, especially in the time domain, still remain to be explored. Here, for the first time, we experimentally achieve this goal by using a parity-time (PT)-symmetric trapped-ion system. The upper limit of temporal quantum correlations, known as the algebraic bound, which has so far not been achieved in the standard measurement scenario, is reached here by approaching the exceptional point (EP), thus showing the unexpected ability of EPs in tuning temporal quantum correlation effects. Our study, unveiling the fundamental interplay of non-Hermiticity, nonlinearity, and temporal quantum correlations, provides the first step towards exploring and utilizing various non-Hermitian temporal quantum effects by operating a wide range of EP devices, which are important for both fundamental studies and applications ofquantum EP systems.

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