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**Parity-time symmetry breaking transitions in an ultracold Fermi gas with Floquet dissipation** LE LUO, JIAMING LI, ANDREW HARTER, LEONARDO DE MELO, YOGESH JOGLEKAR, Indiana University Purdue University Indianapolis — Open physical systems with balanced loss and gain exhibit a transition, absent in their solitary counterparts, which engenders modes that exponentially decay or grow with time and thus spontaneously breaks the parity-time ($\mathcal{PT}$) symmetry. This $\mathcal{PT}$-symmetry breaking is induced by increasing the strength of the loss and gain, but also occurs in a pure dissipative system without gain. Here we report on the first quantum version of $\mathcal{PT}$-symmetry breaking transitions using ultracold $^6$Li atoms. We simulate static and Floquet dissipative Hamiltonians by generating controlled, state-dependent atom loss in a noninteracting Fermi gas, and observe the $\mathcal{PT}$-symmetry breaking transitions by tracking the atom number for each state. In contrast to a single transition in the static case, the Floquet counterpart undergoes $\mathcal{PT}$-symmetry breaking and restoring transitions at vanishingly small dissipation strength. Our results show that Floquet dissipation is a versatile tool for navigating phases where the $\mathcal{PT}$-symmetry is either broken or conserved. The ultracold Fermi gas, with engineered Floquet dissipation, provides a starting point for exploring the interplay between interaction and dissipation effects in open quantum systems.

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