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Observation of photoinduced two-body loss of ultracold RbCs molecules SIMON CORNISH, PHILLIP GREGORY, JACOB BLACKMORE, SARAH BROMLEY, Durham University — Ultracold polar molecules offer many exciting opportunities in the fields of quantum computation, quantum simulation and fundamental studies of quantum matter. Long-lived, trapped samples of molecules are crucial to many of these applications. Yet, remarkably, the nature of the collisions between molecules is poorly understood, with fast loss being observed even for chemically stable molecules such as RbCs. Here we report measurements of collisional loss in gases of ultracold RbCs molecules, comparing our findings with the 'sticky collision' hypothesis that pairs of molecules form long-lived collision complexes. We demonstrate that the loss of molecules is best described by second-order rate equations, and that the rate differs from the limit of 'universal loss' for s-wave collisions. Moreover, we present direct evidence that the loss of collision complexes is driven by very fast laser excitation due to the dipole trapping light. Using square-wave modulation of the optical trap intensity, we are able to suppress the photo-induced loss as the molecules experience time in the dark. By varying the frequency of the modulation, we are able to measure a lifetime of 0.53(13) ms for the collision complex. Our method represents a novel way to perform spectroscopy of long-lived molecule-pair complexes, and offers new insight into reactive and nonreactive collisions.

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