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Steering reactions of ultracold KRb molecules via long-lived intermediates.[1] MING-GUANG HU, YU LIU, MATTHEW NICHOLS, LING-BANG ZHU, KANG-KUEN NI, Harvard University — Ensembles of trapped ultracold bi-alkali molecules have been produced in many research groups. Despite being prepared in their absolute ground states, these molecular gases have been observed to undergo two-body loss, regardless of whether chemical reactions in the gas are energetically allowed or forbidden. Theories suggest that this loss is likely ascribed to the unusual properties of the intermediate complex formed during the reaction. Such properties are currently poorly understood due to a lack of experimental detection of this intermediate, as well as of the reaction products. By combining photoionization with ion velocity map imaging in a potassium-rubidium (KRb) quantum gas apparatus, we recently demonstrated the ability to detect both the products and the intermediates of the reaction KRb + KRb $\rightarrow$ K_2Rb_2* $\rightarrow$ K_2 + Rb_2 [Science 366,1111 (2019)]. We found this intermediate to be long-lived (of order one microsecond), which we further took advantage of to control the product formation rate using an external light source.

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