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Making a molecular gas in the quantum regime

KANG-KUEN NI, Department of Chemistry and Chemical Biology, Harvard University

Ultracold molecules are exciting systems for a large range of scientific explorations including studies of novel phases of matter and precision measurement. In this talk, I will present a brief story of the first quantum gas of molecules, KRb, created under my PhD advisor, Deborah Jin, in 2008. A complete surprise was finding ultracold chemistry in such a system through measurements of reactant losses. In particular, long-range physics that determines KRb reactant collision rates, including van der Waals interactions, quantum statistics, and dipolar interactions, were studied extensively. However, the short-range behavior of these chemical reactions remains unknown. A legacy of her work is carried out in my lab at Harvard, where we are integrating physical chemistry tools with cold atom techniques to study ultracold chemistry with KRb molecules. In particular, we aim to elucidate the four-center reaction $2KRb \rightarrow K_2 + Rb_2$ by detecting the reaction products through ionization both identify the product species and mapping out their complete quantum states.