CHEMISTRY IN THE ULTRACOLD REGIME: PRECISION MOLECULAR ASSEMBLY AND TEST OF STATISTICAL REACTION DYNAMICS

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Advances in quantum manipulation of molecules bring unique opportunities, including the use of molecules to search for new physics, harnessing molecular resources for quantum engineering, and exploring chemical reactions in the ultralow temperature regime. In this talk, I will focus on the latter two topics. First, I will introduce our effort on building single ultracold molecules with full internal and motional state control in optical tweezers for future quantum simulators and computers. This work allows us to go beyond the usual paradigm of chemical reactions that proceed via stochastic encounters between reactants, to a single, controlled reaction of exactly two atoms. Second, I will present our work giving a detailed microscopic picture of molecules transforming from one species to another. We develop full quantum state mapping of chemical reaction product-pairs from single events, which we use to precisely benchmark statistical theory.