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Abstract for an Invited Paper  
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**I.I. Rabi Prize in Atomic, Molecular, and Optical Physics talk: Bringing together Chemistry and Physics with Ultracold Polar Molecules**  
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Ultracold polar molecules are sought-after for a range of goals, from studying ultracold chemical reactions to building quantum simulators and computers. On the one hand, reactions at ultracold temperatures could provide unprecedented quantum state detection of long-lived reaction intermediates. Such experiments aim to improve our understanding of quantum dynamics and provide benchmark results for state-of-the-art calculations. We combine AMO physics and physical chemistry techniques to report the first direct evidence of ultracold reactions of KRb. On the other hand, bringing single particle control and imaging capabilities to molecules promises new quantum applications, enabled by the rich internal degrees of freedom and inter-molecular coupling. I will present our experimental work with individual ultracold molecules in pursuit of quantum simulation, quantum information processing, and ultracold chemistry with precise initial reactant preparation.