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Ultracold Polar Molecules

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bound states of Cs_2 [9], and again used them to produce new potential curves that are a great improvement over existing ones, particularly in the important high magnetic field region.

4. We worked to develop multichannel quantum defect theory (MQDT) as an efficient computational tool for cold molecular collisions [10, 11]. We showed that with MQDT we can produce a complete contour plot of elastic/inelastic rations for sympathetic cooling in the strongly coupled system Li+NH using coupled-channel calculations at just 5 combinations of energy and field. Previous methods required over 200 such calculations, so this saving brings many more systems within reach of calculations.

5. We investigated the behaviour of the effective range, which determines the energy-dependence of cross sections and is very important in studies of few-body and many-body physics with ultracold atoms. This work led to development of new closed-form expressions for the effective range in the vicinity of a Feshbach resonance [12].

6. We compared and contrasted the wide resonances in ^{6}Li and ^{7}Li, and investigated the extent to which mass-scaling applies between these two systems [13].

7. We investigated the way in which loss cross sections in real inelastic/reactive approach the "universal" regime previously described by Idziaszek and Julienne. We compared the results of a single-channel loss model with full close-coupling calculations in a real system. The results suggest a remarkable conclusion: that coupled-channel calculations at very low energy (in the s-wave regime) could be used to estimate a loss parameter and then to predict the range of possible loss rates at higher energy, without the need for explicit coupled-channel calculations for higher partial waves [14].

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