Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Universal reaction rates for ultracold molecular collisions[1] PAUL JULIENNE, Joint Quantum Institute, NIST and the University of Maryland, ZBIGNIEW IDZIASZEK, University of Warsaw — We offer a simple yet general model of reactive collisions using a quantum defect framework based on the separation of the collision dynamics into long-range and a short-range parts [1]. Two dimensionless quantum defect parameters s and y are used to characterize the S-matrix for a given entrance channel; s represents a phase parameter and y the probability of short-range reaction. The simple analytic expressions we obtain give universal values for s-wave and p-wave collision rates for a van der Waals potential when y approaches unity. In this limit, reaction rates are governed entirely by the threshold laws governing the quantum transmission of the long range potential and depend only on the van der Waals coefficient. The universal rate constants explain the magnitude of the observed rate constants for reactive collisions of fermionic KRb + KRb or K + KRb [2]. In contrast, reaction rates will be non-universal and depend strongly on the phase parameter s if the short range reaction probability is low, $y << 1$. [1] Z. Idziaszek and P. S. Julienne, arXiv:0912.0370. [2] S. Ospelkaus, K.-K. Ni, D. Wang, M. H. G. de Miranda, B. Neyenhuis, G. Quéméner, P. S. Julienne, J. L. Bohn, D. S. Jin, and J. Ye, arXiv:0912.3854.

[1]Supported by an AFOSR MURI and a Polish government grant.

Paul Julienne
Joint Quantum Institute, NIST and the University of Maryland

Date submitted: 22 Jan 2010 Electronic form version 1.4