Proposed Development of a Novel Approach for Studying Anion-Neutral Reactions\textsuperscript{1} D.W. Savin, W. Mitthumsiri, M. Schnell, B. Seredyuk, Columbia University, C.C. Havenner, M.E. Bannister, Oak Ridge National Laboratory, A. Dorn, Max-Planck-Institute for Nuclear Physics — We propose a new method for studying anion-neutral reactions. We will use fast, merged anion-neutral beams and detect the charged end products. This novel approach will utilize the ion-atom merged-beams apparatus, a unique state-of-the-art facility located at Oak Ridge National Laboratory, and expand its capabilities by adding a detection system to collect detached product electrons. Future extensions will allow us to detect product anions. Laboratory beam energies will be in the keV range; but because the beams run co-linear, center-of-mass energies from the meV to keV range can be achieved. Proof-of-principle measurements will be carried out using the associative detachment process $\text{H}^- + \text{H} \rightarrow \text{H}_2^\rightarrow \rightarrow \text{H}_2 + e^-$. Published values for this reaction range over a factor of 5. The situation is little better for the time-reverse dissociative attachment process $\text{H}_2 + e^\rightarrow \rightarrow \text{H}_2^\rightarrow \rightarrow \text{H}^- + \text{H}$. Our proposed research will help to resolve this issue. Future possible research directions include adding a cold molecular anion source in order to study reactions such as $X + YZ^-$. This will allow investigations into a wide range of anion-neutral reactions.

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