New measurement scheme to investigate low energy charge transfer in H + H_2^+ V. M. Andrianarijaona[1], D. G. Seely[2], and C. C. Havener[3], [1]Department of Physics, Pacific Union College, One Angwin Avenue, Angwin, CA 94508 USA, [2]Department of Physics, Albion College, 611 E Porter St, Albion, MI 49224 USA, [3]Physics Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831 USA.

Charge transfer (CT) in H + H_2^+ stands out as a strategic research topic for Astrobiology for many reasons. For example, it is of foremost importance in Fundamental Physics and Astrophysics because it involves the smallest atom. Moreover, this CT is at the heart of basic reaction studies in Chemistry. Furthermore, understanding of this simplest fundamental system is a key for mastering more complex systems which exist in, e.g., biophysics where radical attacks on biomolecules include CT at low energy.

The merged-beam apparatus at Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, can reliably access low energy CT in H + $H_2^+ \rightarrow H^+ + H_2$ and is able to benchmark the total cross section at 200 to 0.1 eV/u [1], but is not equipped with a device that would provide the ro-vibrational state distribution of the primary molecular ions.

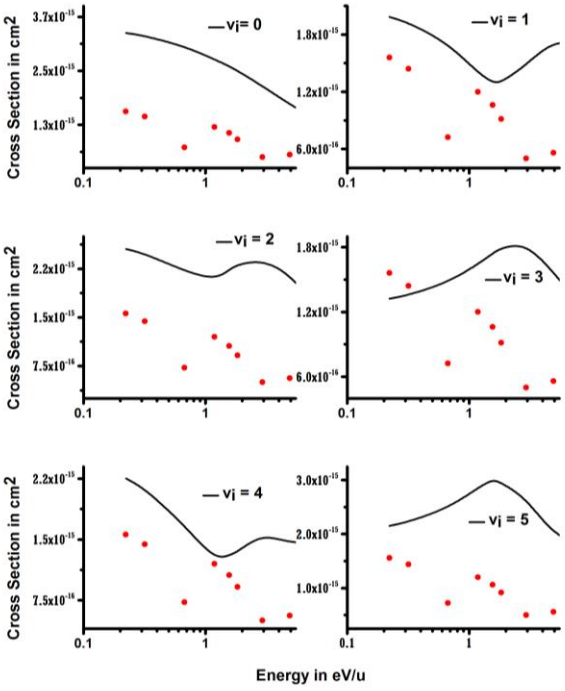

Fig. 1 At low energy, the measured absolute cross section of CT in H + $D_2^+ \rightarrow H^+ + D_2$ (red circle) shows structures that are similar to the ones in the state-to-state calculations (solid black line) from [2]. The knowledge of the D_2^+ internal states will be valuable for an correct interpretation of the data.

At the aforementioned energy range, the collision times are already long enough to sample the ro-vibrational modes. Thus, CT proceeds through dynamically coupled electronic, vibrational, and rotational degrees of freedom (see Fig. 1). Accurate laboratory measurements of n,l state-selective CT cross sections are however necessary to enable the interpretation of these spectra.

A new experimental scheme, which will allow to upgrade the heretofore only total absolute cross section measurements to vibrationally resolved cross section measurements and will make comparison to state-to-state calculations [2] possible, will be presented.

The new data sets might lead to a groundbreaking insight on the single electron capture channel and hopefully will shed light on the interface between physical science and life science.

[1] Andrianarijaona V. M., Seely D. G., and Havener C. C. (2011) *Phys. RevA. 84*, 062716. [2] Krstić P. S. and Janev R. K. (2003) *Phys. Rev. A, 67*, 0022708.