Abstract Submitted
for the DAMOP15 Meeting of
The American Physical Society

Merged beams studies for astrobiology[1] DANIEL WOLF SAVIN, KENNETH A. MILLER, AODH P. O'CONNOR, NATHALIE DE RUETTE, JULIA STUETZEL, Columbia University, XAVIER URBAIN, Université catholique de Louvain — The chain of chemical reactions leading towards life is thought to begin in molecular clouds when atomic carbon and oxygen react with H_3^+, leading to the formation of complex organic molecules and of water. Uncertainties in the rate coefficients for these reactions hinder our ability to understand the first links in the chemical chain leading towards life. Theory and experiment have yet to converge in either the magnitude or temperature dependence. We have developed a novel merged beam apparatus to study these reactions at the low collision energies relevant for molecular cloud studies. Photodetachment of atomic anion beams is used to produce beams of neutral C and O, each in their ground term as occurs in molecular clouds. The neutral beam is then merged with a velocity matched, co-propagating H_3^+ beam. The merged beams method allows us to use fast beams (keV in the lab frame), which are easy to handle and monitor, while being able to achieve relative collision energies down to ≈ 10 meV. Using the measured merged-beams rate coefficient, we are able to extract cross sections that we can then convolve with a Maxwellian energy spread to generate a thermal rate coefficient for molecular cloud temperatures. Here we report recent results.

[1]This work was funded, in part, by the NSF Division of Astronomical Sciences

Daniel Wolf Savin
Columbia University

Date submitted: 23 Jan 2015 Electronic form version 1.4