Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Dissociative recombination of HCl^+, H_2Cl^+, DCl^+, and D_2Cl^+ (300-500 K), and the astrophysical relevance. T. M. MILLER, J. P. WIENS, N. S. SHUMAN, A. A. VIGGIANO, Air Force Research Laboratory — A review by Neufeld and Wolfire[1] pointed out the unique chemistry of chlorine in the interstellar medium (ISM), including (a) Cl is the only species in the ISM with an IE less than that of H atom, which allows Cl^+ to survive among an abundance of H atoms; (b) those Cl^+ can react with H_2 to form HCl^+ exothermically; and (c) HCl^+ can in turn react with another H_2 to form H_2Cl^+. Only in the past 6 years have HCl^+ and H_2Cl^+ been observed in the ISM. Modeling the true quantities of chlorinated species in the ISM requires knowing dissociative recombination (DR) kinetics for HCl^+ and H_2Cl^+. We have used a flowing afterglow apparatus to measure DR rate coefficients at 300-500 K for HCl^+, H_2Cl^+, DCl^+, and D_2Cl^+. For 300 K, we find 7.7 x 10^{-8} cm^3/s (HCl^+), 2.6 x 10^{-7} cm3/s (H_2Cl^+), and 1.1 x 10^{-7} cm^3/s (D_2Cl^+), each with $\sim 35\%$ accuracy. The DR rate coefficient for DCl+ is too slow for us to measure, especially in the face of dealing with mixed H/D species formed in apparatus feedlines when introducing DCl. Novotný, et al.[2] have carried out storage ring measurements in Heidelberg on this problem and will soon report new results over a wide electron energy range and including neutral product information.

1. D. A. Neufeld and M. G. Wolfire, Astrophys. J. **706**, 1594 (2009).
2. O. Novotný, et al., Astrophys. J. **777**, 54 (2013).

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Date submitted: 27 Sep 2016 Electronic form version 1.4