Abstract Submitted
for the GEC08 Meeting of
The American Physical Society

Dissociative recombination of molecular ions in the plasma environment RAINER JOHNSEN, University of Pittsburgh — The two broad categories of experimental methods that are used to determine rates and products of dissociative recombination, single-collision techniques (e.g. merged beams, storage rings) and plasma techniques (afterglows), sometimes give strikingly differing results, in particular in the case of some polyatomic ions. For instance, the afterglow recombination coefficient for H_3^+ is twice that found in storage rings. Water-cluster ions $H^+(H_2O)_n$ for n=4 seem to recombine about eight times faster in afterglows! Neither of the methods necessarily gives "wrong" results but it is questionable if recombination in the plasma environment is truly a binary process or if third-body interactions play a role. Plasma modelers also face a problem: Should they prefer the recombination coefficients obtained by single-collision methods or those measured in plasmas that are closer to the intended application? Which recombination coefficient applies in the D-region of the ionosphere that is dominated by water clusters? I will critically examine possible three-body mechanisms (l-mixing of Rydberg electrons, complex stabilization by ambient molecules) and estimate the magnitude of their contributions. It appears that some proposed mechanisms seriously overestimate third-body effects unless complex lifetimes are much longer than is indicated by available theory.

Rainer Johnsen
University of Pittsburgh

Date submitted: 02 Jun 2008 Electronic form version 1.4