

Abstract Submitted  
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**Dissociation and ionization in capture of antiprotons by the hydrogen molecular ion** JAMES S. COHEN, Los Alamos National Laboratory — Antiprotonic atoms and anti-hydrogen are hot areas of current experimental research. Cross sections for antiproton capture will soon be measured directly for the first time by the ASACUSA collaboration at the CERN antiproton decelerator and trap. In the present work [1], cross sections and initial quantum number distributions are calculated for capture of the antiproton ( $\bar{p}$ ) and the negative muon ( $\mu^-$ ) by the hydrogen molecular ion  $\text{H}_2^+$  using the fermion molecular dynamics (FMD) method. The capture of  $\bar{p}$  is found to be almost entirely adiabatic, occurring via target dissociation without ionization, but nonadiabatic effects are found to play a significant role in the capture of  $\mu^-$ , especially at the higher capture energies. Generally good agreement is obtained with the recent adiabatic classical-trajectory Monte Carlo (CTMC-a) calculation of Sakimoto [2]. The capture properties of  $\text{H}_2^+$  are shown to be completely different from those previously calculated for both the H atom and neutral  $\text{H}_2$  molecule. Proposed experiments [3] on  $\bar{p}$  capture by H,  $\text{H}_2$  and  $\text{H}_2^+$ , at the same relative collision energies, will provide a major test of our theoretical understanding [4].

[1] J.S. Cohen, J. Phys. B (to be published).

[2] K. Sakimoto, J. Phys. B **37**, 2255 (2004).

[3] Y. Yamazaki *et al.*, Nucl. Instrum. Methods B **154**, 174 (1999); **214**, 196 (2004); Hyperfine Interact. **138**, 141 (2001).

[4] J.S. Cohen, Rep. Prog. Phys. **67**, 1769 (2004).

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