MECHANISM OF THE MULTIPHOTON DISSOCIATION OF SO_2 VIA THE $\tilde{H}$ RYDBERG STATE

YUXIU LEI, *Department of Chemistry, University of Pennsylvania, Philadelphia, PA 19104*; EDWIN QUIÑONES, *Department of Chemistry, University of Puerto Rico, San Juan, PR 00931*; AMITAVIKRAM A. DIXIT, KEON WOO LEE, PAUL L. HOUSTON, *Department of Chemistry and Chemical Biology, Cornell University, Ithaca, NY 14853*.

We will present a study on the mechanism of multiphoton dissociation of the SO_2 molecule through the $\tilde{H}$ Rydberg state. For this study, a homemade Wiley-McLaren linear time-of-flight (TOF) spectrometer was constructed to characterize the fragments produced during irradiation of SO_2 with a laser beam in the 222 - 234 nm region. Both SO^+ and S^+ fragment ions were detected but no parent SO_2^+ appeared. The mass resolved excitation spectra (MRES) of both SO^+ and S^+ display the $\mathrm{SO_2}\ \tilde{\mathrm{C}}\ ^1\mathrm{B}_2 \leftarrow X^1\mathrm{A}_1$ vibrational progressions. The first photon in the studied region pumps SO_2 to the $\tilde{\mathrm{C}}\ ^1\mathrm{B}_2$ electronic state. The second photon further excites the molecule to the $\tilde{H}$ Rydberg state, where it dissociates into SO + O and S + O_2 fragments. The third photon then ionizes the SO fragment. From the power dependence of the ion intensity and a kinetic model we developed, we conclude that S^+ is produced by a one-photon dissociation, $\mathrm{SO}^+ + h\nu \rightarrow \mathrm{S}^+ + \mathrm{O}$. The internal energy distributions of the fragmentation products from dissociation of SO_2 via the $\tilde{H}$ Rydberg state were also obtained using an ion-imaging spectrometer. The following five dissociation channels are observed: SO(B $^3\Sigma^-$) + O($^3\mathrm{P}_2$), SO(A$^3\Pi$) + O($^3\mathrm{P}_2$) , S(^{1}D) + O_2($\mathrm{b}^1\Sigma_\mathrm{g}$), S(^{1}D) + O_2($\mathrm{a}^1\Delta_\mathrm{g}$), and S(^{1}D) + O_2($\mathrm{X}^3\Sigma^-$).