$(2+1)$ RESONANCE ENHANCED IONIZATION SPECTROSCOPY OF A JET COOLED, STATE SELECTED BEAM OF OH RADICALS

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A $(2+1)$ resonance enhanced multiphoton ionization (REMPI) technique has been used to characterize transitions of the OH radical from its ground X $^2\Pi$ state to the D $^2\Sigma^-$ and 3 $^2\Sigma^-$ Rydberg states. The OH radicals are produced by a H_2O discharge in a pulsed free-jet expansion.[a] The supersonic expansion cools OH to its lowest rovibrational level and greatly simplifies the REMPI bands to three strong lines, $Q_1(1)$, $R_1(1)$, and $S_1(1)$. Time of flight detection is gated on the OH^+ mass channel, however, interference from strong H_2O transitions in this energy region can also appear. In order to further clarify these spectra, hexapole field focusing is implemented. The hexapole state selects OH molecules with the $|M_J| = 3/2$ component of the upper Λ-doublet level (f-symmetry) of the lowest rotational state of OH X $^2\Pi_{3/2}$ $(v = 0, J = 3/2)$ and focuses these molecules to the point of laser interaction. This focusing results in a five to six fold enhancement of the $Q_1(1)$ and $S_1(1)$ lines that originate from the selected ground state level. These experimental conditions have allowed for the discovery of new, higher vibrational levels in each of the Rydberg states, specifically D $^2\Sigma^-$ $(v = 3)$ and 3 $^2\Sigma^-$ $(v = 1, 2)$. Spectroscopic constants characteristic of OH in these Rydberg states are determined based on the rotational band structure in the REMPI spectra. The constants will be compared with previous experimental work of lower vibrational levels[b] and theoretical predictions of transition probabilities.

[a] M. C. van Beek and J. J. ter Meulen, *Chem. Phys. Lett.* **337**, 237 (2001).

[b] E. de Beer, M. P. Koopmans, C. A. de Lange, Y. Wang and W. A. Chupka, *J. Chem. Phys.* **94**, 7634 (1991).