PFI-ZEKE CHARACTERIZATION OF THE GROUND AND LOW-LYING EXITED STATES OF MgO^+

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We report on the characterization of the rovibrational structure of the ground and first excited electronic states of MgO^+ by high-resolution pulsed-field ionization zero-kinetic-energy (PFI-ZEKE) photoelectron spectroscopy. Rotationally cold (T_{rot}=5 K) MgO molecules in the $X^1\Sigma^+$ (v = 0-2) levels are generated in a supersonic expansion of a 0.1% N_2O/He carrier gas following laser ablation off an magnesium (Mg) rod[1].The rovibrational ionization thresholds corresponding to both spin-orbit components (Ω= $\frac{1}{2}$,$\frac{3}{2}$) of the $X^+\ ^2\Pi_\Omega$ (v^+ = 0-10) states and to the lowest vibrational levels of the $A^+\ ^2\Sigma_{\frac{1}{2}}{}^+$ state are reached in a resonant 1+1′ two-photon excitation sequence via the $F^1\Pi$, $E^1\Sigma^+$, and $G^1\Pi$ rovibrational intermediate levels of MgO studied previously by Breckenridge and coworkers [2]. Our new results include accurate values for the adiabatic ionization energy of MgO and for the dissociation energies of the MgO $X\ ^1\Sigma^+$ and MgO^+ $X^+\ ^2\Pi_{\frac{1}{2}}$ states. This work is carried out in the context of our studies of the rovibrational structure of doubly charge dications by high-resolution PFI-ZEKE spectroscopy of singly charged cations following a similar approach as recently taken to characterize the ground state of the thermodynamically stable dication $MgAr^{2+}$ [3]. The talk will present a roadmap towards characterizing the ground state of MgO^{2+} by resonant multiphoton excitation via electronically excited states of MgO^+. The experiments will reveal whether MgO^{2+} is thermodynamically stable as predicted in Ref. [4] or metastable as predicted in Ref. [5].

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