CHARACTERISATION OF THE GROUND AND LOW-LYING EXCITED STATES OF MgO^+ BY PFI-ZEKE PHOTOELECTRON SPECTROSCOPY

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We report on the characterisation 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 ($T_{\rm rot} = 5$K) MgO molecules in the X $^1\Sigma^+$ ($v = 0 - 2$) levels were generated in a supersonic expansion of a 0.1% N_2O:He gas mixture following laser ablation off a magnesium (Mg) rod [1]. The rovibrational ionization thresholds corresponding to both spin-orbit components ($\Omega = \frac{1}{2}, \frac{3}{2}$) of the $X^+\ ^2\Pi_\Omega$ ($v^+ = 0 - 10$) states as well as to the first excited $A^+\ ^2\Sigma_{\frac{1}{2}}{}^+$ ($v^+ = 0 - 10$) state were reached in a resonant 1+1′ two-photon excitation sequence via the rovibrational levels of the F $^1\Pi$, E $^1\Sigma^+$, G $^1\Pi$ and 3 $^3\Pi_2$ intermediate levels of MgO studied previously by Breckenridge and coworkers [2,3]. 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^+ $^2\Pi_\Omega$ and $A^+\ ^2\Sigma^+_{\frac{1}{2}}$ states. This work is carried out in the context of our studies of the rovibrational structure of doubly charged dications by high-resolution PFI-ZEKE spectroscopy of singly-charged cations following the approach recently taken to characterise the ground state of the thermodynamically stable dication $MgAr^{2+}$ [4]. The talk will present a roadmap towards characterising 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. [5] or metastable as predicted in Ref. [6].

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