## Characterisation of The Ground and Low-Lying Excited States of MgO<sup>+</sup> 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<sup>+</sup> 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 were generated in a supersonic expansion of a 0.1% N<sub>2</sub>O:He gas mixture following laser ablation off a magnesium (Mg) rod [1]. The rovibrational ionization thresholds corresponding to both spin-orbit components ( $\Omega$ =1/2, 3/2) of the X<sup>+</sup> <sup>2</sup> $\Pi_{\Omega}$  ( $v^{+}$  = 0-10) states as well as to the first excited  $A^{+2}\Sigma^{+}_{1/2}$  ( $v^{+} = 0.10$ ) 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<sup>+</sup> X<sup>+ 2</sup> $\Pi_{\Omega}$  and A<sup>+ 2</sup> $\Sigma^{+}_{1/2}$  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<sup>2+</sup> [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<sup>+</sup>. The experiments will reveal whether MgO<sup>2+</sup> is thermodynamically stable as predicted in Ref. [5] or metastable as predicted in Ref. [6].

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