HIGH-RESOLUTION SPECTROSCOPY OF $MgKr^+$ IN ITS GROUND AND LOW-LYING ELECTRONICALLY EXCITED STATES

CARLA KREIS, *Laboratory of Physical Chemistry, ETH Zurich, Zürich, Switzerland*; MATTHIEU GÉNÉVRIEZ, *Institute of Condensed Matter and Nanosciences (IMCN), Université catholique de Louvain, Louvain-la-Neuve, Belgium*; FRÉDÉRIC MERKT, *Laboratorium für Physikalische Chemie, ETH Zurich, Zurich, Switzerland*.

Diatomic molecules RgM consisting of a rare-gas atom Rg and an alkaline-earth-metal atom M and their singly and doubly-charged cations RgM^+ and RgM^{2+} have unusual chemical properties that are related to the low first and second ionization energies of M and the high ionization energy of Rg. In MgAr the second ionization energy of Mg is lower than the first ionization energy of Ar. Consequently, $MgAr^{2+}$ is thermodynamically stable and Rydberg series of $MgAr^+$ can be observed that converge on the $X^{2+}\ ^1\Sigma^+$ ground state of $MgAr^{2+}$.[a] In this contribution, we present the results of spectroscopic investigations of $MgKr^+$ in its ground and low-lying electronically excited states that complement earlier studies of this cation.[b,c] Pulsed-field-ionization zero-kinetic-energy (PFI-ZEKE) photoelectron spectra of the $X^+\ ^2\Sigma^+$ ground state of $MgKr^+$ were recorded following single-photon excitation from the $a\ ^3\Pi_0$ metastable state of MgKr. Vibrational channel interactions enabled the observation of the lowest vibrational levels of $MgKr^+$ and the determination of an accurate value of the adiabatic ionization energy of metastable MgKr ($38183\pm2\mathrm{cm}^{-1}$). Using isolated-core multiphoton Rydberg dissociation (ICMRD) spectroscopy,[d] spectra of several low-lying electronically excited states of $MgKr^+$ were observed that are associated with the Kr + $Mg^+(nl)$ dissociation limits with $n = 3, 4$ and $l = s, p$ and d. These states may be regarded as the lowest members of Rydberg series converging on the ground state of $MgKr^{2+}$. These studies represent first steps towards studying the doubly charged cation $MgKr^{2+}$.

[a] D. Wehrli, M. Génévriez and F. Merkt, Phys. Chem. Chem. Phys., 23, 10978, (2021) and references therein

[b] J. G. Kaup and W. H. Breckenridge, J.Chem. Phys. 107, 2180, 1997

[c] J. S. Pilgrim, C. S. Yeh, K. R. Berry, M. A. Duncan, J. Chem. Phys., 100, 7945, (1994)

[d] M. Génévriez, D. Wehrli and F. Merkt, Mol. Phys. 118, e1703051 (2019)