PHOTODEPLETION SPECTROSCOPY OF IO^- WITHIN THE ACTINIC RANGE

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Iodine oxides (I_xO_y) are atmospherically important due to their high reactivity with ozone. The I^- anion has been detected in the atmosphere, along with IO_2^- and IO_3^- however, IO^- is yet to be directly detected despite being a key intermediate to their formation.[a] A recent gas phase study[b] confirms I^- will react with ozone to form IO^- with subsequent step-wise ozone reactions to form IO_2^- then IO_3^-. The aim of the present study is to investigate the photodepletion of IO^- within the visible range of 650 - 450 nm (15385 - 22222 cm^{-1}) *via* photodetachment and photodissociation spectroscopy. Gas phase spectra are obtained at room temperature by coupling a tuneable OPO laser with a linear ion-trap mass spectrometer. A bound excited state is present in this visible range, which will either undergo autodetachment *via* electron loss ($IO^\bullet$ + e^-) or undergo photodissociation (I^- + $O(^3P)$). Depending on the vibrational energy level of the excited state, either photodissociation or photodetachment is favoured. Investigation of the potential energy surface using the multireference configuration interaction (MRCI) method shows that within the investigated energy range IO^- will excite from the $X^1\Sigma^+$ ground state and populate the $1^1\Pi$ excited state and, in the Franck-Condon region, this is close to the curve crossing that mediates the photodissociation and close to the electron affinity for electron detachment. From this study IO^- has been shown to photodeplete at visible wavelengths and, with previous studies showing that IO^- will react with ozone to form higher order iodine oxides, may together contribute to the low abundance of IO^- in the atmosphere and therefore why it has eluded detection.

[a] Frege C. et al., Atmospheric Chemistry and Physics, 2017 / Koenig T. K. et al., Proceedings of the National Academy of Sciences, 2020 / He X.-C. et al., Science, 2021

[b] Bhujel M. et al., Physical Chemistry and Chemical Physics, 2020