

Highly excited molecular iodine inside helium nanodroplets

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We study predissociation dynamics of Rydberg state excited molecular iodine inside helium nanodroplets by means of femtosecond pump probe photoion and photoelectron imaging spectroscopy and time of flight mass spectrometry. Predissociation proceeds via different channels including ion pair formation inside the droplet.

The dynamics of small molecules and their charged photofragments inside helium (He) nanodroplets following photoexcitation into dissociative states and ionization is a field of particular interest (see e.g. [1] and references therein). These studies aim at facilitating the understanding of charge transfer reactions inside He nanodroplets which are likely to be drastically affected by processes such as redistribution of He solvation shells. Besides, the escape process of both electrons and ions from the droplet is not well understood yet.

Within this context, we study the dynamics of molecular iodine (I_2) excited to high lying molecular Rydberg states inside He nanodroplets. Recent experiments employing femtosecond (fs) pump probe imaging spectroscopy in the gas phase revealed complex dynamics including predissociation via ion pair states[2]. In case of I_2 immersed in the droplet interior, two-photon

UV photoexcitation reveals the formation of ion pairs as well, accompanied by snowball formation for both the cation and the anion (fig. 1). Evidence is present for a solvation shell containing $n=11$ He atoms around I^- . In a fs pump probe scheme, the probe pulse either photodetaches I^- or ionizes atomic Rydberg states emerging from transitions via adiabatic curve crossings. Time resolved velocity map images of photoions and photoelectrons as well as integrated ion count rates gives detailed insight into complex intramolecular dynamics and guest host interactions.

References

[1] M. Mudrich and F. Stienkemeier, *Int. Rev. Phys. Chem.* **33**, 301 (2014).

[2] J. v. Vangerow, A. S. Bogomolov, N. V. Dozmorev, D. Schomas, F. Stienkemeier, A. V. Baklanov, and M. Mudrich, *Phys. Chem. Chem. Phys.* **18**, 18896 (2016).

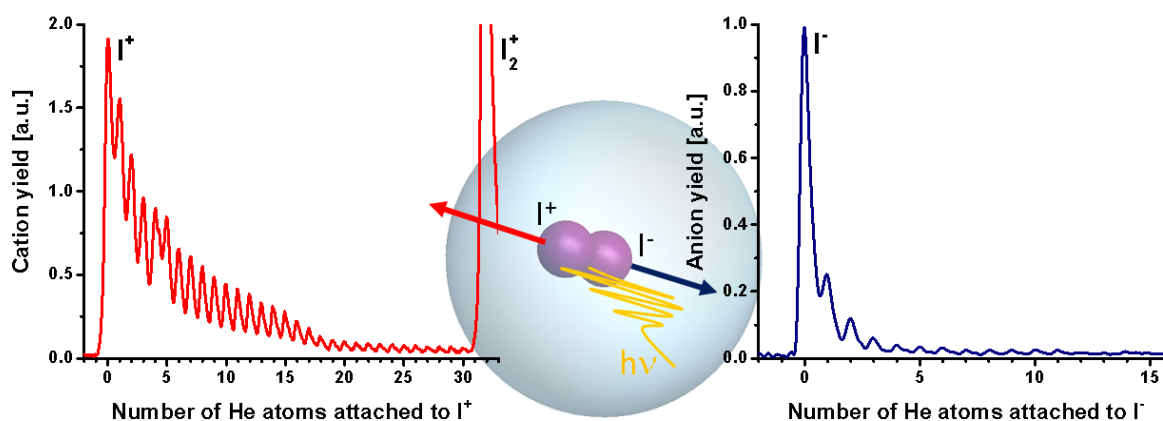


Figure 1 Time of flight mass spectra indicating formation of cationic I^+He_n and anionic I^-He_n snowball complexes arising from different predissociation channels after Rydberg excitation of molecular iodine inside helium nanodroplets.

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