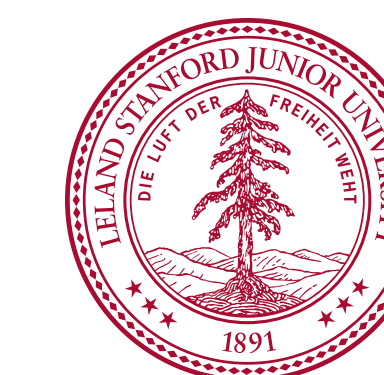


# Ultrafast probing of charge transfer dynamics with an XUV free-electron laser



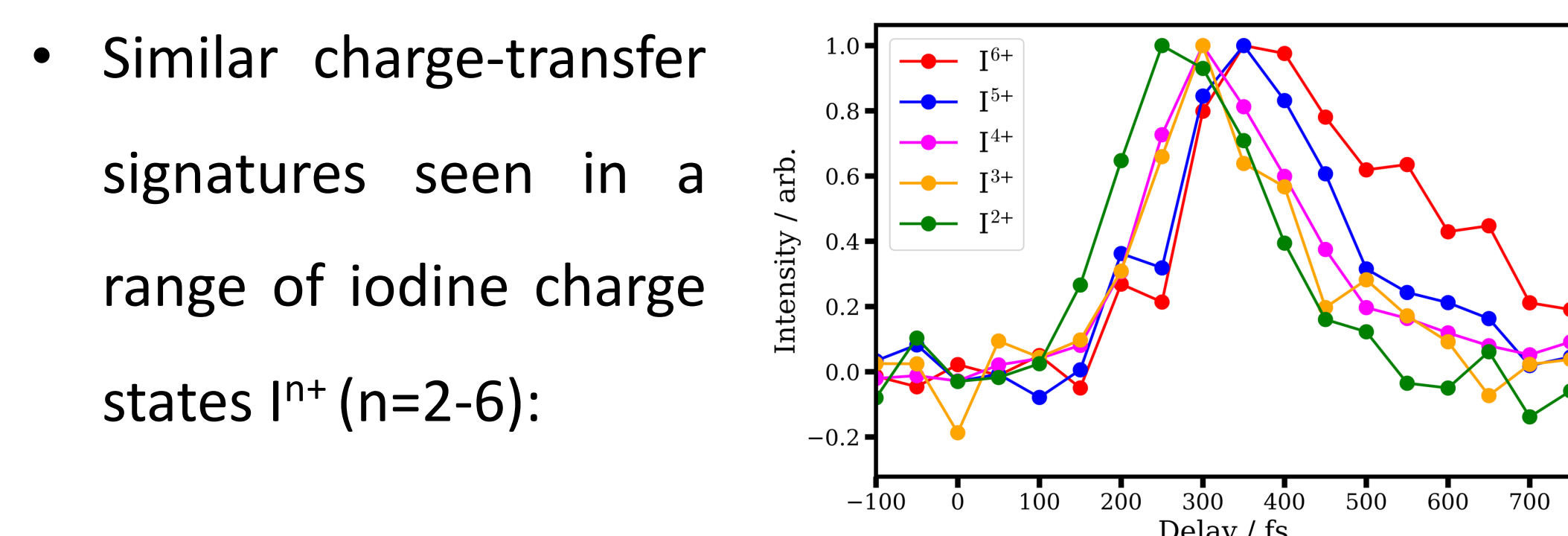
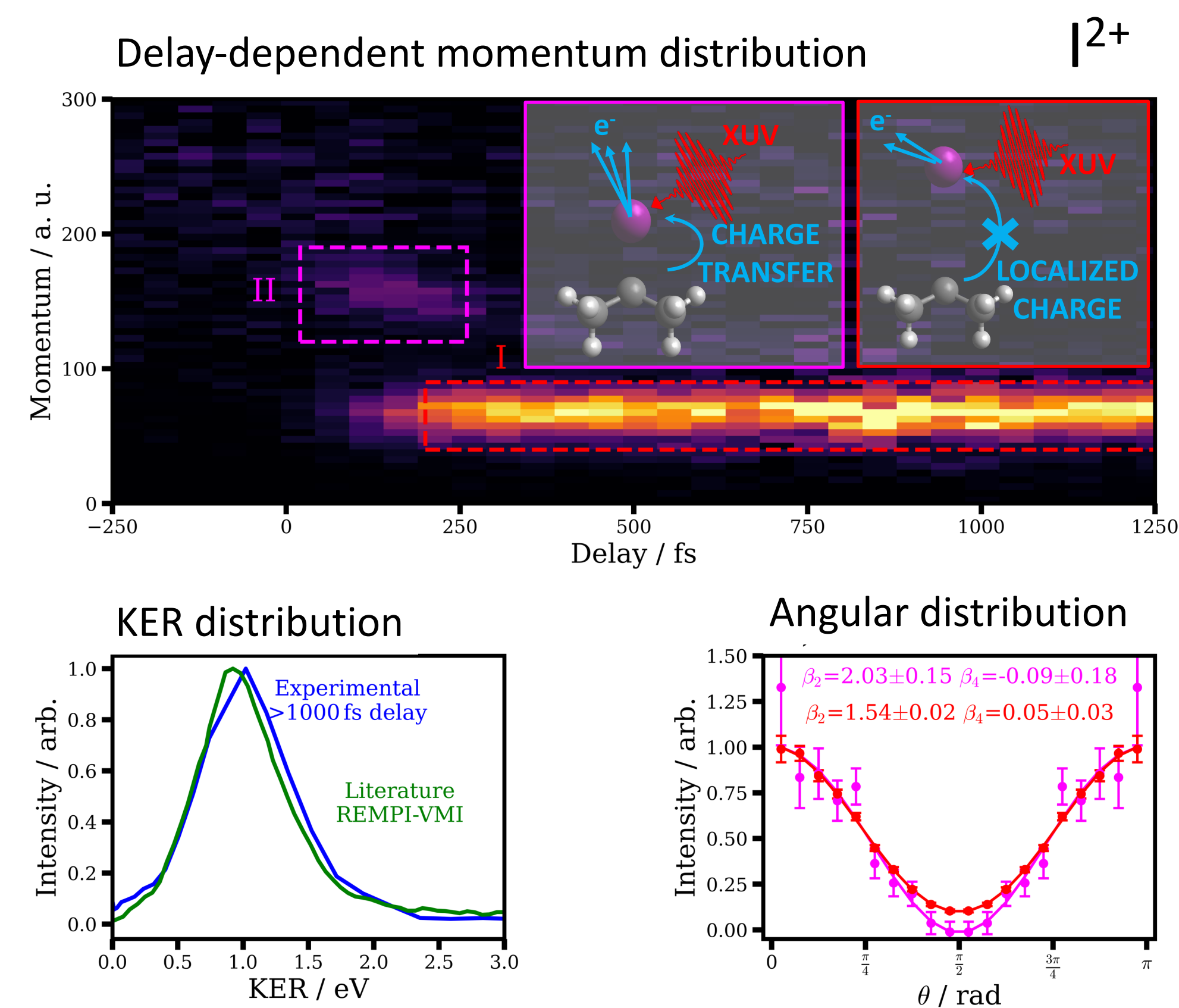
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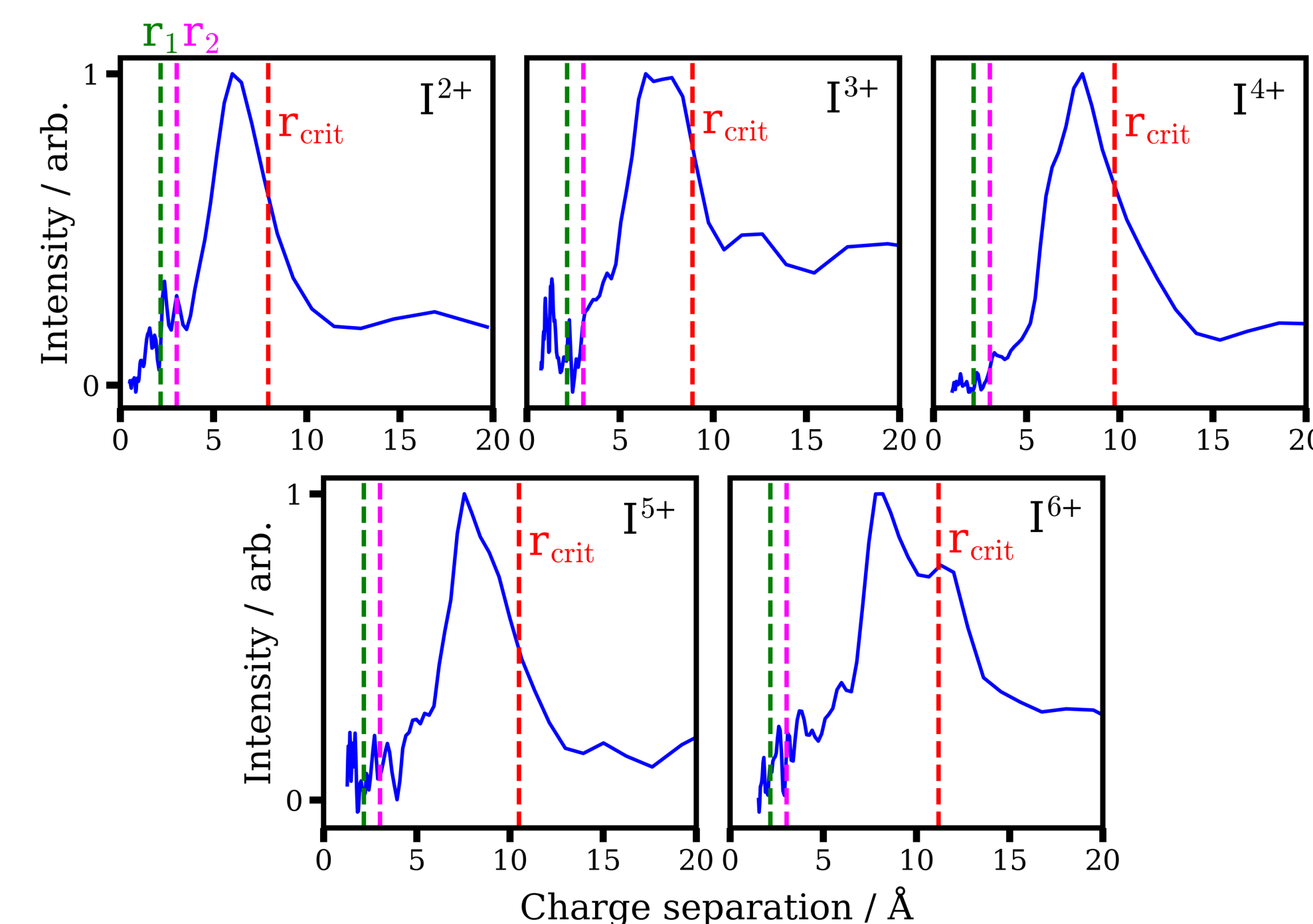
## Introduction

- We study charge transfer in dissociating molecules of 2-iodopropane ( $C_3H_7I$ ) in a UV pump – XUV probe regime at the SACLA free-electron laser.
- Signatures of charge transfer from the recently dissociated iodine atom to the neutral propyl radical are observed in recorded 3D ion momentum distributions. This signature has evaded observation in previous related experiments.
- Detailed analysis of these signatures allows the identification of a region of internuclear separation where charge transfer occurs.

## Results

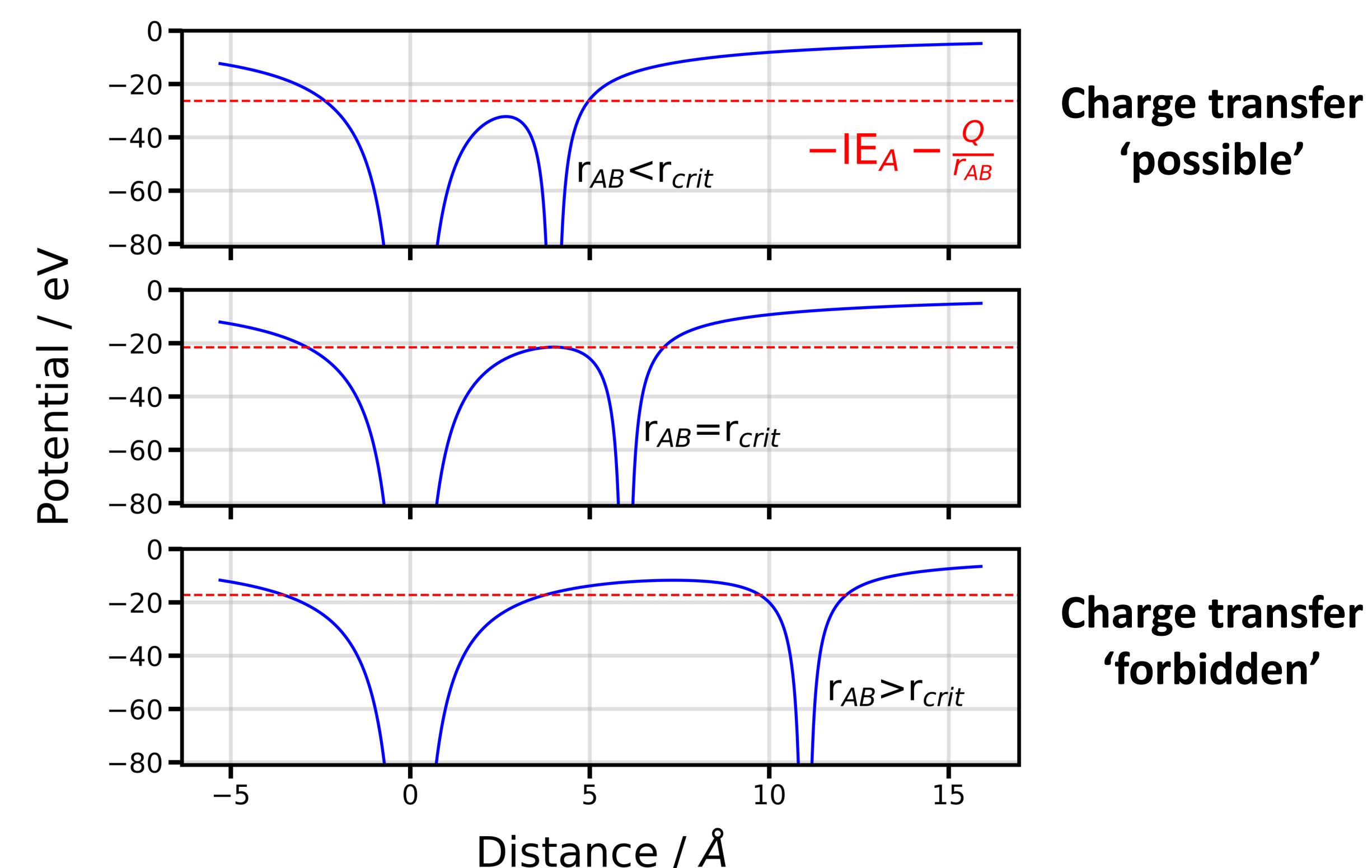


- Similar charge-transfer signatures seen in a range of iodine charge states  $I^{n+}$  ( $n=2-6$ ):
- Assuming Coulombic behavior, we can transform from KE to a separation at the point of charge transfer:



## Beyond the Over-the-Barrier Model

- Charge transfer is often understood within a simple and classical model which considers the (classical) energetic barrier to electron transfer between sites:

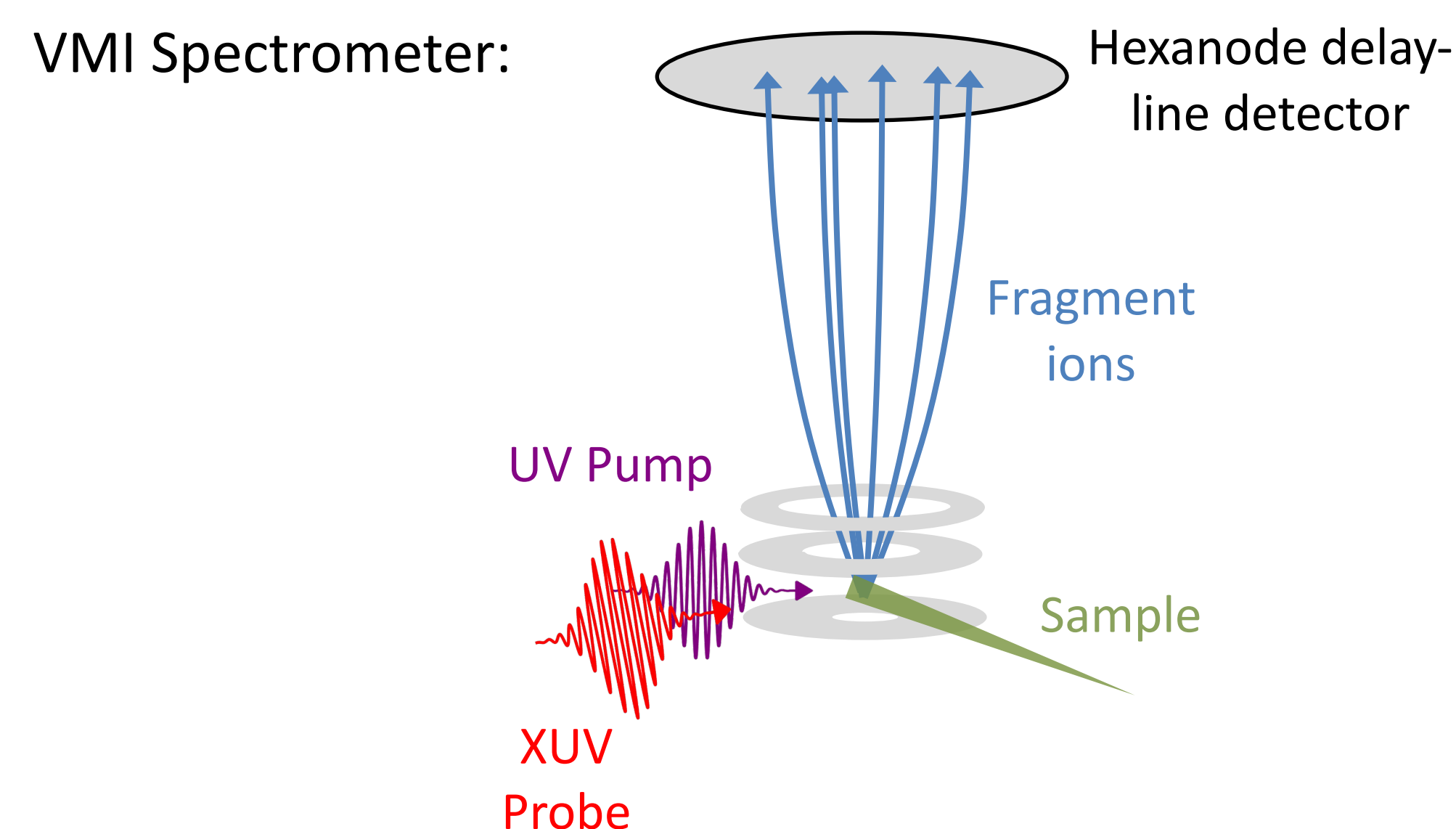
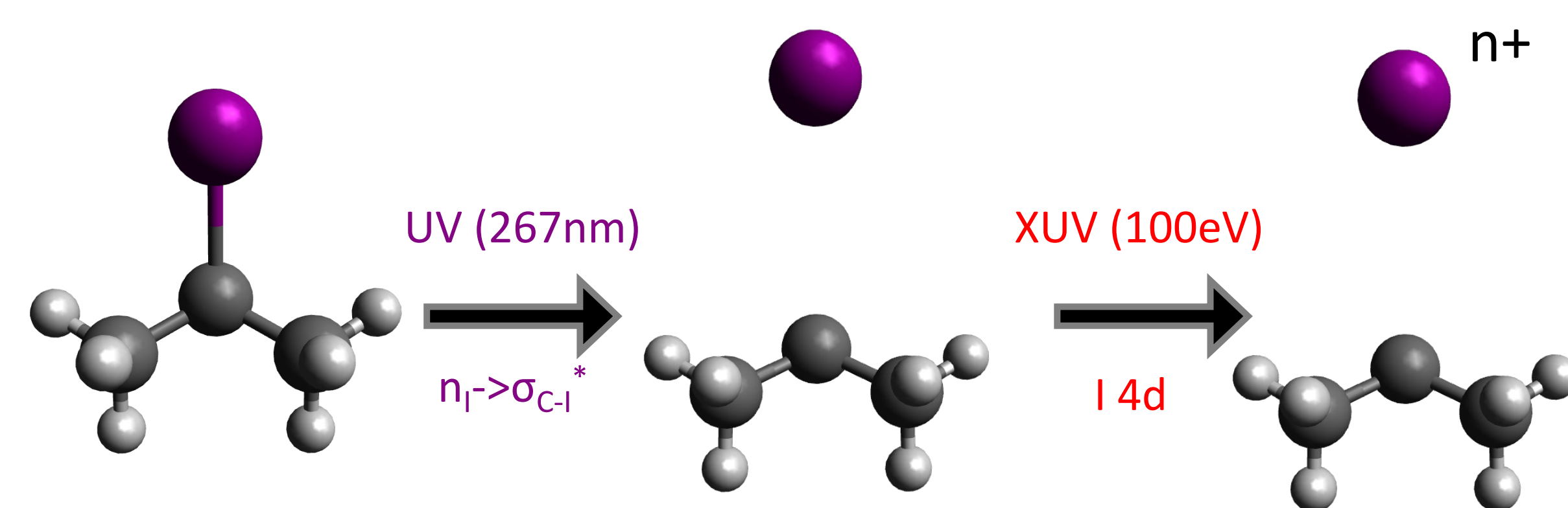


- Our results give information beyond the model: the full dependence of charge transfer probability on internuclear separation.

## Conclusions

- We observe clear ion momentum signatures for ions formed through charge transfer over a range of internuclear distances using a time-resolved site-selective ionization scheme.
- These results give a detailed view of the principles underpinning charge transfer between isolated atomic and molecular moieties.

## Experiment Overview



## References

- [1] Erk *et al.* (2014) *Science*, 345(6194), 288-291
- [2] Fukuzawa *et al.* (2018) *Nuclear Instruments and Methods in Physics Research Section A* 907,116-131
- [3] Corrales *et al.* (2014) *Physical Chemistry Chemical Physics* 16(19), 8812-8818

