ELECTRON SPECTROSCOPIES FOR PROBING ELECTRONIC STRUCTURE AND COLLISION DYNAMICS

DARRYL B. JONES

College of Science and Engineering, Flinders University
E-mail darryl.jones@flinders.edu.au

Abstract. Electrons-impact spectroscopies provide mechanisms for investigating the dynamics of collisions and the electronic structure of materials. An accurate depiction of collision processes is essential in understanding charged-particle transport, and the creation of excited and reactive species in plasma-like environments. They are therefore essential for describing and developing radiation-based therapies and plasma chemical processing technologies. At Flinders we have been employing a range of experimental techniques and theoretical methodologies to improve our understanding of collision phenomena. We also work with the modelling community to apply this knowledge in simulations aimed at describing and predicting properties in plasma-like environments.

In this presentation I will review some of our work on the dynamics of low-energy electron-impact ionization. Here we have employed an (e,2e) technique in an asymmetric coplanar geometry to investigate the ionization of the outermost molecular orbitals of R-carvone (Jones et al. 2019) and pyrazine (Jones et al. 2021). This work uses experiments to benchmark and assess developments in the theoretical descriptions of the ionization process. We will also discuss the role of molecular structure in ionization dynamics by considering the ionized orbital's momentum profile. By studying a range of molecular systems, we have investigated how the shape of the triple differential cross sections in the binary and recoil scattering regions relates to the properties of the ionized orbital.

I will also discuss current research efforts into how we can use electron and momentum-based spectroscopies to probe electronic excitation processes and the dynamics of electronically-excited molecules and materials.

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References

Jones, D. B., Ali, E., Chakraborty, H. S., Ning, C. G., García, G., Madison, D. H., & Brunger, M. J. : 2021, *Chem. Phys. Lett.*, **781**, 139000.

Jones, D. B., Ali, E., Ning, C. G., Silva, F. F. d., Ingólfsson, O., Lopes, M. C. A., Chakraborty, H. S., Madison, D. H., & Brunger, M. J.: 2019, *J. Chem. Phys.,* **151**, 124306.