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(e,2e) Ionization Studies of N_2 at Low to Intermediate Energies from a Coplanar Geometry to the Perpendicular Plane

(e,2e) Ionization Studies of N_2 at Low to Intermediate Energies from a Coplanar Geometry to the Perpendicular Plane.

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Synopsis. The progress of experimental and theoretical measurements for (e,2e) ionization cross sections from Nitrogen molecules is presented. Results are given for energies from ~10 eV above the ionization potential (IP) through to ~100 eV above the IP for the $3\sigma_g$, $1\pi_u$ and $2\sigma_g$ states.

Ionization triple differential cross sections (TDCS) have been determined experimentally and theoretically for neutral N_2 over a range of geometries and energies, from a coplanar geometry through to the perpendicular plane. Data were obtained at incident electron energies from ~10 eV to ~100 eV above the ionization potential (*IP*) of the $3\sigma_g$, $1\pi_u$ and $2\sigma_g$ states, using equal and non-equal outgoing electron energies, and using symmetric and asymmetric geometries. Data were taken with the incident electron beam in the scattering plane ($\psi = 0°$), as well as at angles $\psi = 45°$ and $\psi = 90°$ (see figure 1).

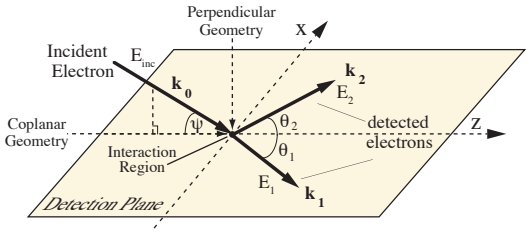

Figure 1. The (e,2e) geometry for these experiments. The incident electron can move from a coplanar geometry ($\psi = 0°$) to the perpendicular plane ($\psi = 90°$) while the analyzers rotate in the detection plane.

The measured differential cross sections at a given energy were inter-normalized to each other by linking the data through a set angle. Binding energy spectra were obtained at each energy, so relative cross sections could be obtained for the different ion states. An example of binding energy spectra is shown in figure 2 at three different incident electron angles, for outgoing electrons having 4.6 eV energy.

The experimental data are compared to new calculations using various distorted wave methods, and differences between theory and experiment are discussed. New results for non-equal angles in a coplanar geometry are also presented, where one of the analyzers is fixed in position (θ_1 = constant) while the second (θ_2) sweeps around the detection plane. Results from these studies are linked to the symmetric results through their common angle when ($\theta_1 = \theta_2$), so that all data are then normalized to each other at a given energy.

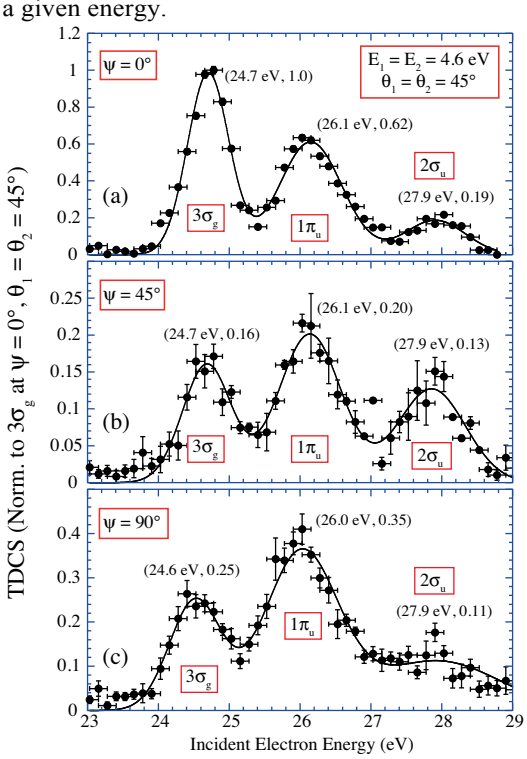

Figure 2. Binding energy spectra for outgoing electrons with 4.6 eV energy in a symmetric geometry, for the electron gun at different angles [1].

The progress of these combined experimental and theoretical studies will be presented.

References

[1] A Sakaamini *et al.* 2016 *J Phys B* **49** 195202

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