High resolution measurements of e^+ and e^- scattering from H_2O

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Synopsis Total cross section measurements of e^+ scattering from H_2O and preliminary results of e^- scattering from H_2O have been investigated using the same high-resolution apparatus. The electrostatic beam used in this work guarantees a field free interaction and detection regions enabling high angular discrimination of $< 2^\circ$ against forward scattered projectiles. The precision and accuracy achieved by our present measurements allow us to make a direct comparison between the two probes, as well as directly compare experimental values against theoretical determinations.

The present total cross section (σ_T) results of positron scattering from H_2O are presented in figure 1, along with previous experimental investigations and theoretical determinations. The current work spans the energy range (10 - 300) eV. The higher angular discrimination of the present beam [1] [2] has yielded values of σ_T which are 50% - 100% higher than previous experiments, characterised by lower angular discriminations, and in quantitative agreement with theoretical predictions in their range of validity [3]. Agreement between experiments is achieved once allowance is made for forward elastic scattering.

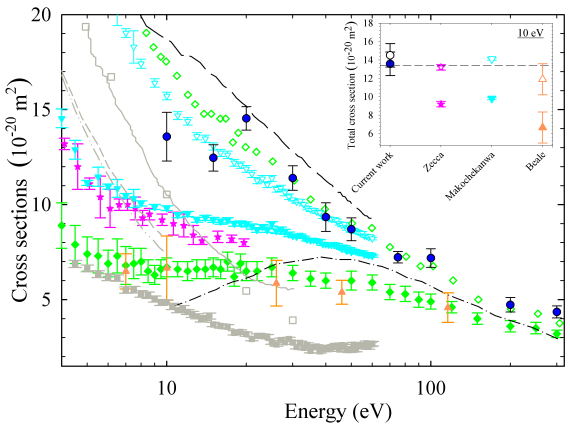

Figure 1. Cross sections for e^+ scattering from H_2O. Solid symbols denote direct measurements, hollow symbols denote measurements corrected for forward-angle elastic scattering, and lines denote theories. Inset demonstrates agreement between experimental results at 10 eV after corrections. [3]

The same experimental set up is now being used to measure σ_T of $(e^- + H_2O)$ scattering. Although measurements for this system have been carried out since early in the 20th century [4], significant discrepancies remain between experimental and theoretical results. The experimental results by Sueoka et al. [5], corrected by Kimura et al. [6] for forward scattering, show good agreement with σ_T theoretical predictions by Jain [7] and elastic integral cross section (σ_{el}) predictions by Zhang et al. [8] at low energies, but direct measurements remain consistently lower.

Whilst our initial results indicate some discrepancies with theoretical determinations, in comparison to previous experimental measurements, fair agreement is noted with the measurements by Szmytkowski [9], performed with a comparable angular acceptance, and lower than other investigations. Preliminary results will be presented at the conference.

References

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