EXPERIMENTAL ANGULAR DISTRIBUTIONS FOR LOW ENERGY ELECTRONS SCATTERED BY ARGON, HELIUM, ATOMIC AND MOLECULAR HYDROGEN.

by

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Bibliography.

SUMMARY

This thesis describes the measurement of angular distributions for electrons scattered by argon, helium, and atomic and molecular hydrogen, using a modulated beam apparatus. Angular distributions for electrons elastically scattered from argon were measured at incident energies of 50, and 100 eV, from helium at 25, 50, 100, and 200 eV, and from molecular hydrogen at 30, 50, 100 and 200 eV. Inelastic angular distributions were also measured for the combined 2^1S, 2^3P, 2^1P excitation of He at incident energies of 100, and 200 eV, and the combined 2s, 2p excitation of H at 50, 100 and 200 eV. Excitation of the b $\left(^3\Sigma_u^+\right)$ state of H_2 was observed at 50, 100 and 200 eV. The angular range covered in these measurements extended generally from 20^o to 130^o.

A parallel plate electron spectrometer energy analysed the electrons scattered through a particular angle in a region which included the intersection of a crossed electron and modulated atomic/molecular beams. Phase sensitive detection was used to distinguish the beam signal from the background gas signal. Atomic hydrogen studies were performed using a partially dissociated H_2 beam. Mass spectrometer analysis of the beam was used to determine the H_2 contribution to the inelastic spectrum produced by the atomic/molecular beam. A data handling system was developed which displayed the energy spectrum of scattered electrons and recorded their elastic and inelastic angular distributions. By accumulating the beam signal in the store of a multi-channel analyser and repetitively scanning over the energy and angular range selected, errors produced by slow

drifts in experimental conditions were minimised.

Angular distributions measured for electrons elastically scattered by argon are compared with both recent calculations, and results that were obtained by others using a different experimental technique.

Excellent agreement has been obtained between the present measurements of the angular distributions of electrons elastically scattered by both helium and molecular hydrogen and the calculations of Khare and Moiseiwitsch. In particular the discrepancy at large angles between the measurements of Webb and the calculations of Khare and Moiseiwitsch are not observed.

The shape of the differential cross section calculated for the combined 2s, 2p excitation of H at 54 eV using the close coupling approximation is shown to be in good agreement with the shape of the observed angular distribution. However there is considerable discrepancy between the measurements reported here and the shape of the differential cross section in the Born - Oppenheimer approximation, the difference being greatest at the highest energy for which measurements were obtained (200 eV).

Implications of these observations are discussed.

PREFACE

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University. To the best of the author's knowledge and belief it contains no material previously published or written by any other person, except where due reference is made in the text.

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