ELASTIC SCATTERING OF ELECTRONS ON He, Ne, Ar IN THE IMPACT ENERGY REGION FROM 1000 TO 3000 eV*

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Introduction

In the last few years a great number of papers were published on the elastic scattering of electrons (see e.g. a recent survey in [1]). Measurements of the differential cross sections, however, were carried out over a wide angular range (especially at higher angles) only at relatively smaller impact energies.

As regards the target species, in the case of He, Williams and Willis published cross section data for incident electron energies from 20 to 400 eV over the angular range from 20° to 150° [2]. Kurepa and Vuskovic measured the cross section for impact energies of 100, 150, 200 eV in the angular range between 5° and 150° [3]. Shyn [4] and Register et al [5] determined the elastic cross section for the impact energy range of 2 to 400 eV and 5 to 200 eV, respectively, in the angular region from 6° to 156° and from 10° to 140°, respectively. The last case, however, was measured as a proposed calibration standard with an estimated accuracy of the data within 5 to 9%, depending on the impact energy.

For Ne gas as the target, DuBois and Rudd [6] published results in the energy range 50–800 eV between 2° and 150°, and Williams and Crowe have results in the range 20–400 eV between 20° and 150° [7]. Elastic scattering cross sections for Ar, however, were determined by DuBois and Rudd [6] and by Srivastava et al [8], in the energy range from 20 to 800 eV and from 3 to 100 eV, respectively; the angular range covered was from 2° to 150° [6] and from 20° to 135° [8], respectively.

* Dedicated to Prof. S. Szalay on his 75th birthday
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The only paper where the elastic scattering of electrons was studied in the relatively higher impact energy region, namely from 100 to 3000 eV, was published by Jansen et al [9] but at the same time, they have data only at the scattering angles between 5° and 55°.

In the present paper our purpose was to study the elastic scattering of electrons in the impact energy range from 1000 to 3000 eV on He, Ne and Ar at scattering angles between 49.6° and 130.0°, where the experimental data are completely lacking. For normalization and checking purposes, several measurements were carried out at some other impact energies too (200, 500, 800 eV).

As regards the theoretical interpretation many calculations on the elastic scattering of electrons have been published, especially on the differential cross section for elastic electron scattering (recently e.g. [10–12]; see a short survey in [1]). However, the number of calculations at the higher impact energy region, where measurements were carried out, is very small. The theoretical values of McCarthy et al [13] seem to be the most suitable for comparison with the present experimental results. These calculations were performed on the basis of an optical model for a number of target gases (He, Ne, Ar, Kr, Xe) in a wide impact energy and scattering angle region (from 20 to 3000 eV; from 5° to 170°) and the calculated values are given in very detailed tabulations.

**Experimental**

The measurements were carried out by means of a new double, distorted field cylindrical mirror electron spectrometer (ESA-13) with second order focusing, constructed at this Institute [14]. The entrance angle of the analyser was 43.5° relative to the axis of the cylinders. The schematic diagram of the spectrometer and the experimental arrangement are given in Fig. 1.

![Schematic diagram of the experimental arrangement](image)

*Fig. 1. Schematic diagram of the experimental arrangement*