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EXPERIMENTAL AND THEORETICAL STUDY OF DIFFERENTIAL CROSS SECTIONS FOR ELASTIC ELECTRON SCATTERING BY Sb ATOM

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Differential cross sections (DCSs) for elastic electron scattering by antimony atom have been measured and calculated for the intermediate impact electron energy range from 10 to 100 eV. The effusive beam of Sb atoms is produced by ohmically heated crucible at temperature of 880 K that corresponds to vapour pressure of 13 Pa. It is perpendicularly crossed by monochromatic electron beam while the elastically scattered electrons are detected from 10^o to 150^o. At the particular impact energy, angular distributions are recorded for several times (3 – 10) and weighted mean was determined. These angular distributions are multiplied by effective path-length correction factors in order to obtain relative DCSs. Angular resolution of the spectrometer has been estimated to be 1.5^o. Overall energy resolution of the obtained spectra is 120 meV. The experimental method and electron spectrometer are reviewed elsewhere [1].

The theoretical results are obtained in terms of a model of phenomenological complex optical potential with allowance for spin-orbit interaction (*SEPASo*-approximation). The calculation without of absorption (*SEPSo*-approximation) is carried out using a parameter-free real potential. Total and some subshells electron densities in Sb atom and static potential are calculated within the framework of the local relativistic approximation of the density functional theory [2] and for them analytical expressions have been obtained. We use the local exchange potential in the free electron gas approximation [2], the parameter-free correlation-polarization potential [3], the spin-orbit potential [4] and the McCarthy-type absorption potential with empirical parameter [5].

In Fig. 1 differential cross sections for elastic electron scattering by antimony atom are presented. Both types of calculations are shown: *SEPASo* approximation with absorption potential and *SEPSo* approximation with only real part of potential (without absorption). Experimental values are normalized at 60^o on the *SEPASo* curve. Statistical error bars are within the size of the symbols. The overall very good agreement between experimental and calculated shapes of elastic DCSs can be noticed. However, some details of discrepancy exist. At small scattering angles, experimental curve is more forward peaked than both calculations. The exact positions of minima in DCS could not be tested by the experiment since the chosen discrete points are separated by 10 degrees. The positions of the first minimum are at 37^o and 41^o; and for the second minimum at 87^o and 88.5^o in the *SEPASo* and *SEPSo* approximations respectively. Both approximations give the position of the third minimum at 143^o. Also, while the span of values between maximum at about 60^o and minima at about 40^o and 90^o are the same for measured and calculated values. The same holds for the case of the second maximum (120^o) and third minimum here this ratio is approximately 25. Absorption effects are especially important at larger scattering angles [6] but

the angular range above 150^{o} is inaccessible for the experiment in the present arrangement of the electron spectrometer.

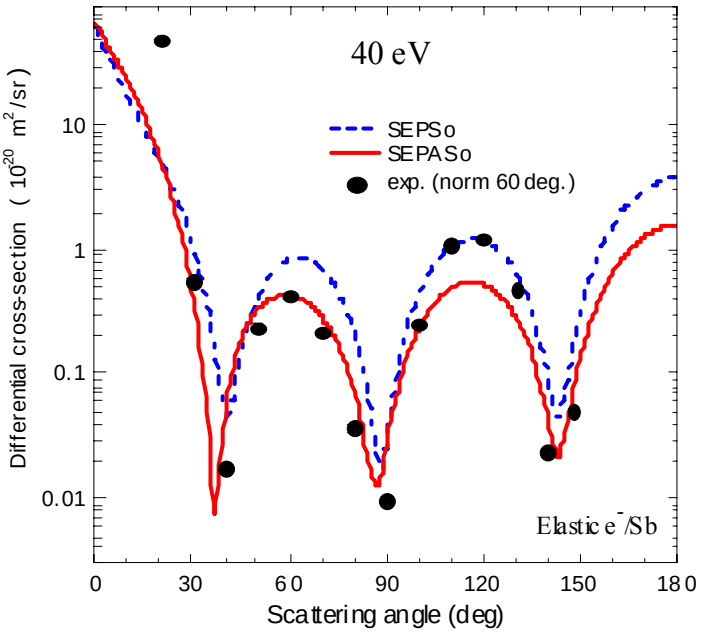

Fig. 1: Differential cross sections for elastic electron scattering by antimony atom at 40 eV impact energy. Experiment: ●. Theory: – – –, *SEPSo*; ——, *SEPASo*. Experimental values are normalized at 60^{o} on *SEPASo* curve.

Similar comparison could be drawn for the other impact energies and it will be communicated at the conference.

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