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POSITION OF DCS MINIMA IN ELASTIC ELECTRON-ARGON SCATTERING

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Minima in elastic differential cross sections (DCS) were firstly observed in electron-argon scattering experiment by Bullard an Massey[1]. Diffraction structure of these DCS are the first strong experimental proof of a wave nature of the electron in binary electron-atom collisions.

Using simple Fraunhofer diffraction formula one can estimate an effective atomic diameter on the base of DCS minima position. But, there are a lot of more sophisticated theoretical approaches to the atomic size and shape at the present.

Our interest in this work is to show the minima position as a fundamental property of e^-/Ar elastic scattering. This is also important because in the vicinity of these minima polarization of scattered electrons changes drastically, especially if DCS attain their smallest values, at critical points[2]. Namely, the range around minima position and corresponding incident electron energies is the spin-orbit "land", where spin effects are small but conspicuous due to falling off generally predominant electrodynamic interactions[3].

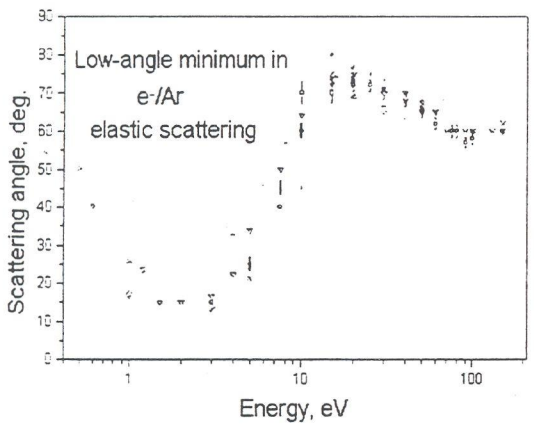

Figure 1. Position of low-angle e^-/Ar elastic DCS minimum. Panajotović et al.'97, □; Srivastava et al.'81, ⊙; Weyhreter et al.'88, ∧; Williams'79,∨; Bitsch and Andric'89,◊; Furst et al. '89,*; Bullard and Massey'31, –; Qing et al.'82, |;Williams and Willis'75,■; Mehr '67, • ; Lewis et al.'74,▲; Schackert'68,▼; Cvejanović and Crowe'94,◊; DuBois and Rudd'76,+; Vušković and Kurepa'76,×; Gibson et al.'96, |.

Experimental evidence of two local DCS minima is clearly seen on the figures, as $[P_2(\cos\theta)]^2$ predicts. The low-angle minimum from 0.5 to 150 eV changes remarkable between 10 and 80°, approximately, and also the high-angle minimum from 1 to 400 eV changes between 90 to 180°, approximately.

Due to a number of results extracted from experimental DCS curves, theoretical results are not included here and will be presented on the conference. Oscillatory structure between 1 and 100 eV is in contrast to classical diffraction formula. It is challenge for the theory to reproduce position of e^-/Ar DCS minima in such broad energy domain in which the minima exist.
A neighborhood of experimental points presented is the range convenient for investigation of spin-orbit interaction.

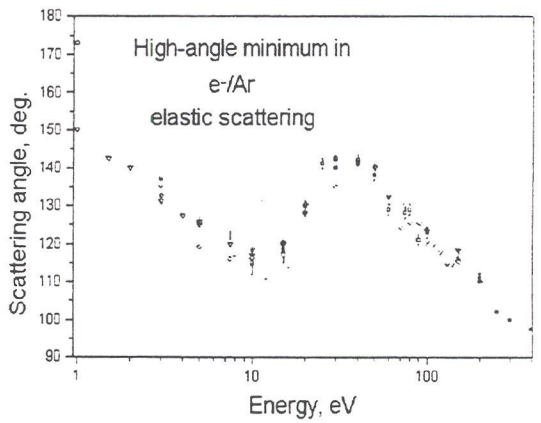

Figure 2. Position of high-angle e^-/Ar elastic DCS minimum. Notation is the same as in the fig.1.

References

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