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MOMENTUM TRANSFER CROSS SECTIONS FOR THE ELECTRON-IMPACT EXITATION OF ARGON, KRYPTON and XENON ATOMS

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A crossed electron-atom beam collisional technique has been used to study the electron scattering by Argon [1], Krypton [2] and Xenon [3] atoms. The scattering angles ranged from 5^{o} to 150^{o}, and the energy resolution was between 40 meV and 60 meV.

Normalized, absolute differential cross sections (DCS-s) have been obtained for a number of incident-electron energies (E_o) from 15 eV to 80 eV. In the same energy region angular distributions of inelastically scattered electrons have been measured. On the basis of elastic-to-inelastic (states $4s'[1/2]_1$, $5s[3/2]_1$ and $6s[3/2]_1$ of Ar, Kr and Xe atoms, respectively) intensity ratios, measured in separate series of experiments, relative inelastic DCS-s were put on the absolute scale.

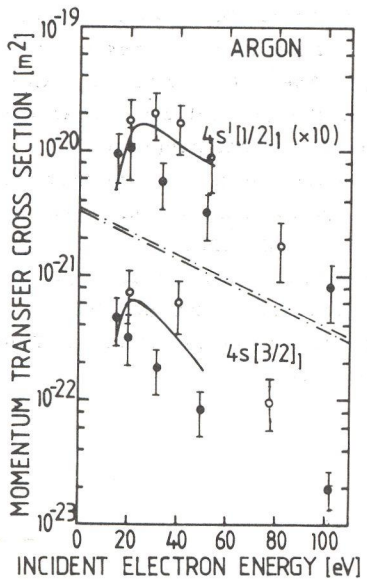

Fig. 1. Momentum transfer cross sections for Argon. The solid lines are results from FOMBT by Padial et al. [4] and the filled circles with error bars are experimental results by Chutjian et al [6].

To obtain a momentum transfer cross section (σ_m), DCS for a separate electronic state (σ) was extrapolated to $\theta = 0^{o}$ and $\theta = 180^{o}$ scattering agles, and formula

$$\sigma_m = 2\pi \int_0^{\pi} \sigma(\theta, E_o)\left[1-(1-\Delta E/E_o)^{1/2}\cos\theta\right]\sin\theta \, d\theta$$

was used, where ΔE is the exitation energy of given state. Our results are obtained by numerical integration of the given formula and presented in the figures by circles with maximum-error bars.

Comparison with the other available data show that agreement with the First-order-many-body theory (FOMBT) results by Padial et al. [4] for Argon as well as by Meneses et al. [5] for Krypton is better than agreement with the experimental results by Chutjian et al. [6] for Argon and by Trajmar et al. [7] for Krypton.

The intermediate incident-energy region is of interest for completing a systematic survey of electron-noble-gas-atoms collision processes. These results can be applied in Plasma Physics for electron-energy distribution functions determination, negative differential conductivity investigation etc. In the analysis of electron transport coefficients, these results are important as a complement to results obtained by using swarm technique (at higher values of the reduced electric field, E/N).

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