

21st Summer School and International
Symposium on the Physics of Ionized Gases

21st SPIG

sponsored by the European Physical Society

CONTRIBUTED
PAPERS

&

ABSTRACTS OF INVITED LECTURES,
TOPICAL INVITED LECTURES AND PROGRESS REPORTS

Editors:

M. K. Radović and M. S. Jovanović

Department of Physics,
Faculty of Sciences and Mathematics,
University of Niš

Niš, Yugoslavia

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DIFFERENTIAL CROSS SECTIONS FOR ELASTIC ELECTRON SCATTERING BY Ca ATOM

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In this work we present the preliminary results of the measurements of the differential cross sections for elastic electron scattering by Ca atom. Results are compared with available theoretical data. No other experimental data are available for comparison.

Relative differential cross sections (DCS) for elastic electron scattering by calcium atom have been obtained for 10, 20, 40, 60 and 100 eV impact energy and scattering angles from 10 to 150°. A crossed electron-atom beam technique has been used in the electron spectrometer "ESMA" [1]. Atomic beam has been produced by heating Ca metal in a wire-heating oven. The background pressure was of the order of 10^{-4} Pa and the oven temperature was between 700 and 720 °C. New design of oven was introduced in order to achieve higher temperatures than those needed for previously investigated metals Hg [2] or Zn [3]. Oven was made more compact, oven walls were reduced and external overheating was avoided by additional water-cooling.

The energy-loss spectra were obtained and the position of zero scattering angle was determined from the symmetry of differential cross section on negative and positive scattering angles. Relative distributions of the scattered electrons were multiplied by effective length correction factors in order to obtain relative DCS. Relative DCS were normalized by forward scattering function [4] of the generalized oscillators strengths of resonant $4p^1P^0$ state (2.93 eV) of calcium.

An energy dependence of relative cross sections for elastic electron scattering by Ca atom is shown in Fig. 1. At lower energies DCSs have three minima, while at higher energies there are only two minima. The first minimum at higher energies turned to be flexing point. Position of the second minimum is shifted gradually from 85° at 10 eV towards smaller scattering angles at higher energies (70° at 100 eV). Absolute scale will be determined by the intensity ratio of the measured inelastic DCS at the particular angle on each impact energy.

The result of the measurements of relative cross section for elastic electron scattering by Ca atom at 10 eV electron impact energy are presented in Fig. 2 together with theoretical data by *Khare et al* [5] at the same energy. Our result is normalized at scattering angle of 110° to the differential cross section result in the static-field-polarization-exchange approximation (SFPE).

The comparison of our measurements with theoretical data shows that good agreement exist with results in (SFPE) approximation. Agreement with results in static-field approximation (SF) is not satisfactory. This experimentally observed DCS clearly support (SFPE) calculations over simpler (SF) calculations. (SFPE) includes polarization and exchange effects.

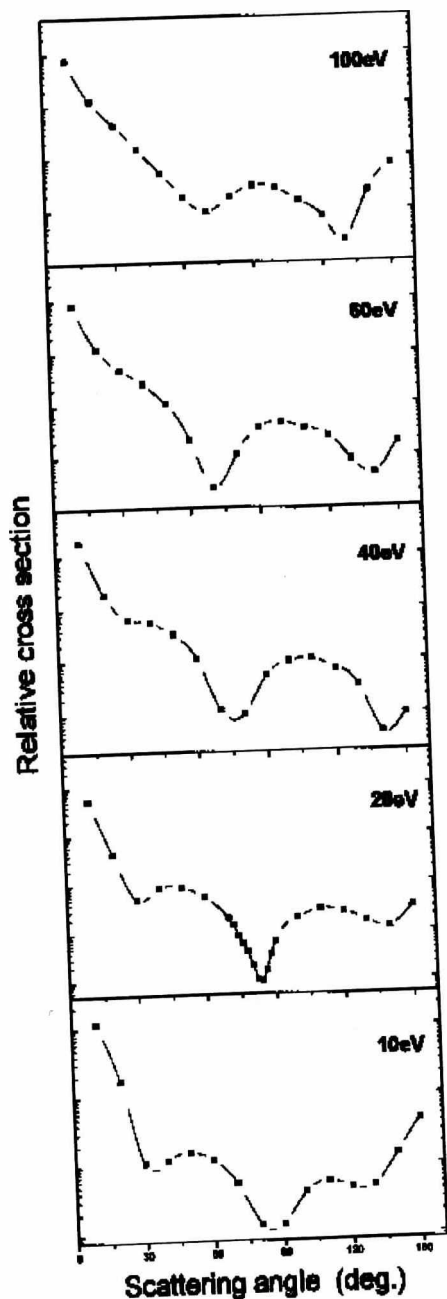


Figure 1. Energy dependence of relative cross sections for elastic electron scattering by Ca atom

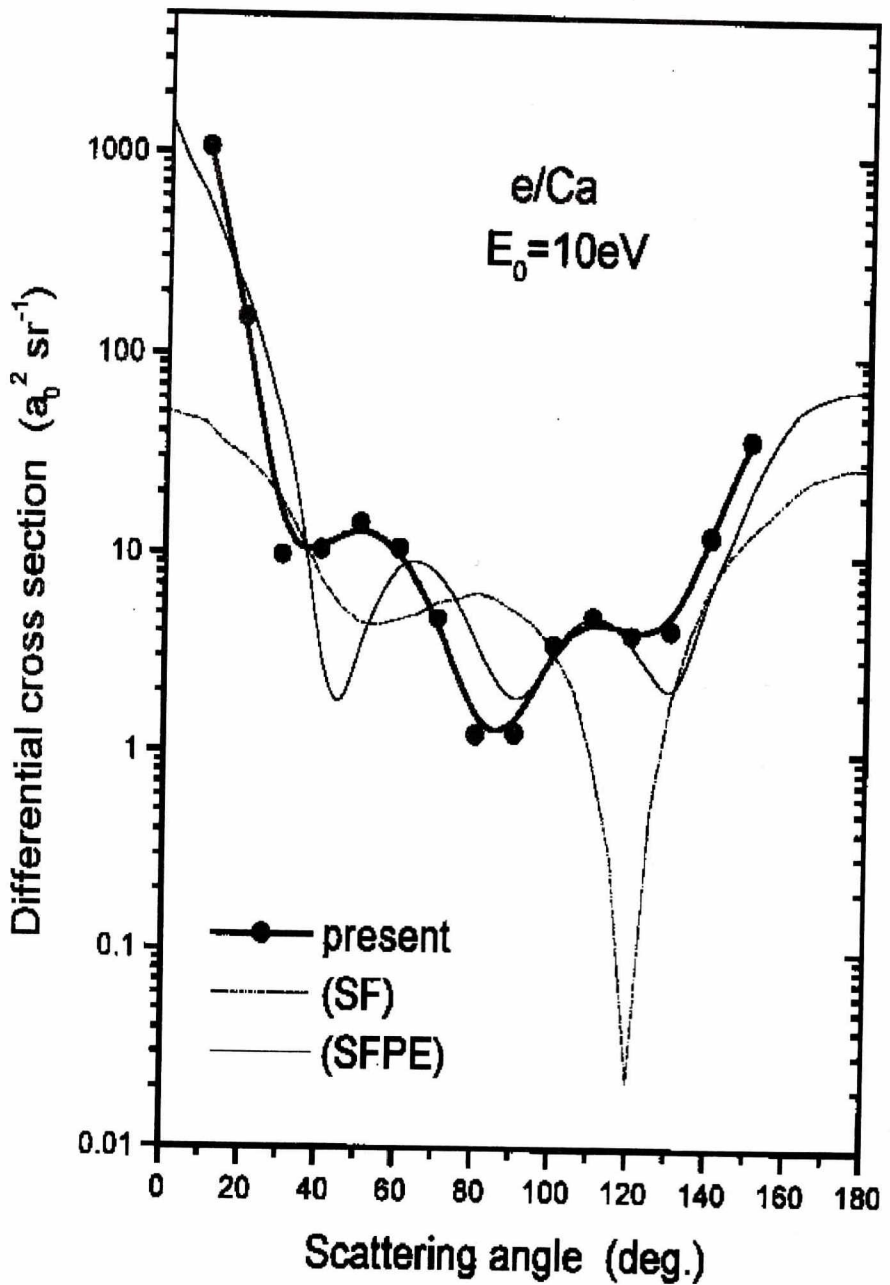


Figure 2. Differential cross section for elastic electron scattering by Ca atom at 10 eV impact energy: ● present results normalized at 110° to the (SFPE) calculations; ----- (SF), Khare *et al.* [2] static-field approximation; ——— (SFPE), Khare *et al.* [2] static-field-polarization-exchange approximation

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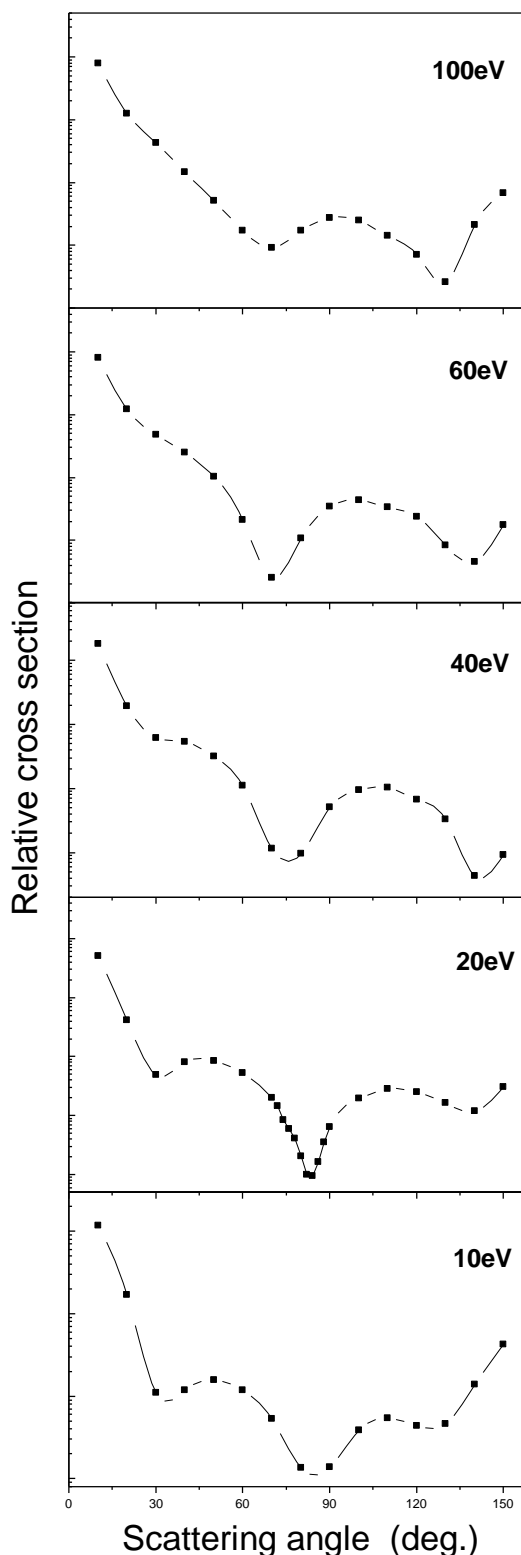


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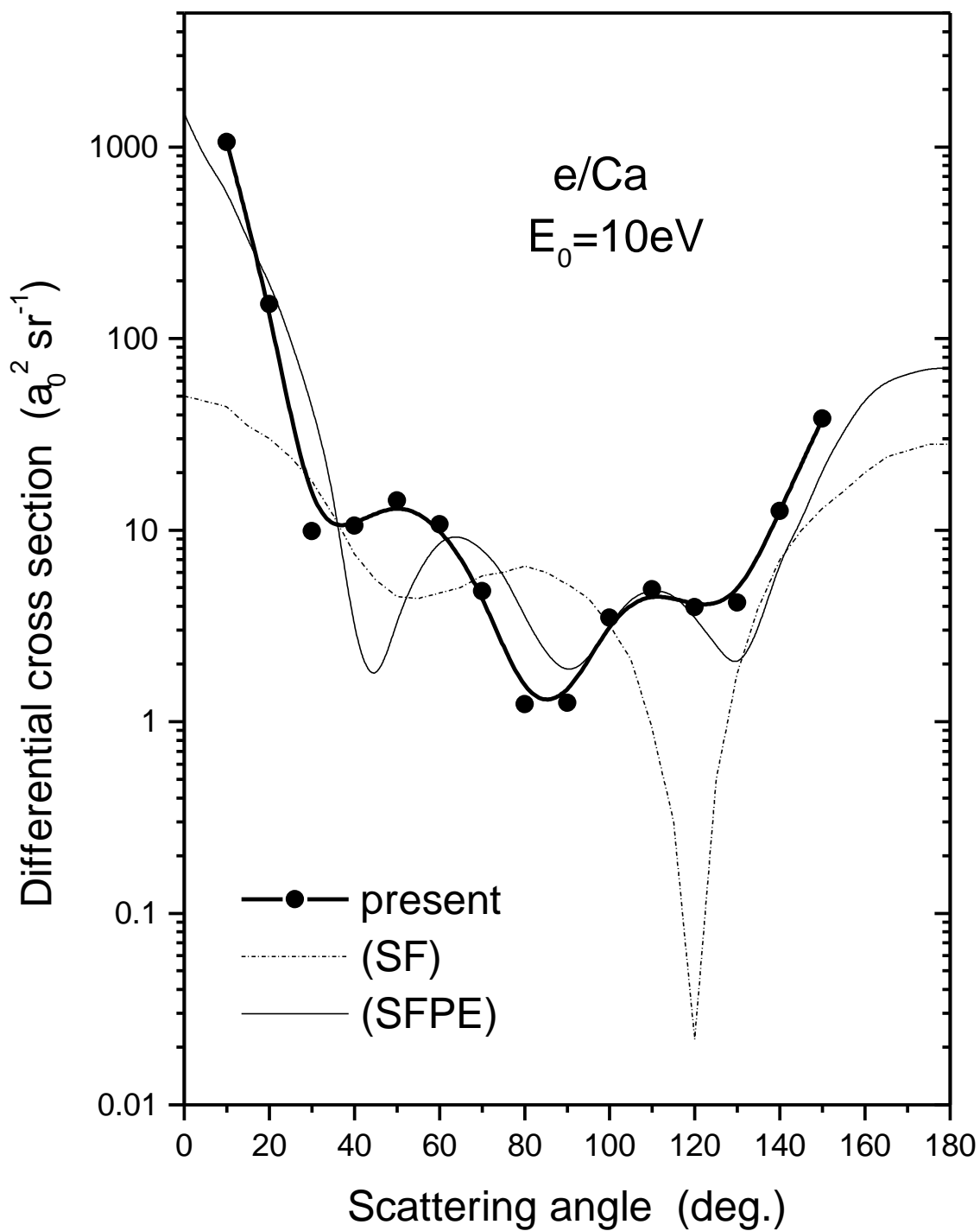


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