ELASTIC SCATTERING OF e^- AND e^+ FROM Rb AND Cd

A W Pangantiwar** and Rajesh Srivastava*

* Physics Department, Roorkee University, Roorkee - 247 667 (India)

** Govt. College of Engineering, Aurangabad, Mahrashtra, (India)

ABSTRACT

Differential cross section results are calculated for the elastic scattering of electrons and positrons from the ground state of Rb and Cd atoms. An optical model potential approach is used for the calculation. Results are compared with the available electron impact experimental results.

I. INTRODUCTION

In the present workshop we wish to report our theoretical study of the elastic scattering of electrons and positrons by the ground state of Rb and Cd atoms. Since the differential cross sections (DCS) as compared to total cross sections provide more rigorous testing for theories and experiments we mainly evaluate the DCS results at various incident projectile energies, especially at energies for which electron impact experimental results are available. However, the direct measurements of the DCS for positrons elastically scattered from alkali and heavy atoms are also becoming available. In our study we describe elastic scattering of electrons and positrons from Rb and Cd atoms in the framework of an "optical model potential approach" (OMPA)[1]

II. THEORY

The choice of optical model potential used in our OMPA can be expressed as

$$V_{opt}(r) = V_{st}(r) + V_{ex}(r) + V_{pol}(r) \qquad ...(1)$$

The first three terms on the right hand side of equation (1) represent respectively the static, exchange and polarization potentials. Exchange potential is absent for positron scattering. We obtain static potential using multi-zeta type Hartree-Fock wavefunction[2] for Rb and Cd. For exchange potential following widely used form is used[3].

$$V_{ex}(r) = (k^2/2 - V_{st}(r) - [(k^2/2 - V_{st}(r))^2 + 8\pi\tau\rho(r)]^{1/2})/2 \qquad ...(2)$$

Here $\vec{k}$ is incident electron wavevector, $\rho(r)$ is atomic target charge density. For Cd, $\tau = 1$ and for Rb, $\tau = -1$ and $+1$ respectively for singlet and triplet modes of scattering. Following functional form of the polarization potential is chosen[4]

$$V_{pol}(r) = = (\alpha/2r^4)(1 - \exp[-(r/r_c g)^8]) \qquad ...(3)$$

α is dipole polarizability of target atom. r_c is cutoff parameter (see ref. 4) and g is energy dependent adjustable parameter chosen such that it provides best fit to electron impact exprimental DCS data. For positron scattering g is taken unity. From the known optical potential the Schrodinger equation is solved for phase shifts which

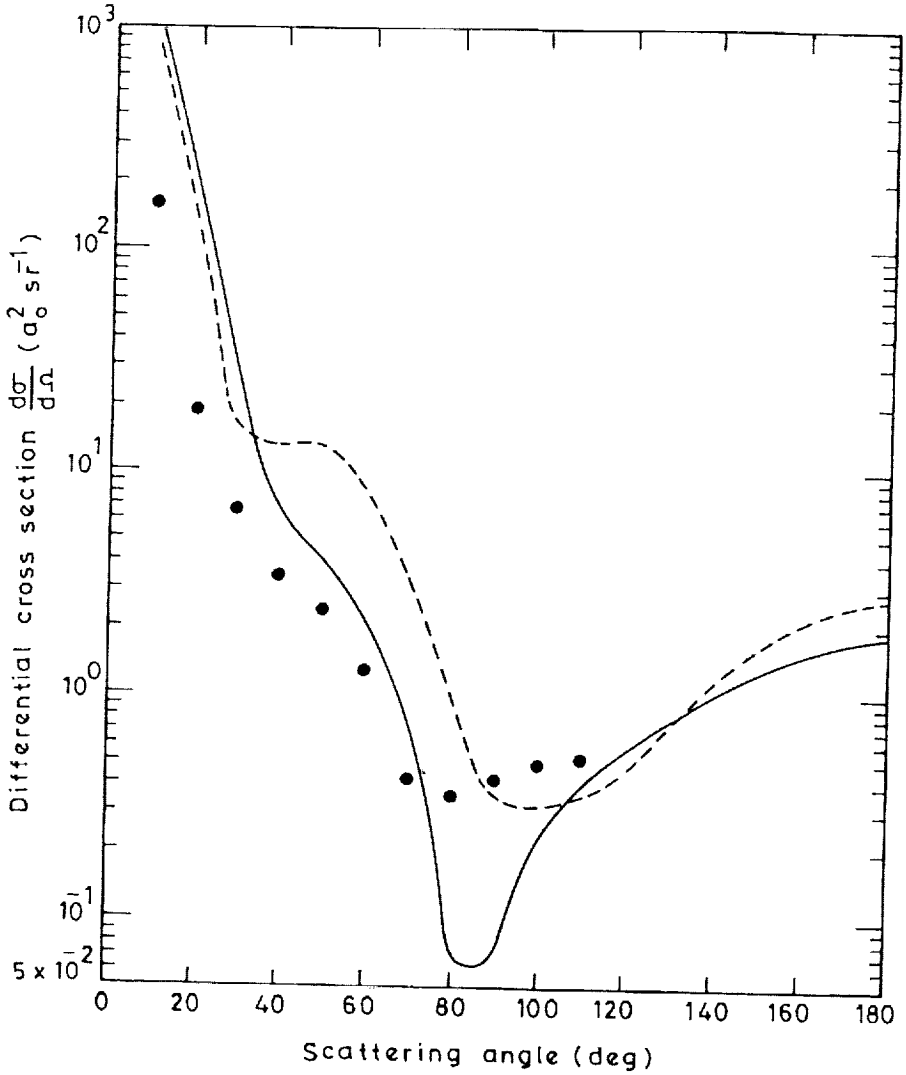

Fig. 1 : DCS results for $e^-(e^+)$-Rb elastic scattering at 10 eV.
—— present e^- results, --- present e^+ results, • experiment[6].

consequently define scattering amplitude and give DCS results in conventional manner[1].

III. RESULTS

The detail of the numerical calculation along with the DCS results for $e^-(e^+)$-Cd elastic scattering is being published elsewhere[5] and we briefly present here our $e^-(e^+)$-Rb elastic scattering DCS results. For Rb we take α = 319 and obtain[4] r_c = 3.576. The DCS results are calculated at 10 and 20 eV energies as displayed through figures 1 and 2. From these figures on comparing with experimental results[6] we find that our optical model potential describes the e^- - Rb elastic scattering reasonably well while for our positron scattering results future experiments can throw some light.

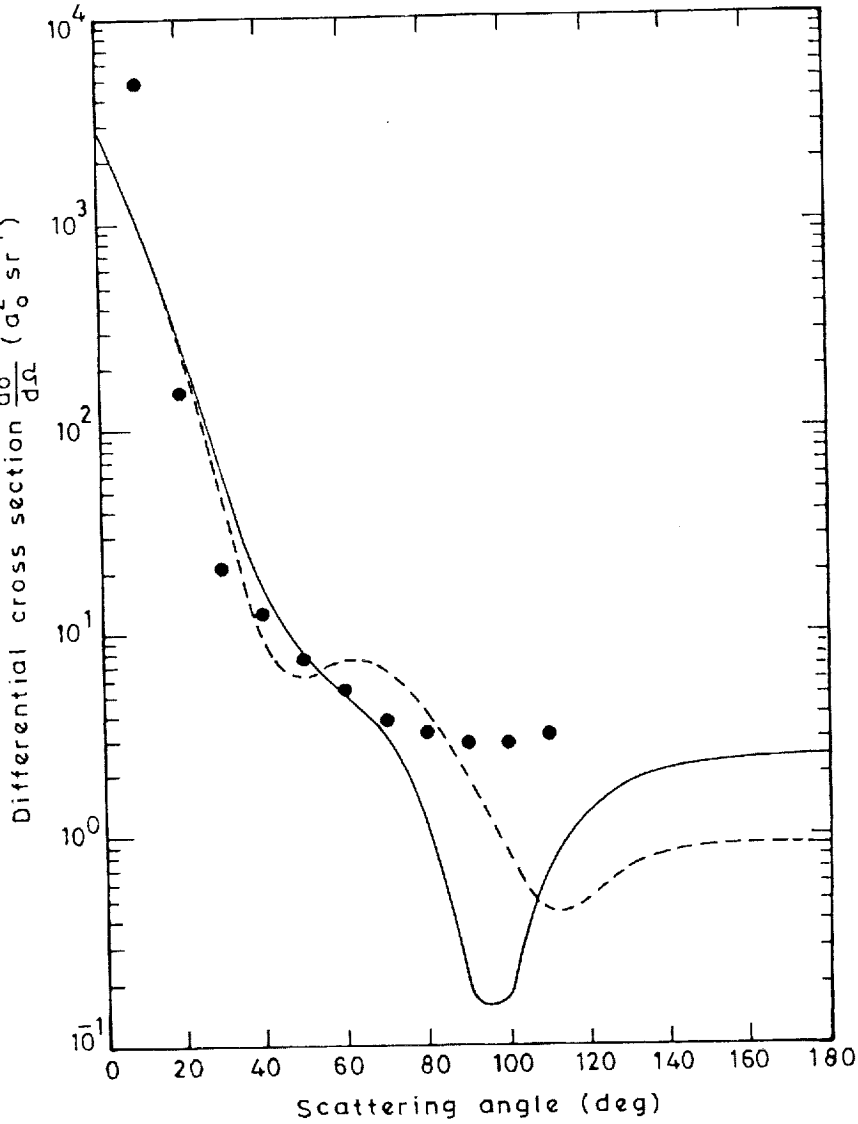

Fig. 2 : Same as Figure 1 at 20 eV.

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