Electron Scattering from Atomic Hydrogen at Low Energy*

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I have performed a very accurate calculation of electron-hydrogen scattering at low energy, using the Harris-Nesbet method [1] .

The trial wave function for electron scattering is, as usual, in the form

$$\Psi_{L,S}(1,2) = \frac{1}{\sqrt{2}}(1 \pm P_{12}) \sum_{n_l \ell_1 \ell_2} u_{n_1 \ell_1}(r_1) F_{n_1 \ell_1 \ell_2}(r_2) Y_{L\ell_1 \ell_2}^{(M_L)}(\hat{r}_1 \cdot \hat{r}_2) \tag{1}$$

where P_{12} is the exchange operator that exchanges the incident and target electrons.

A large coupling scheme of states and pseudostates of hydrogen was considered for the calculation. The detailed description of the Harris-Nesbet method and its numerical procedure and formalism have been available in the literature for both electron [1] and positron [2] scattering.

The most accurate low partial-wave phase shifts were obtained [3]. In order to produce accurate values for the differential cross sections, one requires to calculate a significantly great number of phase shifts. They have all been carried out with the Harris-Nesbet method.

Table 1: Differential Cross Sections (DCS) of e^--H Elastic Scattering in units of $\pi a_o^2 sr^{-1}$.

Energy (eV)	1.207		3.423		8.704	
Angle (deg)	Present	Exp. Data [4]	Present	Exp. Data [4]	Present	Exp. Data [4]
10	1.285	-	1.616	1.66(10)	2.283	2.28(14)
20	1.307	1.38(24)	1.400	1.33(10)	1.771	1.83(12)
50	1.477	1.42(26)	1.008	1.03(6)	0.8523	0.92(6)
140	2.490	2.58(24)	1.512	1.52(8)	0.4859	0.48(3)

I have obtained the differential cross sections for elastic scattering of electron from atomic hydrogen at several energies. In particular, the cross sections at E = 0.582, 1.207, 1.597, 2.171, 3.009, 3.423, 4.889, 6.691, and 8.704 eV were calculated and found to agree well with experimental data by Williams [4]. A sample of these differential cross sections are shown in Table 1.

In Fig. 1 the differential cross sections at E=4.889 eV and 1.207 eV are exhibited together with experimental data by Williams [4].
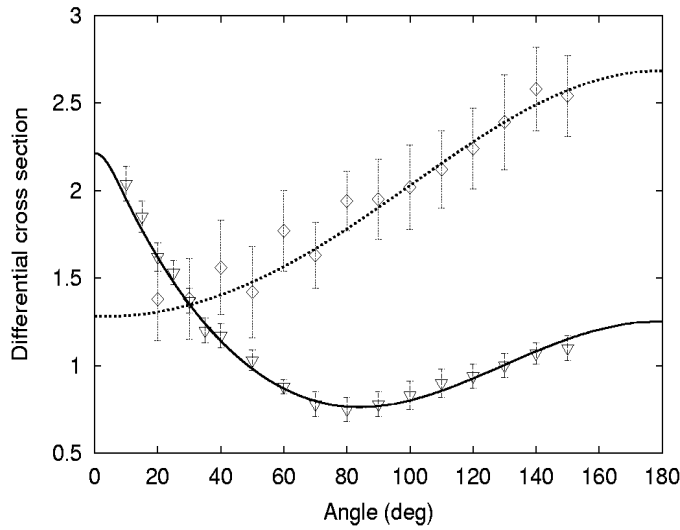
Figure 1: Differential cross-sections of e^- $-$ H scattering at 4.889 eV and 1.207 eV in units of $\pi a_o^2 sr^{-1}$. Experimental data at 4.889 eV ($\bigtriangledown$) and 1.207 eV ($\Diamond$) are by Williams[4].

The integrated elastic cross sections were also calculated and a sample of them are shown in Table 2.

Table 2: e^--H Integrated Elastic Cross Sections

Energy (eV)	1.207	2.171	3.423	8.704
Cross Section $\left(\pi a_o^2\right)$	24.23	18.66	14.96	8.207

Complete results of this work will be reported at the conference with discussion.

[1] R.K. Nesbet,in *Variational Method in Electron-Atom Scattering* (Plenum, New York, 1988), and references there-in.
[2] T. T. Gien, *Phys. Rev. A* **52** 1186 (1995), and references there-in.
[3] T. T. Gien, *J. Phys. B* **31** , L698 (1998).
[4] J. F. Williams, *J. Phys. B* **8**, 1683 (1975).