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GENERALIZED OSCILLATOR STRENGTHS FOR THE RESONANCE TRANSITION IN CADMIUM

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Relative differential cross sections (DCS) for electron elastic scattering and excitation of cadmium states have been measured and reported recently [1]. Several theoretical approaches have been utilized to calculate absolute DCS for elastic [2-4] scattering and electron excitation DCS [3,5,6]. Nahar [2] used Dirac equation with model potential, Madison *et al* [3] performed first order distorted wave (DWB1) approximation, and Toronto group [4-6] have formulated a completely relativistic distorted wave (RDW) theory of electron excitation of closed shell atoms. There is general agreement between experiment and theory in shape of DCS. This is an attempt to use normalization procedure to put relative measurements of DCS on absolute scale.

Measurements of DCS have been performed in a crossed electron - atom beam technique. The electron spectrometer was operating with overall energy resolution of 50 meV while the angular resolution of the spectrometer was estimated to be 1-2°. Primary beam current was 1-10 nA. An electron detector collects scattered electrons of specific energy loss at a particular scattering angle with respect to the incoming electron beam over a solid angle 10^{-3} sr. After applying effective pathlength correction factors, relative DCS were obtained.

To get absolute values of DCS from relative measurements, different normalization procedures could be used. One could normalize DCS at particular angle on some calculated value. Another possibility is to obtain integral cross sections from DCS measurements and to normalize those to some experimentally or theoretically obtained cross section. Thirdly, one could convert DCS to generalized oscillator strengths (GOS) and to normalized those on experimentally very well known optical oscillator strength (OOS) for particular excitation. These several possibilities have been investigated for sodium DCS measurements [7].

Normalization on OOS could be obtained by fitting GOS values (obtained by converting small angle DCS at particular impact energy). Different fitting curves are present in literature. Skerbele and Lassettre [8] used polynomial fit

$$GOS=\frac{1}{(1+x)^6}\sum_{i=0}^{m} f_i\left(\frac{x}{1+x}\right)^i$$

where $x=(K/\alpha)^2$, **K** - momentum transfer, $\alpha = (2I)^{1/2} + [2(I-W)]^{1/2}$, f_0 - optical oscillator strength, I and W - ionization and excitation energies in atomic units, respectively. They applied this for the 6^1P_1 excitation in mercury. Vušković *et al* [9] utilized parabolic function of $\mathbf{K}^2$ for the fitting curve to obtain electron impact cross sections for the 2^2P state excitation in lithium. Recently, Msezane and Sakmar [10] have obtained the formula for the GOS

$$GOS(K)=-f_0\left[1+\frac{x^2-1}{1-xy}\right]$$

where $x^2 = 1-W/E$, $y=\cos\theta$, applicable only to optically allowed transitions for small K^2 values. Ozimba *et al* [11] contrasted this formula for the resonance transitions in cadmium.

These normalization procedures for the 5^1P_1 at impact energy range from 6.4 to 85 eV will be discussed at the conference.

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