POSITRONIUM FORMATION FROM ATOMIC HYDROGEN

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The first Born approximation and the distorted wave Born approximation are used to calculate the cross sections for positronium (Ps) formation in all bound states by the impact of intermediate energy (20 - 500 eV) positrons on atomic hydrogen. Differential and integrated cross sections for the formation of Ps(1s), Ps(2s), Ps($2p_0$) and Ps($2p_1$) are calculated individually and the $1/n^3$ behavior (n being the principal quantum number) for charge transfer cross sections is used for $n \geqslant 3$ to obtain the total cross sections for positronium formation. The formation of Ps in s-state is evaluated using formulation of the distorted wave Born approximation similar to that described in Ref. 1. All calculations are carried out using the prior form of the interaction. The p-state wave functions of Ps, unlike spherically symmetric s-state wave functions, are angle dependent and introduce complexity in the calculations of capture cross sections. The complexity is reduced by expressing the angle dependent part of the wave function in terms of an exponential factor. It is observed in the present calculations that the cross section for Ps formation in n = 1 state dominates significantly over that for n = 2 state. No experimental values of cross sections for Ps formation from atomic hydrogen are available at present. The present results for the formation of Ps(1s) compare[2] favorably with some of the other theoretical investigations. The features of the present differential cross section curves for Ps formation showing a large maximum in the forward direction followed by a minimum also agree well with works of other investigators. The total cross sections for the formation of Ps in all bound states at various impact energies are shown in Fig. 1 on the next page.

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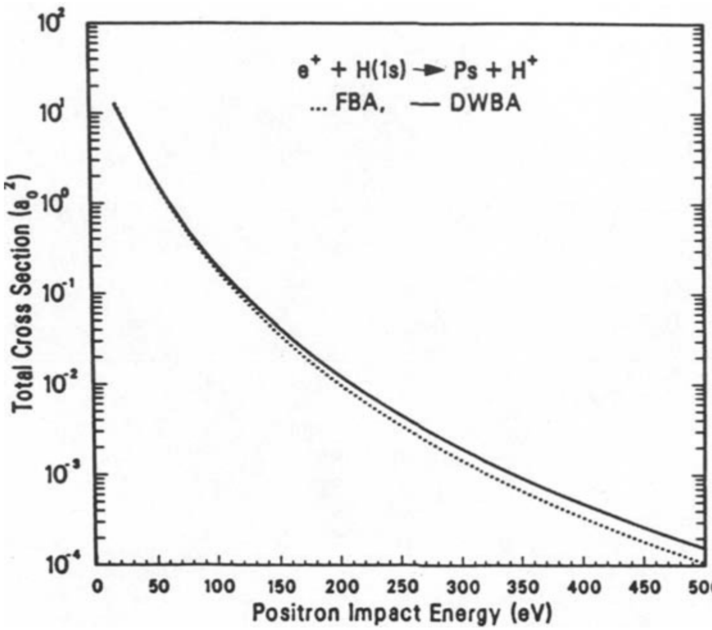

Fig. 1. Total integrated cross sections for positronium formation from atomic hydrogen at various positron impact energies.

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RERERENCES

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