Effect of exchange and absorption potentials in the distorted wave calculations for electron impact excitation of autoionizing states of alkali atoms

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Synopsis We have calculated the differential and integral cross sections for electron impact excitation of lowest autoionizing states of alkali atoms using a distorted wave method with static, exchange and absorption potential. It is found that the absorption potential improves the results in the intermediate energy region.

We have applied a distorted wave method to calculate the differential and integral cross sections for electron impact excitation of the first auoionizing states of alkali atoms (Li, Na, K, Rb and Cs). In the distorted wave method we have used the complex distortion potential which includes the static, exchange and absorption potentials. The exchange potential which we have used is that of Furness and McCarthy [1] and the absorption potential is that of Staszewska *et al* [2]. In the initial channel we have used the initial state static potential and in the final channel a linear combination of static potentials of initial and final states with equal weight.

In our calculation, we have used the multi-zeta wavefunctions of Clementi and Roetti [3] for lithium, sodium, potassium and rubidium and that of McLean and McLean [4] for cesium. We have modified the computer program DWBA1 written by Madison and Bartschat [5] so that it can be used for complex potential.

We have made calculations with the following choices for the distortion potential:

(i) static potential only
(ii) static + exchange potential
(iii) static + exchange + absorption potential.

Comparing the results with other available theoretical and experimental results it is found that the absorption potential has significant effect in the intermediate energy region and it improves the result and bring them closer to the experimental results. The effect of absorption potential is higher than the exchange potential.

These calculations are part of the calculations which we are doing to see how the first order distorted wave method can be improved for both elastic and inelastic processes by including all potentials, as in optical potential method for elastic scattering, to take account of higher order terms of Born series.

The detailed comparison of the present results with other available theoretical and experimental results will be given in the Conference.

References

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