ZERO-DEGREE AUGER PROJECTILE ELECTRON SPECTROSCOPY OF B^{2+} IN 3-8 MEV COLLISIONS WITH $H_2^{\diamondsuit}$

T.J.M. Zouros[1,2], E.P. Benis[2] and Pat Richard[3]

1) Department of Physics, University of Crete, Heraklion, Crete, Greece
2) Inst. of Electronic Structure and Laser, FORTH, P.O. Box 1527, 71110 Heraklion, Crete, Greece
3) Dept. of Physics, J.R. Macdonald Lab., Kansas State University, Manhattan, KS 66506-2604

Recently, we have reported on the investigation of electron production mechanisms in H-like and He-like [1, 2] boron ions in collisions with H_2 gas targets. The projectile electron spectra were found to result predominantly from the Auger decay of doubly or triply excited [3] states produced by direct capture or resonant elastic/inelastic scattering of quasi-free target electrons off the ions. Here, we follow-up these investigations with a report on electron production in 4-8 MeV collisions of Li-like $B^{2+}(1s^22s)$ with H_2 targets.

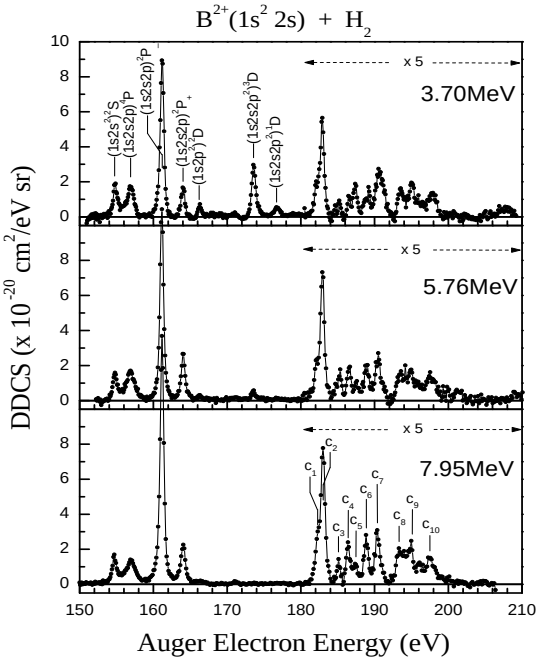

Fig. 1. Absolute electron double differential cross sections (DDCS) for 3.70, 5.76 and 7.95 MeV collisions of $B^{2+}(1s^22s)$ with H_2. The production of the ^2S, ^4P, $^2P_-$, $^2P_+$ and ^2D Li-like doubly excited states is most prominent. The Be-like doubly excited states $(1s2s2p^2)^3D$ and $(1s2s2p^2)^1D$ are also observed. Higher-lying KLn lines (c_1–c_{10}) are scaled for improved presentation as indicated.

The high resolution spectra for all the boron charge states were recorded at zero-degrees with respect to the ion beam with a mean instrumental energy resolution of 0.2% and an absolute experimental uncertainty in the Auger line energy (projectile rest frame) of 0.6–1.1 eV. The three electron spectra for B^{2+} collisions with H_2 are shown in Fig. 1. The Be-like $1s2s2p^2\,{}^{3,1}D$ lines are known to be produced by resonant elastic scattering off the B^{2+} ion of the quasi-free H_2 electrons. These lines go through a maximum at the ion collision energy of 3.8 MeV. The Li-like $(1s2s)2p\,{}^2P_-$ and $1s2p^2\,{}^2D$ lines are produced by direct excitation. The energies of higher-lying KLn lines (c_1–c_{10}) have been compared to Hartree-Fock calculations using the Cowan code. Our analysis shows most of these lines can be assigned to Li-like $1s2lnl''$ states with $n = 3-4$ Auger decaying to the $B^{3+}(1s^2)$ ground state. The proposed intermediate states, the Auger electron energies resulting from their decay to the ground state, and the most probable production mechanisms are discussed.

References

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E-mail : tzouros@physics.uoc.gr