PRODUCTION OF DOUBLY EXCITED STATES IN HE-LIKE BORON*

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We report on the production of doubly excited ionic states in two-electron Boron ions (B^{3+}) for collisions of 5.72 MeV B^{4+} on H_2. Doubly excited states are populated primarily via the resonance transfer and excitation process (RTE)[1]. The experimental signature of the production of doubly excited ionic projectile states is the detection of the electrons resulting from the Auger decay of such states.

The ionic beam was produced in the KSU Tandem Van de Graaff accelerator. B^{4+} ions were obtained by post-stripping the primary B^{3+} beam at a carbon foil target before colliding it with the H_2 target. The beam energy was chosen so that the electron energies are detected at the binary encounter peak region, so that the data can be normalized with respect to the binary encounter yield. The spectra were measured with the new paracentric hemispherical spectrograph[2]. The data were recorded in four different energy slices, matched in the overlapping regions and normalized to the binary encounter peak after being corrected for dispersion.

The spectra, plotted in the projectile rest frame, are shown in fig. 1. The formation of the $(2p^2)^1D$ line is seen to be the most prominent. Although the conventional single configuration scheme can be safely applied for the 2l2l' lines, the admixture of many configurations is substantial for the 2lnl' ($n \geq 3$) states. Therefore, the aformentioned notation 2lnl', retained in fig. 1, should only be taken as a convenience, since there is still a one-to-one correspondence between the radial quantum numbers (2 and n) and the true states[3].

Following Lipsky's calculations[3] for the doubly excited states in isoelectronic helium below the n = 2 threshold, the Auger electron energies resulting from the decay of B^{3+}(2lnl') doubly excited states to the ground state B^{4+}(1s), were obtained. In fig. 1, the results for the energy limits of each isoelectronic sequence are noted. Although the experimental energy resolution was not adequate for resolving the 2lnl' ($n \geq 3$) states, the experimental data are seen to be in excellent agreement with the calculations.

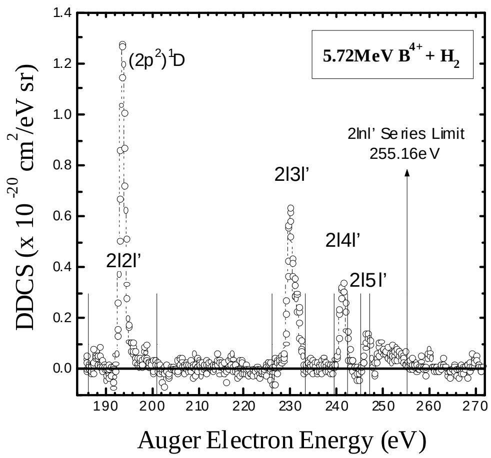

Figure 1. Experimental data for collisions of 5.72 MeV B^{4+} with an H_2 target. Isoelectronic sequences of doubly excited states of He-like Boron formed by RTE and de-exciting via Auger decay are seen to be in excellent agreement to the theory (solid lines). A dashed line connecting the experimental points is drawn to guide the eye. DDCS are accompanied by an average statistical error bar of 0.5×10^{-20} cm^2/eV sr.

References

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