Lawrence Berkeley Laboratory
UNIVERSITY OF CALIFORNIA

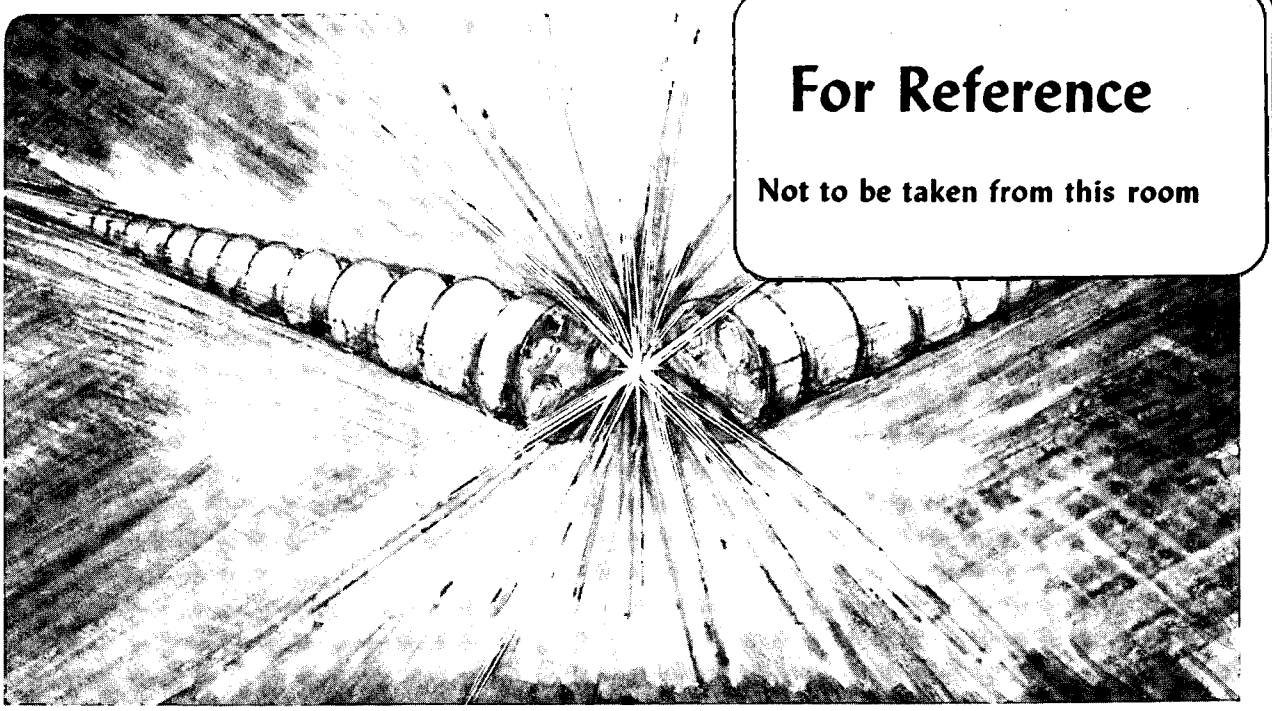
Accelerator & Fusion Research Division

To be presented at the Nagoya Seminar on Atomic Processes in Fusion Plasmas, Nagoya, Japan, September 5-7, 1979

CHARGE-TRANSFER AND IMPACT-IONIZATION CROSS SECTIONS FOR HIGHLY STRIPPED CARBON AND NIOBIUM IONS INCIDENT ON ARGON AND HYDROGEN

K. H. Berkner, W. G. Graham, R. V. Pyle, A. S. Schlachter, and J. W. Stearns

May 1979



Prepared for the U. S. Department of Energy
under Contract W-7405-ENG-48

DISCLAIMER

May 7, 1979 LBL-9263

CHARGE-TRANSFER AND IMPACT-IONIZATION CROSS SECTIONS FOR HIGHLY STRIPPED CARBON AND NIOBIUM IONS INCIDENT ON ARGON AND HYDROGEN*

K. H. Berkner, W. G. Graham**, R. V. Pyle, A.S. Schlachter, and J. W. Stearns

Lawrence Berkeley Laboratory
University of California
Berkeley, California 94720

We have measured the cross sections for net impact ionization of H_2 and Ar targets by 290 keV/amu and 1.1 MeV/amu C^{+q} ions for q = 4-6, and by 3.4 MeV/amu Nb^{+q} ions for q = 23-36. We have also measured charge-transfer cross sections for these projectiles in H_2 and Ar.

The net impact-ionization cross section, σ_i, is the weighted sum, $\Sigma n\sigma(n)$, where σ_n is of the cross section for removal of n target electrons. This cross section can be very large, especially for an Ar target, where multiple ionization is an important process. Typical values for the net ionization cross section are $3.3 \times 10^{-15} cm^2$ for C^{+6} in Ar at 1.1 MeV/amu, $1.0 \times 10^{-14} cm^2$ for Nb^{+34} in H_2 at 3.4 MeV/amu, and $3.4 \times 10^{-14} cm^2$ for Nb^{+34} in Ar at 3.4 MeV/amu. Our results for the net ionization cross section are in reasonably good agreement with the weighted sum of recently measured $\sigma(n)$.[1]

The sum of the charge-transfer and impact-ionization cross sections for a projectile X^{+q} in H is the cross section for electron loss from the hydrogen atom. We use the above results (divided by a factor of 2 for comparison with calculations for H atoms) to extend to large q values and to different ion species the experimental confirmation of our previously determined theoretical/experimental scaling rule[2] for electron loss from a hydrogen atom in collision with a heavy, highly stripped ion.

---

*This work was supported by the Fusion Energy Division of the U.S. Department of Energy under contract No. W-7405-ENG-48.

**Present address: New University of Ulster, Coleraine, Northern Ireland.

[1] C. L. Cocke, submitted to Physical Review.

[2] R. E. Olson, K. H. Berkner, W. G. Graham, R. V. Pyle, A. S. Schlachter, and J. W. Stearns, Physical Review Letters 41, 163 (1978); and K. W. Berkner, W. G. Graham, R. V. Pyle, A. S. Schlachter, and J. W. Stearns, submitted to XI ICPEAC (Kyoto, 1979).

TECHNICAL INFORMATION DEPARTMENT
LAWRENCE BERKELEY LABORATORY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA 94720