Measurement of Absolute Excitation Cross Sections in Highly-Charged Ions Using Electron Energy Loss and Merged Beams

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There is increasing emphasis within this decade on understanding energy balance and new phenomena observed in high electron temperature plasmas. The UV spectral return from FUSE, and the X-ray spectral return from the HETG on Chandra and the LETGS on XMM-Newton are just beginning. The line emissions are almost entirely from highly-charged ions (HCIs) of C, N, O, Ne, Mg, S, Si, Ca, and Fe. In addition, the Constellation-X mission, currently in the planning stages, will provide high-throughput X-ray spectroscopy up to photon energies of 0.12 nm (10 keV), where the primary line emitters will again be the HCIs. This array of space instruments is providing an overwhelming return of HCI spectral data from a variety of astrophysical objects. Collision strengths and Einstein A-values are required to convert the observed spectral intensities to electron temperatures and densities in the stellar plasma [1].

The JPL electron energy-loss and merged-beams approach [2] has been used to measure absolute collision strengths in a number of ions, with critical comparisons to the best available theories. Experimental methods will be reviewed, and results presented on experimental comparisons to R-Matrix and Breit-Pauli theoretical results in C^{3+}[3], O^{2+}[4], O^{5+}[5], S^{2+}[6], and Fe^{9+} [7]. Work is planned for comparisons in Mg^{q+}, and higher charge states $Fe^{(10-15)+}$.

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