ELECTRON LOSS CROSS SECTIONS FOR LOW CHARGE STATE IONS

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Projectile electron loss cross sections have been calculated for a series of systems using large multi-electron, two-center basis sets within the classical trajectory Monte Carlo method. Studied is U^{28+} colliding with H, N and Ar targets. Here, 39-, 45- and 54-body calculations are used to represent the collision systems, respectively. These electron loss cross sections are central to the design of the SIS-100 cyclotron ring at GSI-Darmstadt. The present calculations predict a constant beam lifetime between 10 and 150 MeV/amu which leads to very stringent vacuum requirements, especially at the highest energies.

Multi-electron calculations have also been performed for Ar and Xe isoelectronic ions colliding with nitrogen. These systems include K^+ and Cl^-, and Cs^+ and I^- at energies from 10 keV/amu to 30 MeV/amu. At all energies, the negative ion electron removal cross section is approximately a factor of three larger than its isoelectronic positive ion.

In the above cases the calculated cross sections are compared to available experimental data. The agreement between theory and experiment is reasonable. However, for all systems our multi-electron based cross sections depart significantly from those predicted by one-electron theories such as the binary encounter and first Born calculations. The inclusion of multiple electron removal, Auger losses, and preserving unitarity in the calculations is essential for an accurate description of the scattering processes.

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