IONIZATION CROSS SECTIONS FOR ION-ATOM COLLISIONS IN HIGH ENERGY ION BEAMS*

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Knowledge of ion-atom ionization cross sections is of great importance for many accelerator applications. We have recently investigated theoretically and experimentally the stripping of more than 18 different pairs of projectile and target particles in the range of 3-38 MeV/amu to study the range of validity of both the Born approximation and the classical trajectory calculation. In most cases, both approximations give similar results [1,2]. However, for fast projectile velocities and low ionization potentials, the classical approach is not valid and can overestimate the stripping cross sections by neutral atoms by an order-of-magnitude [3]. We have developed a hybrid approach, which automatically chooses between the Born approximation and the classical mechanics approximation depending on the parameters of the collision.

When experimental data and theoretical calculations are not available, approximate formulas are frequently used. Based on experimental data and theoretical predictions, a new fit formula for ionization cross sections by fully stripped ions is proposed. The resulting plots of the scaled ionization cross sections of hydrogen by fully stripped ions are presented. The new fit formula has also been applied to the ionization cross sections of helium [4]. Again, the experimental and theoretical results merge close together on the scaled plot.

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