Interactions of Highly Charged Ions with Surfaces

Uwe Thumm

J. R. Macdonald Laboratory, Department of Physics, Kansas State University

Manhattan, Kansas 66506–2604, USA

Slow collisions between highly charged ions and many-electron targets, such as large atoms, molecules, clusters, or surfaces in general lead to the transfer of several electrons from the complex target to the projectile. The efficient capture is due to the relatively long interaction time (on an atomic time scale), the strong Coulomb force exerted by the highly charged projectile on loosely bound target electrons, and a large number of excited projectile states for electrons to be captured into.

Within a semi-classical model, I discuss the dynamic neutralization and relaxation of slow multiply charged ions which are reflected on metal and insulator surfaces. Special emphasis is devoted to near-surface interaction mechanisms. The numerical simulations include a Monte-Carlo sampling over electron transfer channels and detailed ionic structure calculations of projectile energy levels. Calculated results for a large number of reflected projectile trajectories are compared with measured projectile kinetic energy gains, final charge-state distributions of the reflected projectiles, and total emitted electron yields and spectra.