B.4.2. Soft Collisions between Highly Charged Ions and C_{60}—*U. Thumm*

With respect to interactions with clusters (Publication #53), we continued to investigate the generation and decay of hollow ions (Publication #53) [1], the simulation of Auger electron and X-ray spectra that are due to the relaxation of the collisionally produced multiply excited projectiles [1], the projectile kinetic energy gain (Publication #10), and angular distributions (Publication #35).

B.4.2.1. Influence of the Target Dielectic Response on the Projectile Deflection

Due to the large polarizability of C_{60} compared to that of atomic targets, the trajectory of a highly charged ion capturing electrons in the "soft" over-barrier region of impact parameters is affected measurably by the polarization potential between projectile and target. Recent experiments at our laboratory measured the angular distributions of 2.5 keV Ar^{8+} projectiles following the capture of 1 to 5 electrons from C_{60}. The experimental results are in good agreement (Publication #35) with the predictions of our (mostly) classical model for soft collisions of slow, highly charged ions with C_{60}, which has previously shown to be successful in predicting total cross sections for such collisions (Publication #53).

We also computed angle differential cross sections for collisions between 26.4 keV Ar^{8+} ions and C_{60} molecules (Publication #78). Using our classical over-barrier simulation, we calculated the deflection function for large impact parameters. To compare with experimental data the theoretical cross section values were convoluted with an instrumental function. The absolute experimental cross section for retaining one electron on the projectile turns out to be well described by the absolute theoretical cross sections for initially capturing one to four electrons from the target.

B.4.2.2. Simulation of Projectile Energy Gain Spectra

The recent experiment by Selberg *et al.*, [2] measured the projectile kinetic energy gain of 3.3 q keV Ar^{q+}, q=8,13...15 ions after collisions with C_{60}. We have extended our dynamical classical over-barrier model for charge transfer in soft ion-cluster collisions in order to simulate the projectile kinetic energy gain of 3.3q keV Ar^{q+} ions in large impact parameter collisions with neutral C_{60} targets (Publication #10). Our semi-classical model allowed for the direct calculation of the energy defect and of the projectile kinetic energy gain in two different ways, either as difference of electronic binding energies before and after the collision or by integration of the dynamically varying force between the collision partners along the trajectory. A comparison

between the two ways provided an intrinsic test of the model calculations. Comparison with experimental data [2] showed good agreement in the main features of the projectile energy gain spectra and facilitates their interpretation by specifying the number of transferred electrons and projectile shells into which electrons are captured.

References

1. U. Thumm, Phys. Rev. A 55, 479 (1997).
2. N. Selberg, *et al.*, Phys. Rev. A 53, 874 (1996).