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MONTE CARLO CALCULATIONS OF THE DETECTION SOLID ANGLE OF ELECTRONS EMITTED FROM SLOWLY DECAYING PROJECTILE ION AUGER STATES

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Abstract. *The long life times of the 1s2s2p ^4P metastable states (in the 10^{-6}-10^{-9} s range) of ions formed in energetic ion-atom collisions permits these to Auger decay well after their excitation in the target making it hard to determine their effective detection solid angle. Our goal is to investigate the formation mechanisms of these states through the study of their Auger decay and the determination of this solid angle is therefore of vital importance. Here, we have used the SIMION 8.1 package to treat the problem in an effective Monte Carlo type calculation. The experimental setup geometry consisting of a hemispherical deflector analyzer (HDA) with injection lens and position sensitive detector (PSD) was accurately simulated and the electrostatic potentials were determined. Random electron distributions in energy and emission angles were created simulating the metastable Auger electron decay along the path of the projectile ions, while the trajectories of the emitted electrons were traced through the HDA and counted at the PSD. A systematic study based on the above simulation procedure allowed for the accurate determination of the relevant solid angle.*

Here, we used the SIMION 8.1 package [3] to treat the problem in an effective Monte Carlo type calculation. SIMION uses the finite difference method to solve for the potential in the lens and HDA while offering an easy user-friendly environment including programming to fly the electrons. Initially, the experimental setup geometry was accurately simulated and the electrostatic problem was solved. Random electron distributions in energy and emission angles were then created simulating the metastable Auger decay along the projectile ion trajectories, while the number of electrons detected at the PSD was recorded. A systematic study based on the above process allowed for the accurate determination of the relevant correction factor for the ^4P decay which is vital for the understanding of the formation mechanisms.