FORMATION AND DECAY OF THE RYDBERG STATES OF MULTIPLY CHARGED IONS INTERACTING WITH SOLID SURFACES

M. A. MIRKOVIĆ[1], N. N. NEDELJKOVIĆ[2], and D. K. BOŽANIĆ[3]
[1]University of Belgrade, Faculty of Physics, P.O. Box 368, Belgrade, Serbia
E-mail: gmirkomarko@sezampro.rs
[2]University of Belgrade, Faculty of Physics, P.O. Box 368, Belgrade, Serbia
E-mail: hecata@ff.bg.ac.rs
[3]Vinča Institute of Nuclear Sciences, P.O. Box 522, Belgrade, Serbia
E-mail: bozanic@vin.bg.ac.rs

Abstract. Processes of formation and decay of the Rydberg states of multiply charged ions escaping solid surfaces with intermediate velocities ($v \approx 1$ a.u.) are complex quantum events that require a detailed quantum description. We developed a two-state vector model of electron captures into lower-*n*, but high-*l* Rydberg states. The electron exchange process is described by a mixed flux through a moving plane, positioned between the solid surface and the ionic projectile. Generally, the lower-*n* model reproduced the experimentally observed non-linear trend of the *l* distributions from $l = 0$ to $l_{max} = n - 1$. In the case of large values of the angular momentum quantum numbers l, the model takes into account an importance of a wide space region around the projectile trajectory. The reionization of the previously populated states is also taken account and can be described as a decay process of the electron wave function. The coresponding ionization rates are obtained by an appropriate etalon equation method: in the large-l case the radial electronic coordinate ρ is treated as variational parameter. The theoretical predictions based on that population–reionization mechanism fit the available beam-foil experimental data concerning the SVI, ClVII and ArVIII ions, as well as the experimental data obtained in the interaction of multiply charged ions with micro-capillary foil.