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# TWO-STATE VECTOR MODEL FOR THE ION-SURFACE INTERACTION: FOUNDATION AND APPLICATION

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**Abstract.** Studies of the intermediate stages of the Rydberg state population of multiply charged ions impinging upon a solid surface are not only of fundamental scientific interest, but also highly relevant in the analysis of the various surface modifications such as the recently obtained surface nanostructures (craters, hillocks and some other structures such as calderas, nanopores etc.): see Aumayr et al 2011, and Lake et al 2011. The appropriate theoretical model which takes into account both the initial and final electron states has to be founded within the framework of the time-symmetrized quantum mechanics. The corresponding two-state vector model has been firstly formulated for the analysis of the proton neutralisation at solid surface: see Nedeljković et al 1991, and further elaborated to the case of highly charged ions: see Nedeljković et al 1994 and a series of articles by the same group of authors.

In our recent theoretical study we apply the model to obtain the final ionic charge in front of the metal surface and to calculate the corresponding neutralization energy: see Majkić et al 2019. We discuss the interplay of the collision geometry and the surface parameters in the neutralization process for the metal surface covered with a thin dielectric film. The ionic velocity plays a decisive role for the particular surface modification. For very low ionic velocity, the neutralization energy gives the main contribution in the surface nanostructuring, while for large ionic velocity the nanofeatures are created due to the kinetic energy loss (nuclear and electronic stopping power). The existence of the critical velocity, which separates these two regions, is discussed. At the conference we consider the role of the critical velocity in the appearance of the particular nanostructures at various types of surfaces.

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