Analytical theory of medium-energy protons reflection from the surface of solid states

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The study of the processes of protons interaction with a solid state is necessary to understand and analyze the situations occurring with the surface facing the thermonuclear plasma in controlled thermonuclear fusion plants. The relevance of this topic is due to the wide application of protons to analyze solid surface by means of such methods as Ion Scattering Spectroscopy, Rutherford Back Scattering, Low Energy Ion Spectroscopy, Medium Energy Ion Spectroscopy. To estimate the rate of surface erosion under the influence of proton fluxes, for the quantitative interpretation of the above-mentioned methods of surface analysis, it is necessary to know the integral and differential scattering characteristics, such as energy and particles reflection coefficients, energy and angular distributions. This paper presents a theory of proton reflection from the surface of solid states, correctly describing the process in the energy range from hundreds of eV to tens of MeV, which does not contain restrictions on ion sensing angles and target thicknesses. A theoretical description of the reflection of protons from the layered inhomogeneous targets is presented. The analytical theory is validated on the basis of comparison with computer simulation results and experimental data for a wide number of elements and energy interval.

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