investigation of THE interaction of hydrogen isotores of thermonuclear energies with structural materials [[1]](#footnote-1)\*)

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Knowledge of the interaction of light ions with solids is necessary for the practical implementation of a number of technological processes [1,2]. Solid state analysis methods (Ion Scattering Spectroscopy – ISS, Low Energy Ion Spectroscopy – LEIS) based on target probing with light ions (hydrogen isotopes and helium ions) are widely used to study targets of complex composition. A consistent quantitative description of reflection from and penetration through structural materials is required to solve the problems of the "first wall" in the context of controlled thermonuclear synthesis.

This paper presents a theoretical description of light ion scattering processes. A numerical model is developed which uses the recent data on elastic and inelastic scattering cross sections. Calculations are performed using analytical and numerical models. The results are compared against the experimental data. Both the reflection and penetration of light ion fluxes through layers of polycrystalline samples are considered. The developed models are extended on the case of multi-layered samples. The interaction of light ions with energies between hundreds of eV and tens of keV with materials in a wide range of atomic numbers is considered. A critical review of existing analytical models of multiple scattering is performed.

The models of energy losses for light ions are reviewed. It is shown that the widely used Fokker-Planck–MFP modelis not applicable in the energy range from hundreds of eV to several keV. Moreover, it causes substantial errors in the retrieved parameters, such as the average ion energy loss per unit length. The latter is determined with an error of hundreds of percent [3] and differs significantly when obtained from reflection and transmission measurements.

The paper outlines the problem of determining the differential cross-section of elastic scattering of light ions in solids. It is shown that in order to achieve a reasonable description of the experimental data, it is necessary to tune significantly the parameters of the differential elastic scattering cross section compared to those recommended in the literature.

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References

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/L/Pt/ru/GT-Lobanova.docx) [↑](#footnote-ref-1)