Elastic Proton-Scattering on ^{13}C and ^{15}C Nuclei in the Diffraction Theory

M.A. Zhusupov[1], **E.T. Ibraeva**[2], **R.S. Kabatayeva**[1]

[1]al-Farabi Kazakh National University, Almaty, Kazakhstan

[2]Institute of Nuclear Physics, Almaty, Kazakhstan

A study of non-stable, neutron- or proton-rich isotopes put the nuclear physics to the fundamental questions of determination of the nucleon stability boundaries, nuclear shells evolution and super-heavy elements synthesis in accelerators and cosmic objects. Carbon isotopes are intensively studied what is caused by both the large distribution of the stable ^{12}C nucleus and the obtaining of the beams of non-stable carbon ^{15,16,17,19,20,22}C isotopes at the facilities in GANIL, NSCL MSU, RIKEN and other.

The objective of the present study is a microscopic calculation of the matrix elements and the analysis of the differential cross sections of proton scattering on the ^{13}C and ^{15}C nuclei in the framework of the Glauber theory with the wave functions of the shell model at energies of 1 GeV. The role of the interference effects in the Glauber multiple scattering operator has been estimated.

There is a representation of the calculation technique of the matrix element of proton elastic scattering on the ^{13}C nuclei in the framework of the diffraction Glauber theory in the study. A neglect of the "small" nuclear momenta $\vec{Q}_i$ in comparison with the transferred ones $\vec{q}$, taken in the calculation, allowed one to sum the total series of multiple scattering and the use of the shell model wave functions in the harmonic oscillator basis provided us with the analytic calculation of the dynamic integrals. The obtained calculation formula of the matrix element is a product of two multipliers, one of which is a sum of the series of multiple scattering and another one stands for the scattering on nucleons from different shells of the ^{13}C nucleus. Thus, it became possible to calculate the contributions into the differential cross sections from both the different scattering orders and the scattering on nucleons located on different shells.

The absence of experimental data for p^{15}C-scattering motivated us to compare the differential cross sections of the close isotopes of carbon ^{12}C and ^{13}C at energies of 1 GeV for which the experimental data are available. The cross sections of the p^{15}C-scattering repeat the peculiarities of the above-mentioned ones and are consistent with them by absolute values and by locations of minimums and maximums.