MICROSCOPIC FOLDING POTENTIAL IN FUSION OF $^{12}C + ^{12}C$ WITH INCLUSION OF QUARK EFFECTS IN NUCLEI

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The report will present the development of a new method for incorporating quark effects into the microscopic folding formalism in describing the scattering of light nuclei with the possibility of fusion. The fusion process is performed on the basis of an understanding of how a compound nucleus is formed during such a reaction. Note that the inclusion of quarks into the microscopic folding formalism has not been studied yet.

For such a study the following methods have been developed.

(1) Synthesis of nuclei in reaction is investigated within the folding approximation of the cluster model, created by semi-realistic nucleon-nucleon potential and shell-model description of the internal structure of interacting nuclei [1-2].
(2) Characteristics of nucleons in nuclei are changed due to influence of quarks in nuclei according to Quark-meson-coupling model (QMC [3-4]).
(3) Formation of compound nucleus and fusion are studied with high precision and tests on the basis of the method of Multiple Internal Reflections.

The following results are obtained.

(1) Parameters and wave functions of resonance states of ^{24}Mg are determined in fusion of two ^{12}C nuclei. This process is studied with influence of quarks in nuclei (quark effects) and without such influence.

(2) In both cases clear maxima of probability of formation of compound nucleus are established. Such a phenomenon has not been studied taking into account quark effects.

(3) Difference between quasibound energies in synthesis of ^{24}Mg for the folding potential taking into account quark effects and without those is established.

(4) Only the first quasibound energies for $^{12}C + ^{12}C$ are smaller than the barrier maximums. At the first quasibound energy the compound nuclear system has barrier which prevents its decay going through tunneling phenomenon. This is the new excited stable nucleus ^{24}Mg synthesized in reaction.

Investigation has shown visible changes in formation of compound nucleus in reaction after inclusion of quark effects in nuclei. Synthesis of isotopes of Magnesium from isotopes of Carbon is estimated. All calculations are obtained with comparison with available experimental data.

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2. S.P. Maydanyuk, V.S. Vasilevsky. Systematic study of bremsstrahlung emission in reactions with light nuclei in cluster models. Phys. Rev. C108 (2023) 064001. arXiv: 2304.04082.
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4. K. Tsushima. Magnetic moments of the octet, decuplet, low-lying charm, and low-lying bottom baryons in a nuclear medium 2008. arXiv: 2008.03724 [hep-ph]. Prog. Theor. Exp. Phys. 2022 (4) (2022) 043D02.