

REVIEW

for the dissertation paper of Valiolda D.S. on the topic

"Study of the Coulomb breakup of exotic nuclei in the quantum-mechanical approach", submitted for the degree of Doctor of Philosophy (PhD) in the specialty "6D060500 - Nuclear Physics"

In the framework of the dissertation paper of Valiolda D.S. for a more detailed study of the mechanism of the halo structure of exotic nuclei a quantitative model was developed to describe the Coulomb breakup of nuclei with one neutron halo in a wide range of collision energies (5-70 MeV/nucleon), including both excited and low-lying resonant states of ^{11}Be . The Coulomb breakup of the nuclear halo is studied numerically by solving the nonstationary Schrödinger equation with a nonperturbative algorithm on a three-dimensional spatial grid. The developed computational scheme opens up new possibilities in the study of the Coulomb, as well as the nuclear breakup of halo nuclei, both on heavy and light targets.

One of the outstanding tasks of the work is to study the contribution of low-lying resonances to the breakup cross section. In the dissertation work of Valiolda D.S. the low-lying resonance states of the ^{11}Be nucleus were taken into account for the first time, which clearly improved the theoretical description of the experimental data on the cross section for the breakup reaction $^{11}\text{Be} + ^{208}\text{Pb} \rightarrow ^{10}\text{Be} + n + ^{208}\text{Pb}$ at intermediate energies and explains the appearance of visible peaks in the energy region of 1.23, 2.78 and 3.3 MeV, which corresponds to the position of the peaks resonances $5/2^+$, $3/2^-$ and $3/2^+$.

Within research on the topic of the dissertation, the theoretical model was extended for the first time to the region of low energies. This approach was used to calculate the ^{11}Be breakup cross section on a heavy target (^{208}Pb) at a beam energy of 5–30 MeV/nucleon, taking into account the Coulomb and nuclear interactions between the projectile and the target. Thus, the obtained results are important for testing the existing theoretical models and for practical application of theoretical calculations in the experiments on the study of exotic nuclei in low-energy radioactive beams.

Results of the dissertation research were provided on actual topic and besides the undoubted theoretical value, they also have an applied value. Reliability of the obtained results was proved by successful presentation of the materials of the research work at the international scientific conferences and at the seminar in the BLTP of JINR (Dubna, Russia) and became the basis for publications in the highly ranked journals such as European Physical Journal A, Letters in PEPAN, Eurasian Journal of Physics and Functional Materials and others.

During the preparation of the dissertation thesis Valiolda D.S. took the initiative and showed independence in research implementation. Over the years of work from undergraduate, Valiolda Dinara has shown herself as a responsible specialist capable of solving various complicated tasks in scientific research of a theoretical nature. Accuracy in work, punctuality, industriousness and high abilities for numerical calculations, interest and enthusiasm for theoretical calculations enabled her to obtain new, relevant results in fundamental research and prove high professionalism of the doctoral student.

I consider that the dissertation work of Valiolda D.S. on the topic "Study of the Coulomb breakup of exotic nuclei in the quantum-mechanical approach" meets the qualification requirements of dissertation for the degree of Doctor of Philosophy (PhD) and the author deserves the awarding this scientific degree in the specialty "6D060500 - Nuclear Physics".

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ЗАБЕРЯЮ

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