

A NEW OUTLOOK ON THE SQUARE-WELL POTENTIAL APPROACH FOR ASTROPHYSICAL FUSION REACTION

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Latest achievements in experimental study of light nuclei fusion reactions relevant for nuclear astrophysics in the deep subbarrier region required the development of models that make it possible to describe the reaction cross section at low energies [1]. Today there is no unified approach to describe such reactions: a) with excluding of the potential choice ambiguity [2]; b) with the description of the resonant nature of the cross section [3] and its hindrance for low energies [1].

As a first approach we can consider the square-well potential, which allows a simple analytical expression to determine the transmission coefficients and hence the reaction cross section. As was shown in [4], this model gives us the possibility to describe the fusion cross section in the low-energy region for $16\text{O} + 16\text{O}$ nuclei with sufficient accuracy.

In present work, the square-well model was applied to the light nuclei (10B , 12C , 14N , 16O , 18O , 20Ne) fusion reactions important for nuclear astrophysics. Functional dependences for the potential depth and well's radius were obtained. Artifacts associated with abruptly changed shallow potential well: overestimations of the channel radius, anomalous behavior of the imaginary potential for a number of reactions were determined. It was shown that, within the framework of used model, a satisfactory description can be achieved for all investigated reactions.

1. C. L. Jiang, B. B. Back, K. E. Rehm et al, Eur. Phys. J. A 57, 235 (2021).
2. S. Y. Torilov, N. A. Maltsev and V. I. Zhrebchevsky, Bull. Russ. Acad. Sci. Phys. 85, 548 (2021).
3. S. Y. Torilov, N. A. Maltsev and V. I. Zhrebchevsky et al, Phys. Part. Nuclei 53, 403 (2022)
4. R. Ogura, K. Hagino and C. A. Bertulani, Phys. Phys. Rev. C 99, 065808 (2019).

The speaker is a student or young scientist

No

Section

1. Neutrino physics and nuclear astrophysics

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