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Study on deep sub-barrier fusion within the improved coupled-channels method and Bayesian method

Based on the improved coupled-channels model, implemented by means of the finite element method, we analyze the deep sub-barrier heavy-ion fusion hindrance in 64Ni+100Mo, 64Ni+64Ni, and 28Si+64Ni reactions. Our analysis is with the aid of the Woods-Saxon potential the experimental cross sections and the S-factors of these reactions are remarkably well reproduced within the sudden approximation approach. We found that the nondiagonal matrix elements of the coupling matrix, traditionally neglected in the conventional approaches in setting the left boundary conditions inside the potential pocket, and its minimal value are crucially important for the interpretation of experimental data. Bayesian method has been widely used in nuclear physics, which was demonstrated in previous work that it is more suitable in evaluating than the confidence intervals than the traditional frequentist method. The S-factor of the astrophysically important fusion reaction 12C+12C is also systematically studied based on the Bayesian method for the first time.

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