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Studies of the low energy resonance reactions in the medium mass nuclear systems

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Today, one of the fundamental problems in physics of nuclear reactions is a quantitative description of the elements formation in the Universe. These studies lead to an understanding of the mechanisms and processes that occur in stars. When analyzing the nuclear reaction experimental data, playing a key role in astrophysical studies it becomes necessary to use interaction potentials. These potentials allow with good accuracy to take into account the effects of particles transfer and particles (clusters) interaction [1]. The building of these potentials is also associated with an important fundamental problem - the explanation (prediction) of the astrophysical spectroscopic factor behavior for the nuclear fusion reactions near the Gamow window. It was experimentally obtained that during the fusion of carbon and oxygen nuclei in this mass region one can observe the resonance behavior of the reaction cross section. Such resonances have been not yet fully described by the existing nuclear models [2]. In addition, due to the ambiguity of the potential choice, the theoretical predictions for low energies have different values (by several orders of magnitude) in this energy range.
In present work the nuclear reaction 12C + 16O was studied in the framework of a potential model. Several types of potentials obtained in the cluster [3], semi-microscopic [4] and phenomenological approaches [5] were discussed. It was shown that the excitation function may contain "false"resonance states. In addition, the discrete uncertainty of potentials was eliminated by using the analysis of the cross section in the low-energy region.

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