APPLICATION OF THE FINITE ELEMENT METHOD IN THE COUPLED-CHANNELS CALCULATIONS FOR HEAVY-ION FUSION REACTIONS

Wen P.W.[1,2], Chuluunbaatar O.[1,3], Gusev A.A.[1], Nazmitdinov R.G.[1,4], Nasirov A.K.[1,5], Vinitsky S.I.[1,6], Lin C.J.[2,7], Jia H.M.[2], Góźdź A.[8]

[1] Joint Institute for Nuclear Research, 141980 Dubna, Russia; [2] China Institute of Atomic Energy, Beijing 102413, China; [3] National University of Mongolia, 14202 Ulan-Bator, Mongolia; [4] Dubna State University, 141982 Dubna, Russia; [5] Institute of Nuclear Physics, Ulugbek, 100214, Tashkent, Uzbekistan; [6] RUDN University, 117198 Moscow, Russia; [7] Department of Physics, Guangxi Normal University, Guilin 541004, China; [8] Institute of Physics, University of M. Curie-Sklodowska, Lublin, Poland

E-mail: wenpeiwei@hotmail.com

Fusion of two nuclei that occurs at strong coupling of their relative motion to surface vibrations is analyzed. To this aim a new efficient finite element method, that improves the KANTBP code [1], is used to solve numerically coupled-channels equations. With the aid of this method, the important role of boundary conditions, corresponding to the total absorption (e.g., [2,3]), is shown. A comparison of the presented results with available experimental data demonstrates the advantage of the modified KANTBP code with respect to the wildly used numerical method, known in literature as the CCFULL [4]. The deep sub-barrier fusion cross sections of some reaction systems have been successfully described. It is confirmed that multiphonon excitations play important role in the description of the spectroscopic factor (see Fig.1).

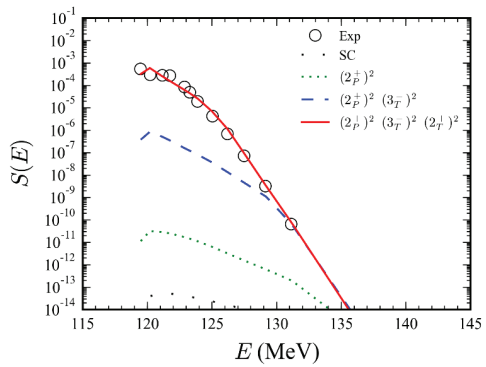

Fig. 1. Spectroscopic factor representation of the $^{64}Ni + {}^{100}Mo$ fusion reaction data. The circles denote the experimental data. The left two circles are the experimental upper limits. Different lines are the theoretical calculations considering different excitations.

1. O.Chuluunbaatar *et al*. // Comput. Phys. Commun. 2007. V.177. P.649.
2. V.I.Zagrebaev *et al*. // Phys. Atom. Nucl. 2004. V.67. P.1462.
3. V.V.Samarin *et al*. // Nucl. Phys. A. 2004. V.734. P.E9.
4. K.Hagino *et al*. // Comput.Phys.Commun. 1999. V.123. P.143.