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(^{3}He,α) REACTIONS ON NUCLEI ^{9}Be, ^{12,13}C, ^{14}N, ^{16}O AT ENERGIES 50 AND 60 MeV

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The differential cross sections of reactions (^{3}He, α) as well as elastic scattering of ^{3}He at wide angular region on nuclei ^{9}Be, ^{12,13}C, ^{14}N, ^{16}O at energies 50 and 60 MeV have been measured at Cyclotron INP NNC of Republic of Kazakhstan [1]. The total error of the experimental measurement is less than 10%. Statistical error is about 1-5%.

From analysis of the experimental angular distribution of elastic scattering cross sections a set of optical potentials for describing elastic ^{3}He channel of the reactions has been obtained. For outgoing channel the optical potentials are taken from [2].

The analysis of the (^{3}He,α) reaction has been made in frame of method combining DWBA and dispersion theory of direct nuclear reactions [3]. In [3] it was shown that (*d,t*) reactions are pure peripheral ones with pole diagram dominating. Comparison of vertex constant values obtained from analysis of (*d,t*) reaction with ones obtained from the analysis of the (^{3}He,α) reaction allows one to elucidate weather the pole diagram dominates in the reaction amplitude. DWBA calculations are made by means of DWUCK5 program.

Table

Nucleus	Bound state parameters	Theoretical Values		*Empirical Values*		
$A \to B+n$	V, MeV r_0, fm; a, fm	c^2S	$\|G\|^2$, fm	$\|G\|^2$, fm (d,t)	$\|G\|^2$, fm (^{3}He,α), E_{lab}	c^2S (^{3}He, α)
$\alpha \to {}^3$He+n	-65.4685 1.259, 0.25	2.0	5.95			
^{9}Be$\to{}^8$Be +n	standard. 1.25, 0.65	0.58	0.05	0.03	0.01, 23 MeV 0.01, 50 MeV 0.02, 60 MeV	0.10 0.13 0.23
^{12}C$\to{}^{11}$C + n	-55.407 1.373, 0.55	2.85	40.5		21.6, 50 MeV 19.7, 60 MeV	1.52 1.39
^{13}C $\to{}^{12}$C + n	-50.618 1.166, 0.65	0.61	0.30	0.4	0.11, 23 MeV 0.13, 50 MeV 0.12, 60 MeV	0.23 0.26 0.25
^{14}N$\to{}^{13}$N+n	-40.488 1.484, 0.55	0.68	2.62	2.5	2.89, 23 MeV 1.20, 50 MeV 6.4, 60 MeV	0.75 0.29 1.54
^{16}O$\to{}^{15}$O+n $\to{}^{15}$N+p	-44.292 1.498, 0.55	2.0	28.99		9.85 , 60 MeV	0.68

The parameters of bound state potential obtained by method demanding equivalence of proton and neutron nuclear potentials for symmetrical nuclei and ones with Z=N (e.p.n. method) are used [4] in the analysis (except ^{9}Be. For the case, the standard values of the parameters have been used). Using theoretical values of spectroscopic factors and the potential parameters some theoretical values of vertex constants have been calculated. So for $\alpha \to {}^3He + n$ vertex constant is to be $|G|^2 = 5.95$ fm. The results of calculations are presented in Table I.

All the reactions under study are peripheral ones. The reaction $^{14}N(^3He,\alpha)^{13}N$ at E= 23 MeV [5] at the main peak of angular distribution goes with domination of pole diagram in the reaction amplitude. The empirical value of the vertex constant $^{14}N \to {}^{13}N + n$ obtained from the analysis is in agreement with those known from analysis of (d,t) reactions at different energies [3]. As for other reactions there are differences between the values. The difference might be caused by not proper optical potential for outgoing elastic channel.

1. Adodin V.V. et all. // Preprint INP , Almaty, 1992.
2. M.Nolte et al. // Phys.Rev. C, 1987, v.36, №4, p.1312-1316.
3. I.R. Gulamov, A.M. Mukhamedzhanov, G.K. Nie, Physics of Atomic Nuclei v, 58, 1995, 1689.
4. G.K. Nie, Proceedings of International Conference on Nuclear Structure, St.-Petersburg, Russia, June 2000, p 124.
5. R. Gulamov, Doctoral Dissertation 1990

SEPARATOR AND MAGNETIC ANALYZER FOR THE IDENTIFICATION OF RECOILING NUCLEI

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The electrostatic separator VASSILISSA [1] with upgraded detector system [2] was used in the experiments to synthesize the isotopes $^{283}112$ and $^{287}114$ using ^{238}U and ^{242}Pu targets. An additional possibility for the distinguishing of the isotopes produced in complete fusion reactions from multinucleon transfer reactions products and identification of new nuclides is the method of the measurement of atomic mass number of the ERs, synthesized during the experiment. In the case if the mass resolution of the experimental set up will reach value less than 0.5 % for heavy nuclei with masses in the region 270-290 amu one could make direct identification of the obtained isotope on the basis of its mass measurement.

Some possibility is the use simple and compact systems which will allow to have mass resolution at the level of 1.5 - 3 %. For the mass region 270 - 290 amu it leads to the accuracy of 3 - 6 amu In this case, one could define belonging of newly synthesized nuclide to the region of superheavy nuclei formed from compound nuclei after complete fusion reaction between heavy ion and target nucleus.

With the aim of continuation of the experiments on the synthesis and study of decay properties of superheavy nuclei the separator VASSILISSA was upgraded. For that purpose a new dipole magnet, having a deflection angle of 37 degrees, was installed behind the separator VASSILISSA replacing the old 8^0 magnet. The new magnet will provide an additional suppression of unwanted reaction products by a factor of about 100 and a possibility to have the mass resolution at the level of 1.5 -2% for heavy nuclei with masses of about 300 amu. For