INVESTIGATION OF ANGULAR DISTRIBUTIONS OF INSTANT GAMMA RADIATION IN REACTION ^{93}NB (A, 2N) ^{95}TC *

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Abstract

In a device, designed by us for the undertaking γ-spectroscopic investigations in the cyclotron U-150, investigated angle distributions of γ-radiation from excited levels of the nucleus ^{95}Tc, occupied in (α,χ) reactions. As a target we used monoisotopic niobium foil with a thickness of 17mg/cm^2. Angle distribution of γ-quantum shoot in different angles

INTRODUCTION

The study of high spin excited states is of a special significance to study the atomic nucleus. Since, it makes possible to learn a nature of collective, i.e. rotation and vibration excitations in nuclei and their relationship with the quasi-particle degrees of freedom. Such states are populated in reactions with α -particles or heavy ions at the large angular momentum in entrance channel. The important particularity of such reaction going through formation of compound nucleus is the high initial velocity of the excited recoil nuclei (in order 1,5% of the light velocity) that sharply raises an efficiency of using of the Doppler methods of the time measurements. The main difficulty at carrying out such experiments is concluded in necessity of the suppression of intensive g-background which is attendant to experiments on the beam.

EXPERIMENT AND RESULTS

We created a new setup [1] (the principal scheme presented on fig.1) which allowing to research the angular distributions of the gamma-rays emitted from the excited levels of nucleus 95Tc formed in the ^{93}Nb (**α**, 2n) ^{95}Tc reaction at the beam energy 36 MeV.

The setup is located on the distance 30 m from the cyclotron and behind the four meter concrete wall. The beam is transported and carefully focused by means of the two doublet quadrupole lenses. Four additional blocks of testers are rated for tracing of the beam through ion conductor which allows us to determine the profile of the beam and to choose the optimal position of collimators in intermediate focus. Readjustment of beam on the target is carried out using two directed magnet which are installed around ion conductor.

The current of the beam derived from the cyclotron is about 1 мкA, but it is 3-5 nA on target at 3 mm^2 area of the beam section.

The reaction camera is made from plexiglas in the form of cylinder with diameter 50 mm and it is provided with cassettes for the replacement of the targets without disturbance of the vacuum. Each cassette can contain up to 4 targets. The gamma-spectra were measured by the Ge(Li)-detector with the sensitive volume of 60 sm^3 and energetic resolution of order 4 keV on the line 1330 keV of γ-rays from ^{60}Co. The foil from natural monoisotope of niobium by thickness 17 mg/sm^2 was used as a target.

Angular distributions of the gamma-quanta were measured at angles 60, 90, 120, 130 and 145 degree relatively to the beam direction. The experimental results of the angular distribution: were fitted by the two Legandr functions

$$W(\theta) = 1 + \sum_k A_k P_k(\cos\theta) \qquad (1)$$

from which we defined the factors A_2 and A_4 characterizing the angular distribution. Their values are considered as a factor of attenuation α_2 and α_4 are presented in table 1. For comparison, the literary data [2] are given in square brackets under our results.

As seen from the table 1, our data are in good agreement with the early measured data.

REFERENCES

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[2] Sarantites D.G., Phus. Rev., C.12, p.1176

*Work supported by Science and Technology Center of Uzbekistan

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E_g, keV	J_i-J_f	A_2	A_1	a_2	S
957.0	11/2-9/2	-0.332 [-0.337(11)]	0.125 [0.066(20)]	- -	- [3.03]
363.2	21/2-19/2	-0.235 [-0.24(3)]	-0.073 [-0.08(4)]	0.823 [0.65(7)]	2.63 [3.78]
882.1	13/2-9/2	0.221 [0.206(11)]	-0.043 [-0.04(1)]	0.502 [0.53(3)]	2.80 [2.99]
632.6	17/2-13/2	0.192 [0.21(2)]	-0.114 [-0.09(2)]	0.457 [0.60(4)]	2.68 [3.4]
1031.6	21/2-17/2	0.223 [0.17(2)]	-0.083 [-0.06(2)]	0.546 [0.58(6)]	4.57 [4.15]
968.8	25/2-21/2	0.288 [0.28(7)]	-0.019 [-0.03(8)]	0.720 [0.65(16)]	4.00 [4.56]
402.3	29/2-25/2	0.365 [0.295(38)]	-0.150 [-0.12(5)]	0.926 [0.80(10)]	2.32 [3.73]

Table 1. The factors A_2, A_4 defined from (1), and the factors of attenuation α_2 and α_4.

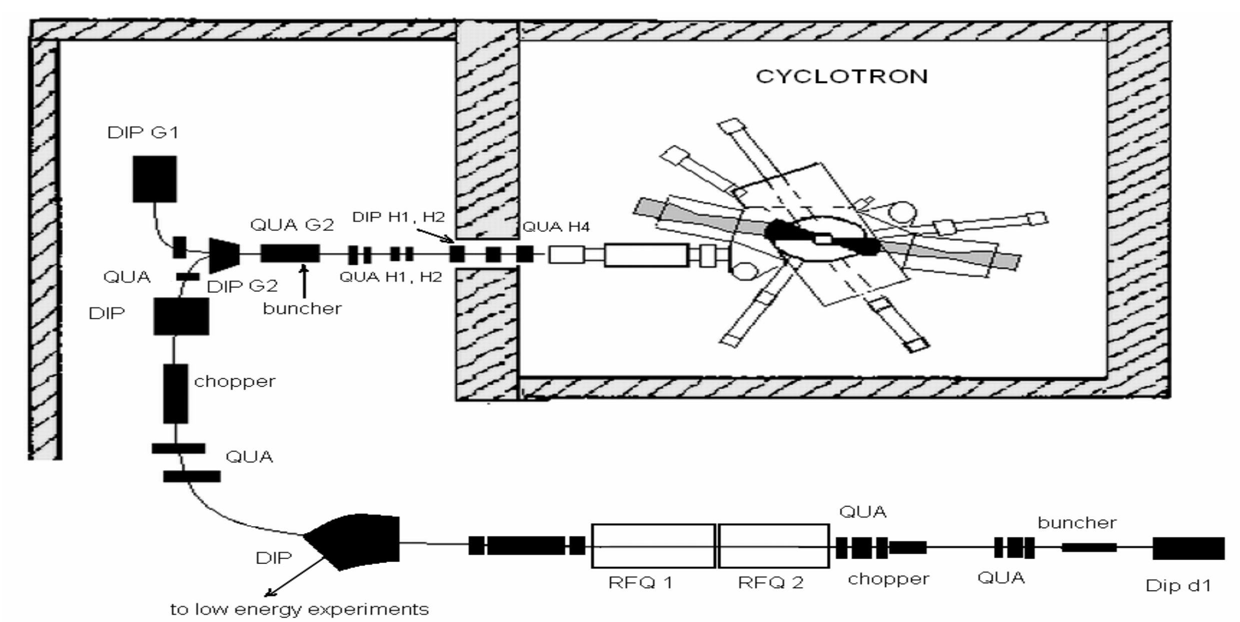

Fig.1. The principal scheme of cyclotron and lay-out facilities.