

# EXPERIMENTAL STUDIES OF RESONANCE STATES IN REACTIONS WITH HEAVY IONS ON THE DC-60 CYCLOTRON

Nauruzbayev D.K.<sup>1,2</sup>, Zherebchevsky V.I.<sup>1</sup>, Torilov S.Yu.<sup>1</sup>, Goldberg V.Z.<sup>3</sup>,  
Nurmukhanbetova A.K.<sup>2</sup>, Golovkov M.S.<sup>4</sup>, Rogachev G.V.<sup>3</sup>

<sup>1</sup> Saint-Petersburg State University, Saint-Petersburg, Russia;

<sup>2</sup> National Laboratory Astana, Nazarbayev University, Astana, Kazakhstan;

<sup>3</sup> Cyclotron Institute, Texas A&M University, College Station, Texas, USA;

<sup>4</sup> Joint Institute for Nuclear Research, Dubna, Russian

E-mail: dosbol.ndk@gmail.com

The purpose of the present investigations is to explore the resonances in the nuclei representing astrophysical interest. Studies were carried out by using thick target in inverse kinematics (TTIK) method and time of flight (TF) technique at the Astana cyclotron DC-60 [1–3]. This technique has several advantages such as: to carry out measurements at 180 degrees, to measure excitation functions in a wide energy range, to work near the Coulomb barrier [4–6]. The located below Fig.1 demonstrates alpha particles from the interaction of  $^{16}\text{O}$  with helium. This experiment was carried out to study the compound of the neon nucleus arising in the reaction in the excitation energy range from 6 to 10 MeV. The energy spectrum of this reaction is well known [1] and, therefore, it is possible to compare the results obtained by our method with the classical approach.

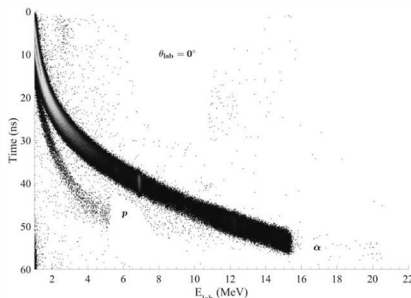


Fig. 1. E-T spectrum for the zero-degree detector,  $\alpha$  particles dominate; one can see also a weaker proton locus below the  $\alpha$  particles.

Using *R*-matrix approach for the data analysis, the characteristics of the compound nucleus: spin, parity, and the width of the levels can be found [2].

1. D.K.Nauruzbayev *et al.* // Phys. Rev. C. 2017. V.96. 014322.
2. A.K.Nurmukhanbetova *et al.* // NIM. 2016. V.847. P.125.
3. N.A.Mynbayev *et al.* // JETP. 2014. V.146. Iss. 4. P.754.
4. G.V.Rogachev *et al.* // AIP Conference Proceedings. 2010. V.1213. P.137.
5. K.Markenroth *et al.* // Phys. Rev. C. 2000. V.62. 034308.
6. K.Artemov *et al.* // Sov. J. Nucl. Phys. 1990. V.52 P.406.