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DECAY BRANCHING RATIO OF GROUND AND EXCITED STATES OF ^{11}B NUCLEUS PRODUCED BY NEUTRON FROM 1 TO 6 MEV

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Introduction

The branching ratio of decay of ground and excited states of the ^{11}B nucleus in the interaction of neutrons with the ^{10}B nucleus for thermal and intermediate energies is well studied and it is equals to 0.064. However, the data of the ENDF / B-VII.1, JEFF-3.1.2 and JENDL-4.0 libraries contradict each other in the energy range above 1 MeV and therefore they are questioned.

1 – R. Bevilacqua, F-J Hambsch, M. Vidali, I. Ruskov and L. Lamia. EPJ Web of Conf. 146, 11010 (2017)

A value of the cross section at these energies is also criticized. Now we present our data obtained on the photoneutron source based on a linear accelerator. A neutron detector based on a ^{10}B layer was used. It served as both the target and the cathode of the wire chamber for detecting ionization losses of secondary nuclei.

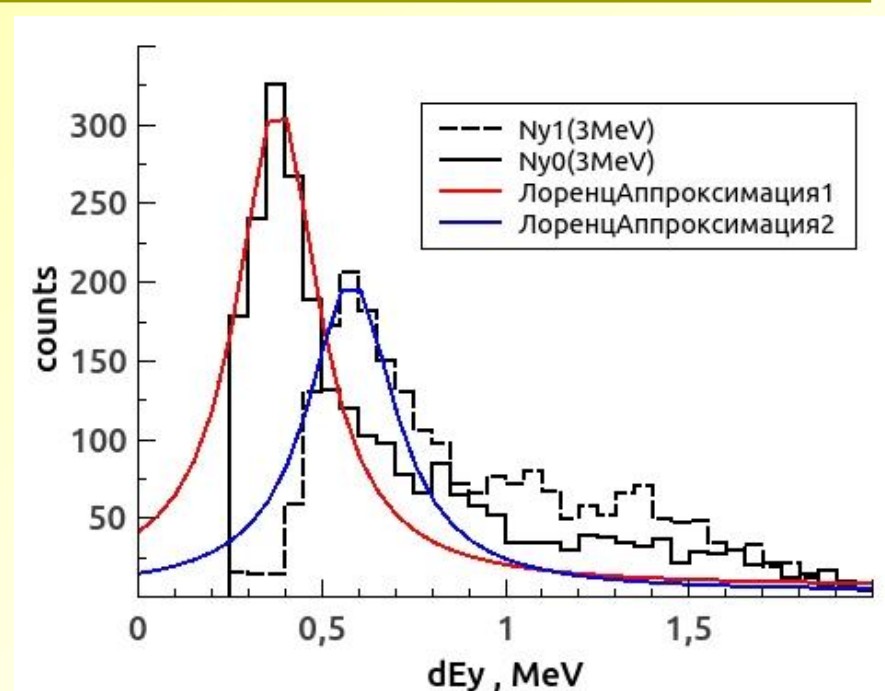
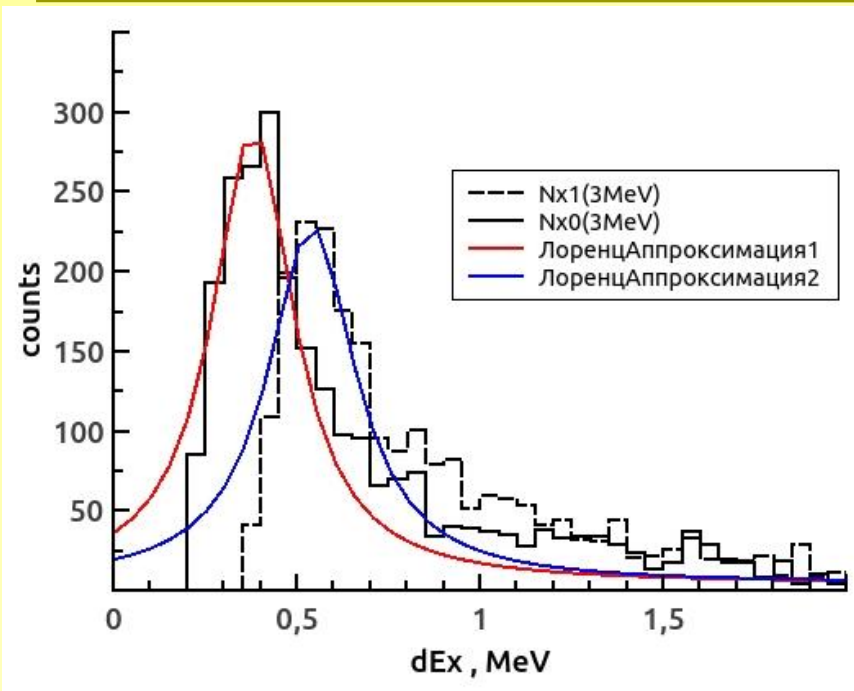
S. Potashev, A. Drachev, Yu. Burmistrov, S. Karaevsky, A. Kasparov, V. Ponomarev, and G. Solodukhov. Hybrid boron-10 gaseous detector for slow and fast neutron simultaneous detection. EPJ Web of Conf. V.231, P.05010 (2020).

Method

The sensitive 3- μm layer of ^{10}B is on the glass plate. It is coated with 0.2- μm aluminum layer which serves as the first cathode of the wire chamber. Ionization signals from two gaps of the chamber are proportional to energy losses of the secondary ^4He and/or ^7Li nuclei.

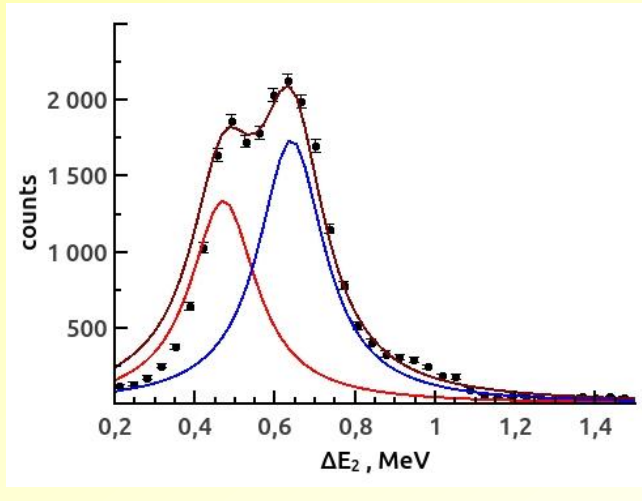
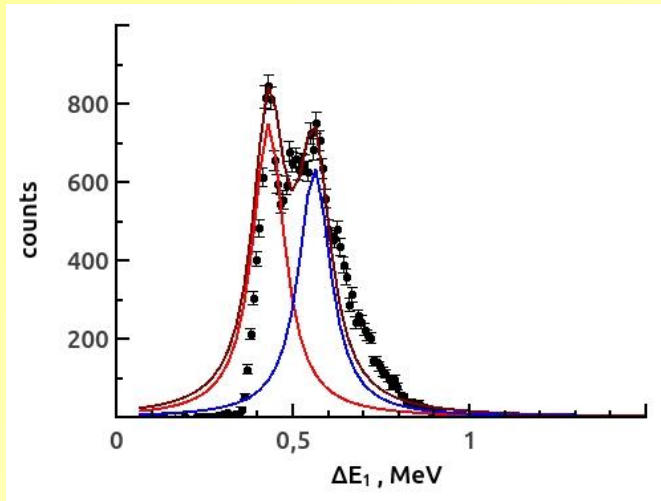
Branching ratio of $n + ^{10}\text{B} \rightarrow ^7\text{Li} + ^4\text{He}$ and $n + ^{10}\text{B} \rightarrow ^7\text{Li} + ^4\text{He} + \gamma$ reactions was determined from the pulse height spectrum analysis and correlations of signals from two gaps. A simulation of ionization losses of the ^4He was performed taking into account the kinematics of each of the two investigated reactions.

Simulation

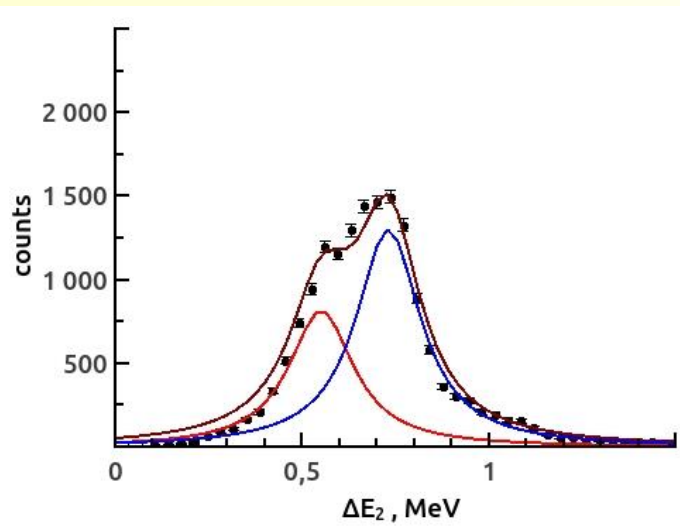
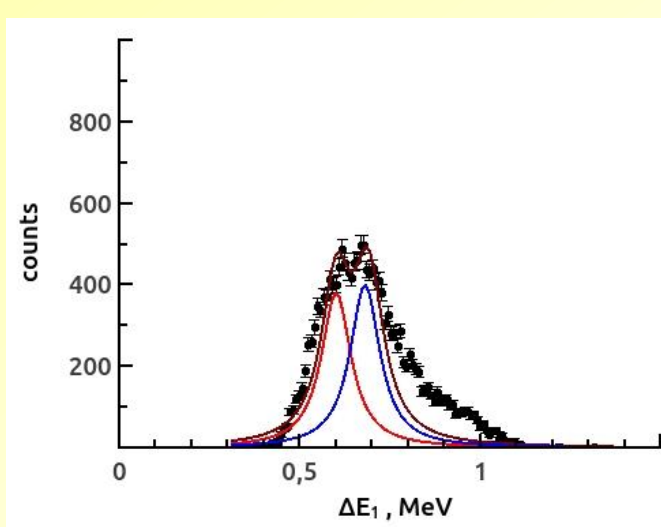


Pulse height spectra from ^4He in X (1) and Y (2) gaps at 3 MeV neutron energy

Experimental fast neutron spectra at 3 and 4 MeV

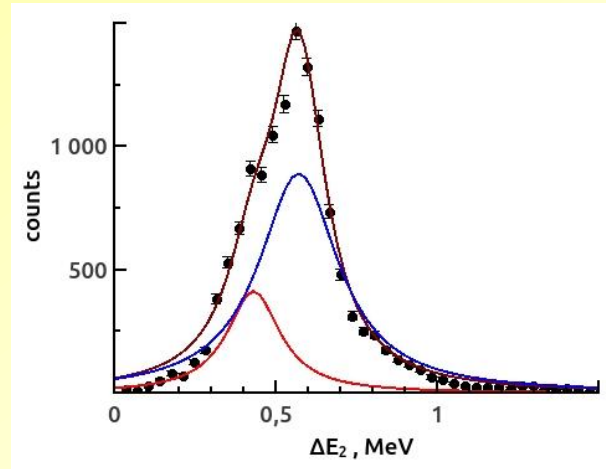
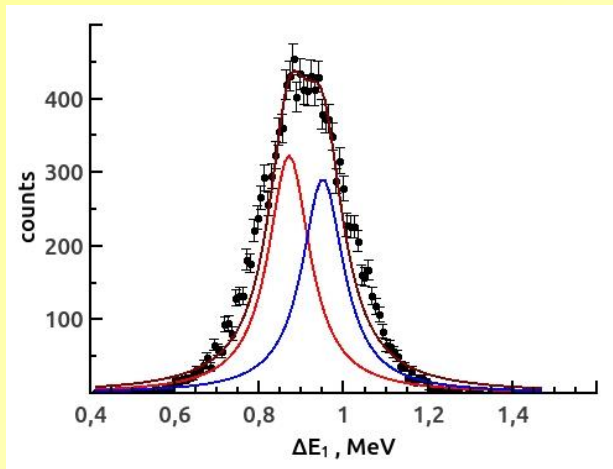


$E_n = 3 \text{ MeV}$

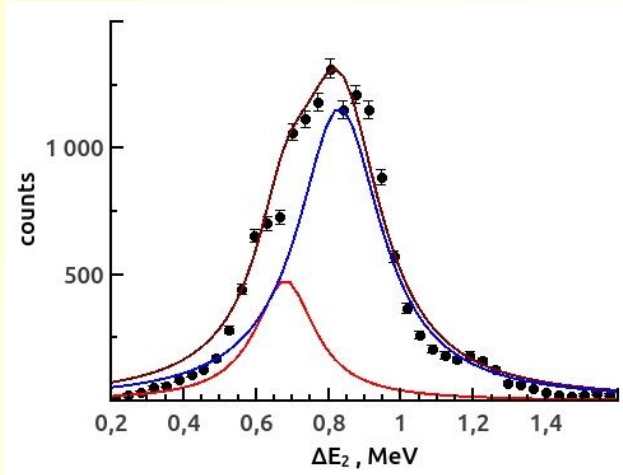
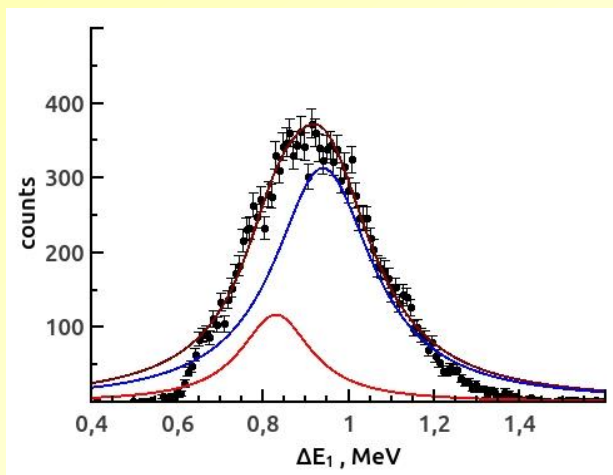


$E_n = 4 \text{ MeV}$

Experimental fast neutron spectra at 5 and 6 MeV

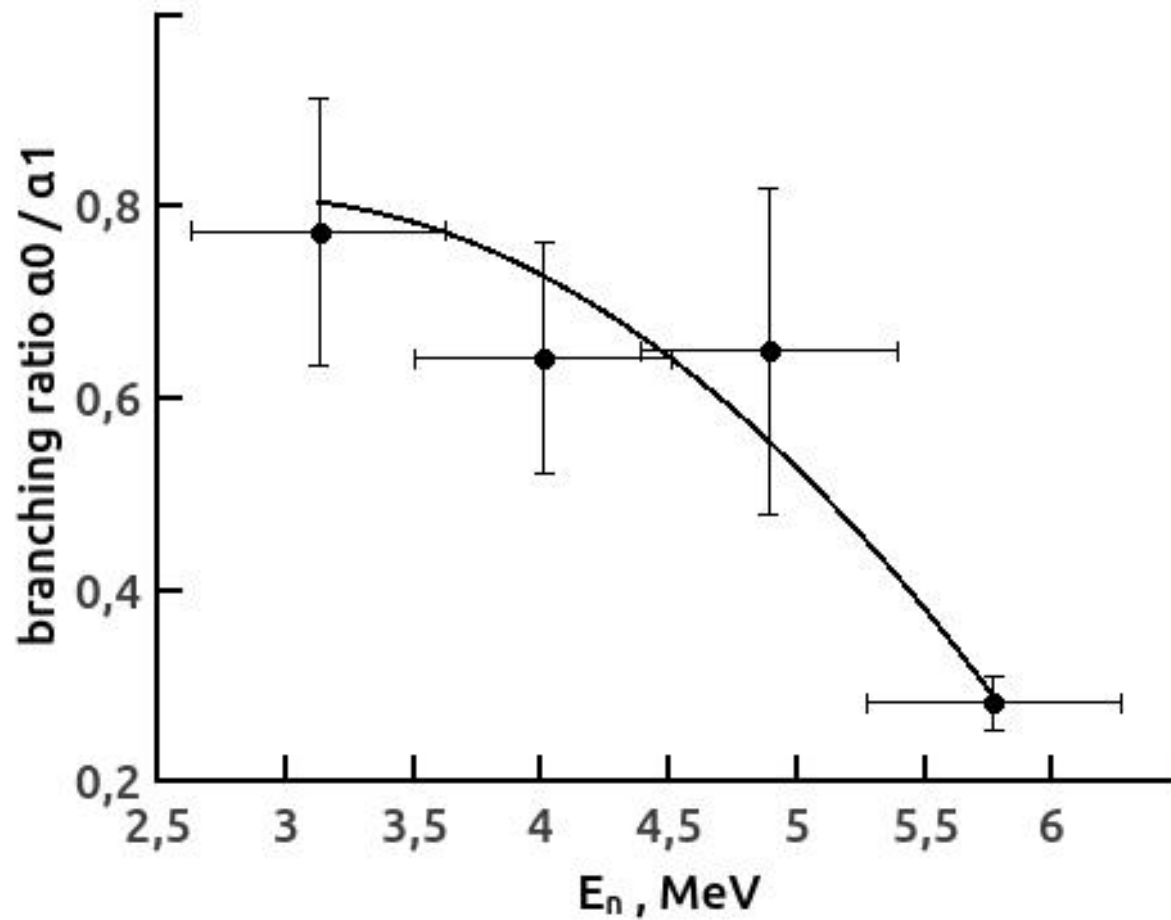


$E_n = 5$ MeV



$E_n = 6$ MeV

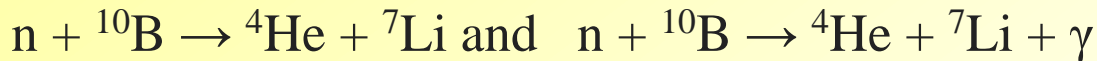
Branching ratio



Summary and conclusions

Decay branching ratio of ground and excited state of ^{11}B in the neutron and ^{10}B interaction between 1 and 6 MeV was studied

The decay branching ratio of



reactions was estimated using the pulse height spectrum analysis

Thank you!