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ABOUT THE RECOIL NUCLEI METHOD OF THE FAST NEUTRON SPECTRA MEASUREMENT WITH TELESCOPE OF SEMICONDUCTOR Si DETECTORS

The method of measurements of fast neutron spectra by the hydrogen recoil nuclei is well known. However, when it is used, the problem of background reactions initiated by neutrons in the detector material arises almost always.

To specify these effects we performed a simulation of two-dimensional ΔE2 –E spectra formed when neutrons with energies <14 MeV are detected by a telescope of semiconductor silicon detectors, consisting of 2 passing detectors, ΔE1 and ΔE2, and a detector of E-losses. For generating the recoil nuclei a thin converter is proposed, containing three types of hydrogen isotopes (see loci 1-3 in Fig.). A charged particle arising from the interaction of neutrons with the material of converter or detectors is registered only when passing through all 3 detectors. It is shown that the telescope arrangement is optimal when deuteron-polyethylene film serves as a converter and the thicknesses of the telescope detectors are ΔE1 ˜ 20 µm, ΔE2 ˜ 60 µm, and E ˜ 700 µm. One can see, that the reactions 28,29Si(n,p)28,29Al in the detector ΔE1 leave for the recoil protons detection without background only the region of the proton locus (1) above 10.5 MeV. The region of the deuteron locus that is suitable for the background-free detection of deuterons is much larger (Ed ˜ 5.5 MeV ÷ 9.0 MeV which corresponds to En ˜ 7.8 MeV ÷ 14.0 MeV). At that the main background reaction is the proton emission in the opposite direction from the 28Si(n,p)28Al reaction in the material of E detector (region (4) in Fig.). The reaction 28Si(n,d)27Al which occurs in the material of ΔE1-detector produces deuterons with energies lower than the above mentioned protons. For illustration, the triton locus (3) is also given at using tritium as a converter. It should be noted that tritons, 3He ions, alpha particles which arise in the background reactions can' t be detected by such telescope as their ranges are less than the summed thickness of the ΔE detectors (see hypothetic locus (5) of alpha-particles). In principle, the contribution of the above-mentioned background sources due to elements of the telescope itself can be estimated and subtracted under similar experimental conditions when irradiated with neutrons without a converter.

Such detecting system was made and tested at the 14 MeV neutron flux of the neutron generator NG-150 of the INP AS (Uzbekistan).

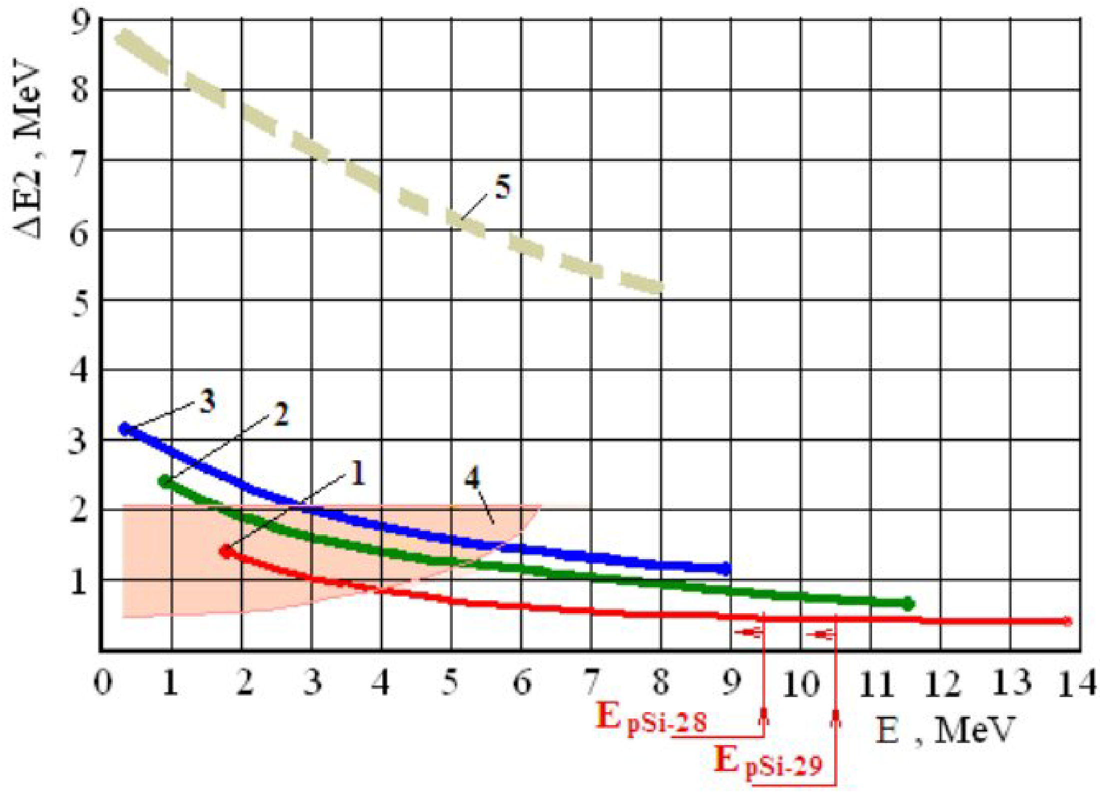

Figure 1:

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