Prompt Fission Neutron Spectra of ^{240}Pu(*n,F*)

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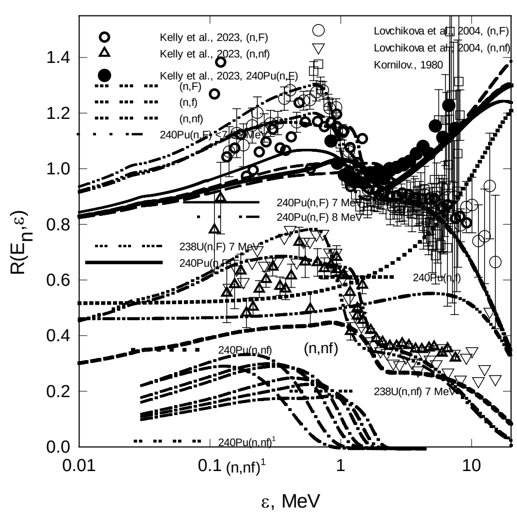
Pre-fission neutron spectra influence the partitioning of fission energy between excitation energy and total kinetic energy of fission fragments. For incident neutron energies up to E_n ~20 MeV prompt fission neutron spectra (PFNS) of ^{240}Pu(*n,F*) are predicted as described in [1]. Simultaneous analysis of measured data for ^{238}U(*n,F*) and ^{240}Pu(*n,F*) allows extract sensitivities of PFNS shape near (*n,xnf*) reaction thresholds to the exclusive pre-fission neutron spectra. Those for ^{238}U(*n,F*) PFNS [1] are strongly supported by the data of [2,3]. The disclosed data [3] on average energies <E> of ^{240}Pu(*n,F*) PFNS support the approach pursued in [1], though the lowering of <E> in [3] is inconsistent with predicted contribution of ^{240}Pu(*n,*2*nf*) to the observed PFNS and fission cross section. In case of ^{238}U(*n,F*) the various influence of ^{238}U(*n,nf*)^1 excusive neutron spectra on PFNS at E_n ~7 MeV and E_n ~7–8 MeV is demonstrated, while it is predicted for the ^{240}Pu(*n,F*) and ^{240}Pu(*n,nf*)^1 (Fig. 1). The largest amplitude of excusive neutron spectra at E_n~6–6.25 MeV is envisaged. For the reactions ^{238}U(*n,F*) and ^{240}Pu(*n,F*) shape of PFNS strongly depends on the fissility of composite and residual nuclides (Figs. 1 and 2). The ^{240}Pu(*n,F*) shape is rather close to that of ^{239}Pu(*n,F*), though the contribution of pre-fission neutrons is a bit higher, as predicted in [1]. Exclusive neutron spectra (*n,xnf*)$^{1,..x}$ are consistent with fission cross sections of $^{237–240}$Pu(*n,F*), as well as neutron emissive spectra of ^{239}Pu(*n,xn*) at ~14 MeV. Initial model parameters for ^{240}Pu(*n,F*) PFNS, fixed by description of PFNS of ^{240}Pu(*sf*) are consistent with ^{240}Pu(*n,F*) PFNS at E_n ~1–2 MeV. We predict the ^{240}Pu(*n,xnf*)$^{1,..x}$ exclusive pre-fission neutron spectra, exclusive neutron spectra of ^{240}Pu(*n,xn*) $^{1,..x}$ reactions, total kinetic energy TKE of fission fragments and products, partials of average prompt fission neutron number and observed PFNS of ^{240}Pu(*n,F*). PFNS of ^{240}Pu(*n,F*) are harder than those of ^{238}U(*n,F*), but softer than those of ^{239}Pu(*n,F*).



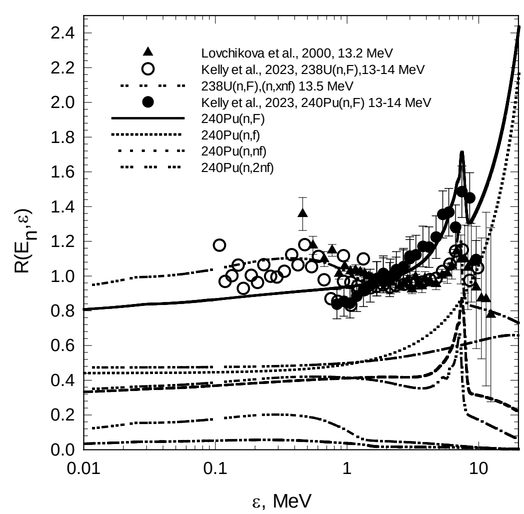


Fig.1. ^{238}U(*n,F*) and ^{240}Pu(*n,F*) PFNS, E_n~7–8 MeV. Fig.2.^{238}U(*n,F*) and ^{240}Pu(*n,F*) PFNS, E_n~13–14 MeV.

1. V.M. Maslov, Physics of Particles and Nuclei Letters, 2023, vol.20, No. 4, pp. 565–576.
2. K.J. Kelly, M. Devlin, J.M. O'Donnel et al., Phys. Rev. C, 108, 024603 (2023).
3. K.J. Kelly et al., https://indico.bnl.gov/event/18701/contributions/82692/(2023).