LETTERS TO THE EDITOR

COMMENT ON "ELECTROFISSION OF ^{237}Np IN ENERGY RANGE 10–34 MeV"*

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A recently published work on ^{237}Np(e, f) is commented; inconsistencies regarding data analysis and errors in data interpretation are shown.

A recent study of the electrofission of ^{237}Np in the energy range 10–34 MeV, by Mariańska et al. [1], found evidences for both an isoscalar and an isovector E2 giant resonance (GQR) in the photofission of this nucleus. The above mentioned work contains some inconsistencies and errors related to the experimental procedure for the obtention of cross sections, data analysis, data interpretation, and quotation of previous published data. We would like to comment on Mariańska's et al. [1] work for ^{237}Np (e, f), in a modest attempt to shed some light on the very important subject of fission decay of the GQR for actinide nuclei.

First of all, the absolute values of the electrofission cross section for the ^{237}Np [1] were established using the ^{238}U(e, f) cross section of Ref. [2]. However, the existing data for the electrofission of ^{238}U are all in serious disagreement by at least a factor of two (we refer the reader to a recent review on electrofission and hadron-induced fission for ^{238}U [3]). In particular, the results of Ref. [2] (used for normalization purpose) are compatible with zero E2 strength (that is, the electrofission process is explained as pure El), therefore, in direct disagreement with the conclusions established for ^{237}Np (e, f) [1]. Furthermore, each set of ^{238}U (e, f) data from the literature (see Ref. [3]) used for normalization generates different amounts of E2 strength in ^{237}Np.

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In order to obtain the percent of sum rule %EWSR (energy weighted sum rule) exhausted by the GQR, the authors of Ref. [1] based their estimations on two outdated results: a) ^{238}U (e, e′) [4], which were reinterpreted recently by Pitthan et al. [5] resulting in a substantial alteration of the % EWSR (from ~50% to ~70%), and b) ^{238}U (e, α) [6], which were proved to be in error [7, 8] and were repudiated by their authors [9]; furthermore, the (e, α) channel and any other decay channel contributes only with a *fraction* to the EWSR. A correct estimation for the total E2 strength (summed over all the competing channels) should be obtained from single inelastic experiments [10].

Finally, the excitation curve for ^{237}Np (e, f) demonstrates two broad *maxima* at energies of 17 MeV and 21.5 MeV, and a hint for a maximum at ~24 MeV. This is amazing because an integral cross section, like the one for (e, f), never shows bumps and should increase all the time as a function of the incident electron energy. More specific: considering the multipolarities E1 and E2, the electrofission cross section $\sigma_{e,f}(E_0)$ is given by

$$\sigma_{e,f}(E_0) = \int_0^{E_0 - mc^2} \sigma_{\gamma,f}^{E1}(E) N^{E1}(E, E_0) \frac{dE}{E} + \int_0^{E_0 - mc^2} \sigma_{\gamma,f}^{E2}(E) N^{E2}(E, E_0) \frac{dE}{E}, \tag{1}$$

where E_0 is the total electron energy, mc^2 the electron rest mass, E the real (or virtual) photon energy, $N^{\lambda L}$ the virtual photon spectrum, and $\sigma_{\gamma,f}^{\lambda L}$ the photofission cross section for a multipolar transition λL. It is a trivial task to show that the function defined by Eq. (1) will never exhibit one (or more) maximum, even at energies where $\sigma_{\gamma,f}^{E1}$ and/or $\sigma_{\gamma,f}^{E2}$ go to zero. However, most astonishing is the fact that the authors of Ref. [1] tried to interpret the bumps observed in the electrofission cross section of ^{237}Np as a predominance of even parity states just above the fission barrier; they argued that *similar* bumps were observed in the anisotropic coefficient of the angular distributions for ^{232}Th [11] and in the ratio σ^-/σ^+ for ^{232}Th and ^{238}U [12], but those are a different story and by far they are not similar to the electrofission cross section. The ratio σ^-/σ^+, for fission induced by electrons and positrons, is given by

$$\frac{\sigma_{e,f}^{-}(E_0)}{\sigma_{e,f}^{+}(E_0)} = \frac{\sum_{\lambda L} \int_0^{E_0 - mc^2} \sigma_{\gamma,f}^{\lambda L}(E) N^{\lambda L(-)}(E, E_0) dE/E}{\sum_{\lambda L} \int_0^{E_0 - mc^2} \sigma_{\gamma,f}^{\lambda L}(E) N^{\lambda L(+)}(E, E_0) dE/E} \tag{2}$$

where $N^{\lambda L(-)}$ and $N^{\lambda L(+)}$ stand for electrons and positrons, respectively. The virtual photon spectra for electrons and positrons are quite different [13]; then, a change in the behavior of $\sigma_{\gamma,f}^{\lambda L}$ will correspond to different changes in the slopes of σ^- and σ^+, and this can produce a shoulder in the ratio σ^-/σ^+ as a function of E_0 as observed by Kneissl et al. [12]. Concerning the electrofission angular distributions subject, we refer the reader to Ref. [14] where a detailed formalism was developed.

We believe that the work on ^{237}Np (e, f) [1] should be revised by their authors as soon as possible, framing it in a firm nuclear physics basis.

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