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COMISSÃO NACIONAL DE ENERGIA NUCLEAR
INSTITUTO DE ENGENHARIA NUCLEAR

PROGRESS REPORT ON NUCLEAR DATA IN BRAZIL

May 1983

Compiled by
L.T. Auler
Brazilian Liaison Officer
of the
International Nuclear Data Committee

Introduction.

This progress Report on Nuclear Data in Brazil consists of abstracts received by the Liaison Officer to the INDC, upon request to a number of scientists that in his judgement could be doing work related to nuclear data.

To submit or not an abstract was, of course, a choise of the scientists addressed. The abstracts received are reproduced in what follows.

Further information as well as permission to reproduce quoted data should be addressed to the authors.

DECAY SCHEME OF ^{92}Tc

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We are studying the decay scheme of ^{92}Tc. This nuclide is being produced via the ^{93}Nb(^{3}He,4n) reaction and transported, with the aid of the He-Jet system developed in this laboratory[1], to a low background region.

We have been searching for 7 gamma-ray lines which are assigned as uncertain in the last edition of the "Table of Isotopes"[2]: 1596 keV, 2979.2 keV, 3134.3 keV, 4037.6 keV 4368.4 keV and 4572.3 keV. Up to now we could not find evidence for these lines due to:

a) low cross section for the production of ^{92}Tc via the chosen reaction at 36 MeV, which is the highest possible energy for ^{3}He particles from IEN's CV-28.
b) low transport efficiency ($\simeq$ 20%),
c) low detection efficiency at high gamma ray energies and
d) very low intensity of the lines.

Another reaction is being tried in order to increase the production of ^{92}Tc, namely: ^{92}Mo(p,n), with natural Mo targets and proton energy of about 18 MeV, which according to the work of C. Gil[3] is the best energy for production of the nuclide. Additional advantage of this reaction is a cleaner spectrum, free from contaminants. If this reaction turns out to be the most suitable, enriched ^{92}Mo will be processed to be used as a target.

1. S.C. Cabral, A.M.Borges, O.F.Lemos Jr., L.T.Auler and A.G. da Silva, Relatório Técnico Anual do Instituto de Engenharia Nuclear, 4.4 (1981).
2. C.M. Lederer and V.S. Shirley, "Table of Isotopes" 7th ed., John Wiley and Sons Inc., New York (1978).
3. C.Gil, "E2 Core Polarization of ^{92}Mo by Lifetime Measurements of 6^{+} State", Journal of the Physical Society of Japan, 34, 575 (1973).

FAST NEUTRON PRODUCTION

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According to the planned use of IEN's CV-28 cyclotron to produce fast neutrons, an extension of the beam line to an area suitable for such experiments is being built. The polar pieces of the magnetic lenses necessary to guide the beam up to the neutron production target are also being built: the coils are already wound. Ten T targets were received from IAEA, and the vacuum system needed for the extension of the beam lines was already purchased.

A cooperation program was started with the Neutron Dosimetry Section of the Physikalisch Teknische Bundesanstalt of Braunschweig to implement the neutron program.

NEUTRON TEMPERATURES IN THE ARGONAUT REACTOR BY INTEGRAL TOTAL CROSS AND DIFFERENTIAL VELOCITY DENSITY DISTRIBUITION MEASUREMENTS.

VOI, D.L. (IEN/CNEN).

The neutron temperatures of Argonaut Reactor are measured by two different methods using the neutron beam of an irradiation channel, in identical conditions of geometry.

The obtained temperatures with the differential method using de crystal espectrometer and the integral method by transmission in direct beam are:

(522 ± 49) K to beam and (392 ± 37) K to core.

The results obtained are compared with previous works in the same Reactor as shown in table below.

T_{NUCLEO} (K)	T_{FEIXE} (K)	MEASUREMENT TYPE	AUTHOR (YEAR)
315	-	Integral Lutetium Ativation	Klawa, R. (1973)
380 ± 20	-	Differential Crystal Espectrometer	Stasiulevicius, R. et al (1975)
430 ± 30	-	Differential Time of Flight Espectrometer	Vilar, G.J. (1976)
392 ± 37	522 ± 49	Differential Crystal Espectrometer Integral - Gold Transmission	Present Work (1982)

STUDY OF ^{237}Np PHOTONUCLEAR REACTIONS NEAR THRESHOLD, INDUCED BY GAMMA-RAYS FROM THERMAL NEUTRON CAPTURE

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The photodisintegration of ^{237}Np has been studied using monoenergetic photons obtained from thermal neutron capture reactions at the IEA-R1 reactor. The photofission and photoneutron cross sections and the angular distribution of photofission fragments were determined at energies near threshold, in the range 5-11 MeV.

Some evidences for structures were observed at 8.0 MeV and near the photoneutron threshold (6.62 MeV) in the photofission cross section curve. Analysing the photofission data according to the liquid drop model, the height (E_t) and curvature ($\hbar w$) of the single fission barrier for ^{237}Np were determined: E_t= (5.9 ± 0.2 MeV) and $\hbar w$= (0.8 ± 0.4 MeV).

For the competition between photoneutron emission and fission ($\Gamma n/\Gamma f$) a constant value was found (1.28 ± 0.15) in the energy range 6.73 -10.83 MeV. From this result the following nuclear temperatures for ^{237}Np were determined on bases of some models: T= 0.84 ± 0.06 MeV (Fujimoto-Yamaguchi model) and T= 0.60 ± 0.04 MeV (constant nuclear temperature model).

An angular anisotropy of b/a= 0.064 ± 0.017 was observed in the ^{237}Np electric dipole photoabsorption at 6.61 MeV excitation energy. By mathematical analysis of this result, one could conclude that the predominant fission channels are the compound states with k= 1/2 and/or 3/2, with a small contribution (~ 5% of the transition states with k= 5/2).

GAMMA-GAMMA ANGULAR CORRELATIONS IN ^{129}Te

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The technique of directional gamma-gamma angular correlation has been used to investigate ten gamma cascades of ^{129}Te, resulting from the beta decay of ^{129}Sb. This radionuclide was obtained by the (γ,p) reaction in metallic Te, followed by a chemical separation to eliminate other reaction products and impurities. Using a Ge(Li) - NaI(Tl) spectrometer, the angular correlation coefficients A_{22} and A_{44} were determined for ten gamma cascades. The experimental results are discussed in terms of nuclear models applicable for nuclei in this mass region.

DIRECTIONAL CORRELATIONS OF GAMMA TRANSITIONS IN ^{127}Te

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The directional correlations of various gamma transitions in ^{127}Te have been measured from the β^- decay of ^{127}Sb using a Ge(Li) - NaI(Tl) spectrometer. The radioactive source of ^{127}Sb was prepared by chemically separating it from other fission products of ^{235}U, irradiated with thermal neutrons in the IEA-R1 reactor. Measurements have been carried out for thirteen gamma cascades. The angular correlation coefficients A_{22} and A_{44} were obtained by the least-squares fitting procedure. The multipole mixing ratios δ (E2/M1) were calculated from the measured angular correlations. The experimental results are discussed in terms of nuclear models applicable for nuclei in this mass region.

g-FACTOR OF THE 341 KeV STATE IN ^{127}Te

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The integral perturbed angular correlation technique has been used to measure the g-factor of the 341 keV ($9/2^-$) state in ^{127}Te. This state is populated from the beta decay of ^{127}Sb. The measurements were made using the hyperfine field of Te in Ni, which is 190 kG, in an external field of 5 kG. The result is g(341 keV)= 0.212 ± 0.028. The experimental result is discussed in terms of nuclear models applicable for nuclei in this mass region.

EVALUATION OF THE FISSION YIELD DATA FOR RARE EARTH ELEMENTS FISSION PRODUCTS BY MASS SPECTROMETRIC TECHNIQUE

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A B S T R A C T

The aim of the proposed project is to evaluated the fission yield values for some of the rare earth element fission products in the neutron induced fission. The total number of atoms fissioned is determined by the well established ^{148}Nd fission product method. The total number of fission products nuclides produced is determined by mass spectrometric isotope dilution method. Using the fission yield values given in the literature for these nuclides, the total number of atoms fissioned is calculated and is compared with the value obtained from Nd^{148} method. From this comparison the fission yield data are evaluated.

ELECTRON LINEAR ACCELERATOR LABORATORY

UNIVERSITY OF SÃO PAULO - BRAZIL

PROGRESS REPORT ON NUCLEAR DATA FOR PEACEFUL USES OF ATOMIC ENERGY

FEBRUARY - 1983

The research groups of the Electron Linear Accelerator Laboratory are devoted to several research lines. However, as far as nuclear data for peaceful uses of atomic energy is concerned, only the following research lines were selected:

1 - Photofission and Electrofission of actinide nuclei (group leader: Dr. João D.T. Arruda-Neto).

2 - Electro- and Photodisintegration of medium-heavy nuclei (group leader: Dr. Elisa Wolynec).

3 - Nuclear spectroscopy (group leader: Dr. Iuda D.G. vel Lejbman).

1 - PHOTO ISSION AND ELECTROFISSION OF ACTINIDE NUCLEI

(J.D.T.Arruda-Neto)

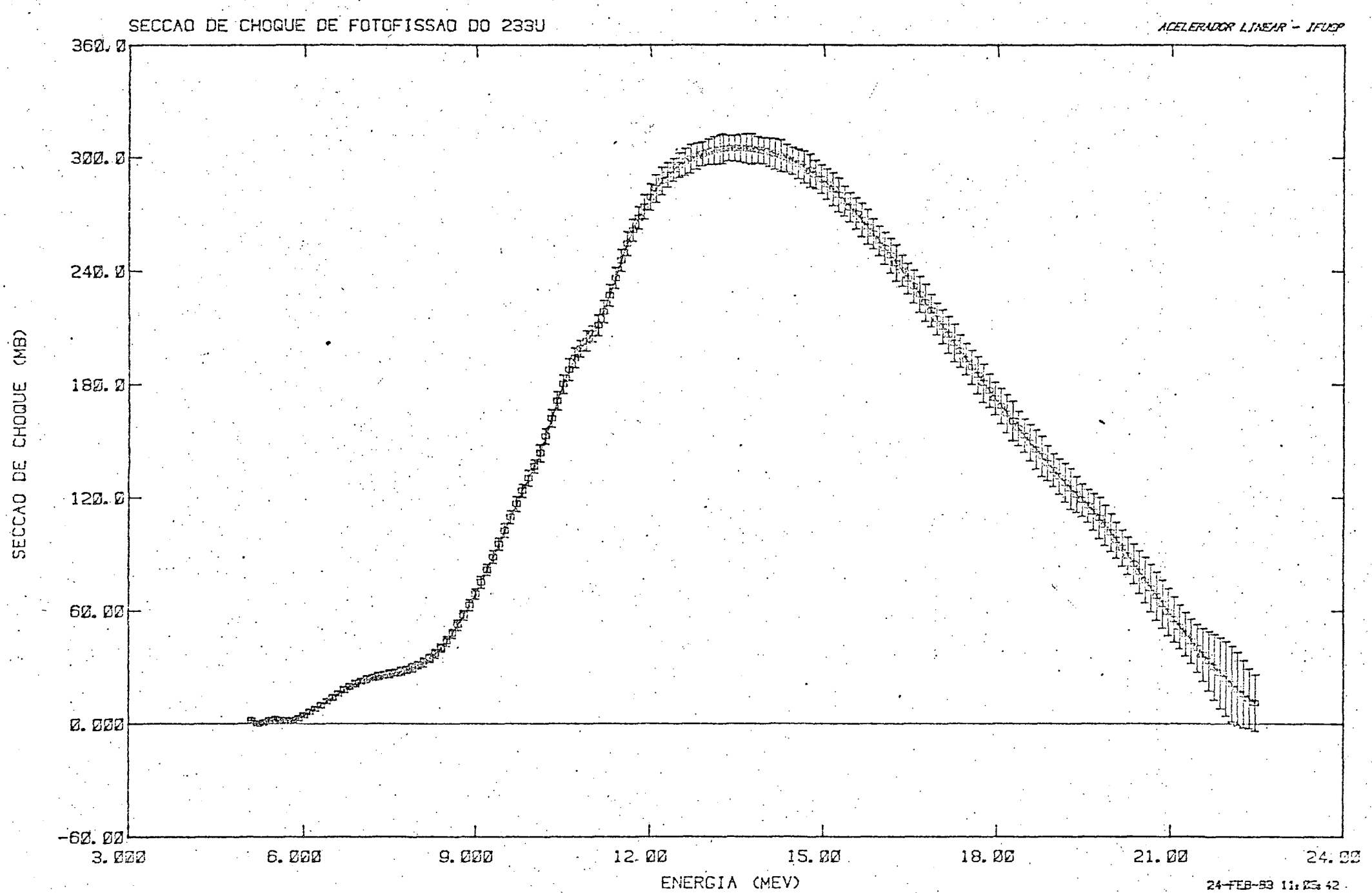
Measurements of the cross sections for fission induced by electrons and photons have been extensively carried out, in the energy range 5-35 MeV, by using the electron beam of the University of São Paulo Linear Accelerator. A systematic study of ^{232}Th, ^{234}U, ^{236}U, and ^{238}U has been so far completed. Presently, we are measuring the electro- and photofission cross sections of ^{233}U, ^{235}U, and ^{237}Np. Preliminary data and a resumé of the fission barrier parameters determined at this Laboratory are shown below.

to be accurate to $\pm$ 1% throughout the energy range studied. Contamination (of the order of 10%) of the photofission yields with electrofission events was accounted for by means of a method developed at this Laboratory. Details of the accelerator, beam-transport system, shielding walls, reaction chamber, monitoring devices, and detection techniques and procedures can be found in Refs, 1,2, and 3.

As mentioned above, the ^{233}U photofission cross section was deduced from the experimentally determined bremsstrahlung-induced fission cross section $\sigma_{B,f}(E_e)$, namely

$$\sigma_{B,f}(E_e) = \int_0^{E_e} \sigma_{\gamma,f}(\omega)\ N^B(\omega,E_e)\,d\omega \qquad (1),$$

where the kernel N^B is the thin-target bremsstrahlung spectrum, corrected for the finite thickness of the radiator[3]. The cross section $\sigma_{\gamma,f}$ was obtained by solving the integral equation (1), using the least-structure unfolding technique of Cook[4]. This unfolding technique is characterized by the smoothing out of any structure not compatible with the experimental errors (as long as it is not pushed too far in the attempt to delineate fine structure). The uncertainty in $\sigma_{\gamma,f}$ (see Fig.1) includes the uncertainties both in $\sigma_{B,f}$ and in the unfolding procedure. The ^{233}U photofission cross section exhibits a resonant behaviour, which reflects the well-known giant dipole resonance shape of the photoabsorption process. The most relevant parameters are:


SECCAO DE CHOQUE DE FOTOFISSAO DO 233U
ACELERADOR LINEAR - IFUSP
360.0
300.0
240.0
180.0
120.0
60.00
0.000
-60.00
SECCAO DE CHOQUE (MB)
3.000
6.000
9.000
12.00
15.00
18.00
21.00
24.00
ENERGIA (MEV)
24-FEB-83 11:25:42

energy peak = 13.6 ± 0.2 MeV

integrated cross section = $\int_5^{20} \sigma_{\gamma,f}(\omega)d\omega$ = 2595 (mb.MeV)

average fission branching ratio = $\left\langle \frac{\Gamma_f}{\Gamma} \right\rangle$ = 0.69 ± 0.07

The quantity $\left\langle \frac{\Gamma_f}{\Gamma} \right\rangle$ was estimated by taking the ratio of the integrated photofission cross section for ^{233}U (2595 mb.MeV) to the integrated photoabsorption cross section for ^{235}U; the use of the latter quantity is justified because (a) we don't know the photoabsorption cross section for ^{233}U, and (b) the photoabsorption cross section is quite similar for all the actinide nuclei.

1.B - FISSION BARRIER HEIGHTS

A type of data eminently suitable for the study of the low-lying levels in the fission spectrum (at the saddle point) is the angular distribution of fission fragments induced by real (via photofission) and virtual (via electrofission) photons, especially for even-even nuclei. Also, the low-energy electro- and photofission cross sections reflect barrier-penetration effects and, therefore, constitute a sensitive means for the study of the nature of the fission barrier. Recently we have been completed a very detailed study of the $J^{\pi} = 2^{+}$ levels, of the fission spectrum for the uranium even-even isotopes, by the analysis of the experimentally determined electrofission angular distributions at energies near the fission barrier. The experimental technique and procedures were the same as for our previous work and are described at length in Refs. 2 and 3. Fig. 2

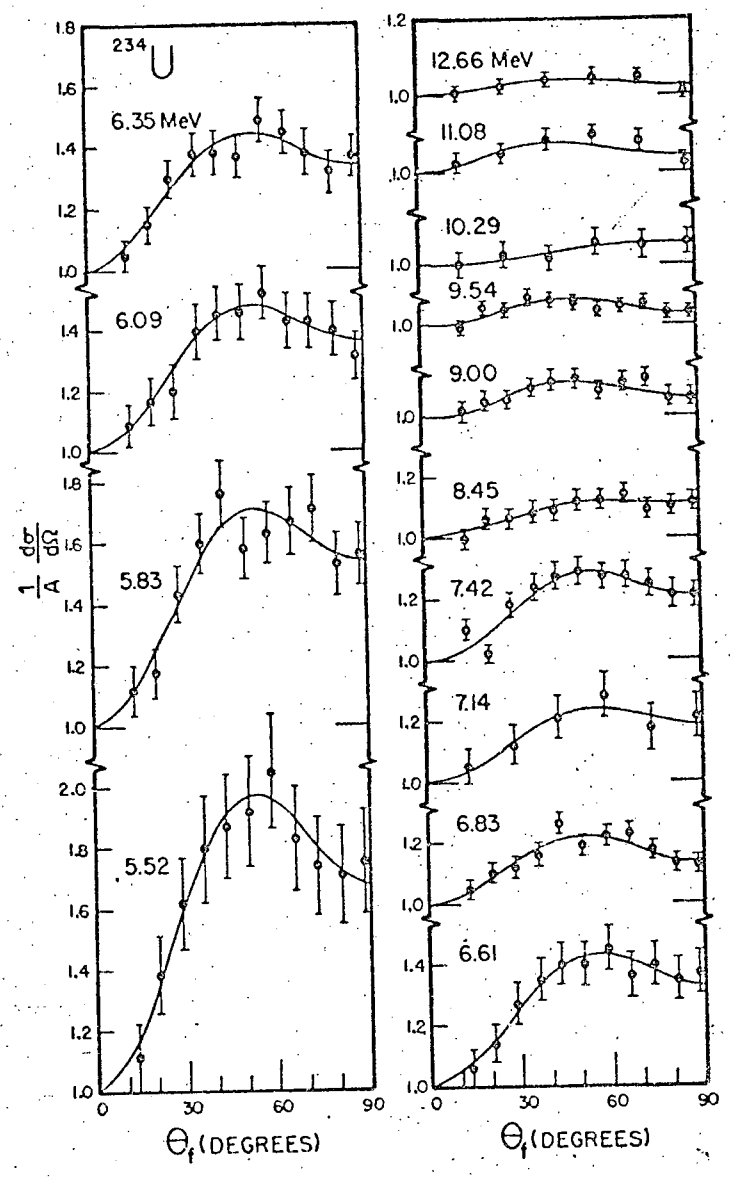

234U
6.35 MeV
6.09
5.83
5.52
12.66 MeV
11.08
10.29
9.54
9.00
8.45
7.42
7.14
6.83
6.61
1/A dσ/dΩ
θf (DEGREES)
θf (DEGREES)

Fig. 2

shows, e.g., the electrofission differential cross sections for ^{234}U for values of E_e between 5.5 and 12.7 MeV; the solid curves were obtained as least-squares fits of $A + B\sin^2\theta_f + C\sin^2 2\theta_f$ to the experimental points. A detailed analysis can be performed by means of the coefficient C in particular of the angular distributions, because it represents contributions only from the fission low-lying levels $(J^\pi,K) = (2^+,0)$, $(2^+,1)$, and $(2^+,2)$ of the transition nucleus (at the saddle point). The results are listed in table 1 (a general description of the method of analysis is presented in Ref. 3).

TABLE 1

The 2^+ fission-barrier heights

Nucleus	$B_f(2^+,0)$ (MeV)	$B_f(2^+,1)$ (MeV)
^{234}U	6.0 to 6.4	$\gtrsim$ 6.7
^{236}U	5.5 to 6.0	$\gtrsim$ 6.4
^{238}U	5.8 to 6.2	$\gtrsim$ 6.7

2 - PHOTONUCLEAR REACTIONS: PHOTONEUTRON CROSS SECTIONS

(E. Wolynec)

In the last 20 years, photoneutron cross sections have been measured for many nuclei using monoenergetic photons. Most of this work was carried by two laboratories: Saclay and Livermore. The avai

lable results up to 1976 are compiled in the "Atlas of Photoneutron Cross Sections obtained with Monoenergetic Photons"[5]. There is also in the literature a few review articles on the subject but none of these publications has addressed the problem of the differences between the measurements performed by the Saclay and Livermore laboratories. We are presently performing electro- and photodisintegration measurements for ^{197}Au and ^{181}Ta in order to study them.

To illustrate these differences we will take the measurements performed for ^{159}Tb by Saclay[6] and Livermore[7], as an example, since the same pattern is found for all isotopes studied by both laboratories. In the discussion that follows below, the label S(L) refers to the cross sections measured by Saclay (Livermore).

The cross sections $\sigma^S_{\gamma,n}$ and $\sigma^L_{\gamma,n}$ for ^{159}Tb are in good agreement up to the γ,2n threshold, apart from a difference in the absolute scale, $\sigma^S_{\gamma,n}$ being 4% bigger than $\sigma^L_{\gamma,n}$. Above the γ,2n threshold there is an important difference: $\sigma^L_{\gamma,n}$ vanishes a few MeV above the γ,2n threshold, in good agreement with the predictions of the statistical model, while $\sigma^S_{\gamma,n}$ has a tail. In ref. 6, the observed tail in the $\sigma^S_{\gamma,n}$ cross section is interpreted as arising from fast neutrons, that would have escaped detection in the Livermore measurements, leading to the conclusion that for ^{159}Tb the "direct effect" photoneutrons contribution is $n_d = 23 \pm 4\%$.

Eventhough up to the γ,2n threshold $\sigma^S_{\gamma,n}$ and $\sigma^L_{\gamma,n}$ differ only by 4% in the absolute scale, their integrated cross sections up to 28 MeV are 1936 and 1413 MeV.mb, respectively.

The (γ,2n) cross sections, $\sigma^S_{\gamma,2n}$ and $\sigma^L_{\gamma,2n}$, differ in shape and magnitude. Their integrated cross sections up to 28 MeV are 605 and 887 MeV.mb, respectively. While the integrated (γ,n) cross section from Saclay is 37% bigger than the Livermore result, their in-

grated γ,2n cross section is 47% smaller than the (γ,2n) from Livermore.

In order to understand these differences we reconstructed the total neutron measurements, that is, we computed:

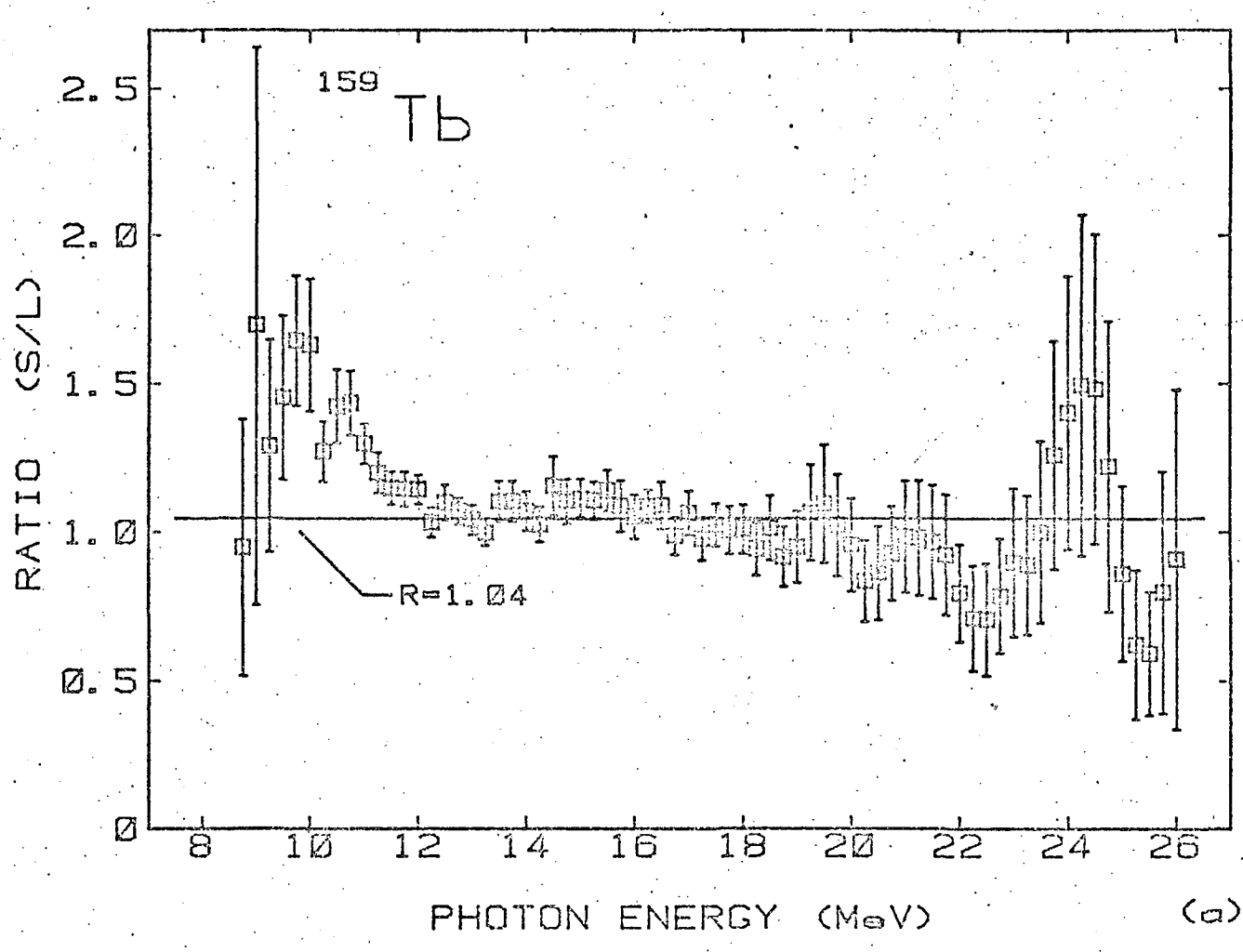
$\sigma^{S(L)}_{\gamma,Tn} = \sigma^{S(L)}_{\gamma,n} + 2\sigma^{S(L)}_{\gamma,2n} + 3\sigma^{S(L)}_{\gamma,3n}$. In Fig. 3-a we show the ratio $R = (\sigma^{S}_{\gamma,Tn} / \sigma^{L}_{\gamma,Tn})$ versus the photon energy. The ratio is reasonably constant and the least squares fit of a constant yields the value $R = 1.04 \pm 0.01$. In order to compute R we interpolated $\sigma^{S}_{\gamma,Tn}$ and $\sigma^{L}_{\gamma,Tn}$, since their data points are not at exactly the same photon energies. One important conclusion can be derived from Fig.3-a: both laboratories are detecting the same number of neutrons (apart from an overall constant) for all photon energies. If there were fast neutrons escaping detection in the Livermore measurements above 20 MeV, R should increase above this energy.

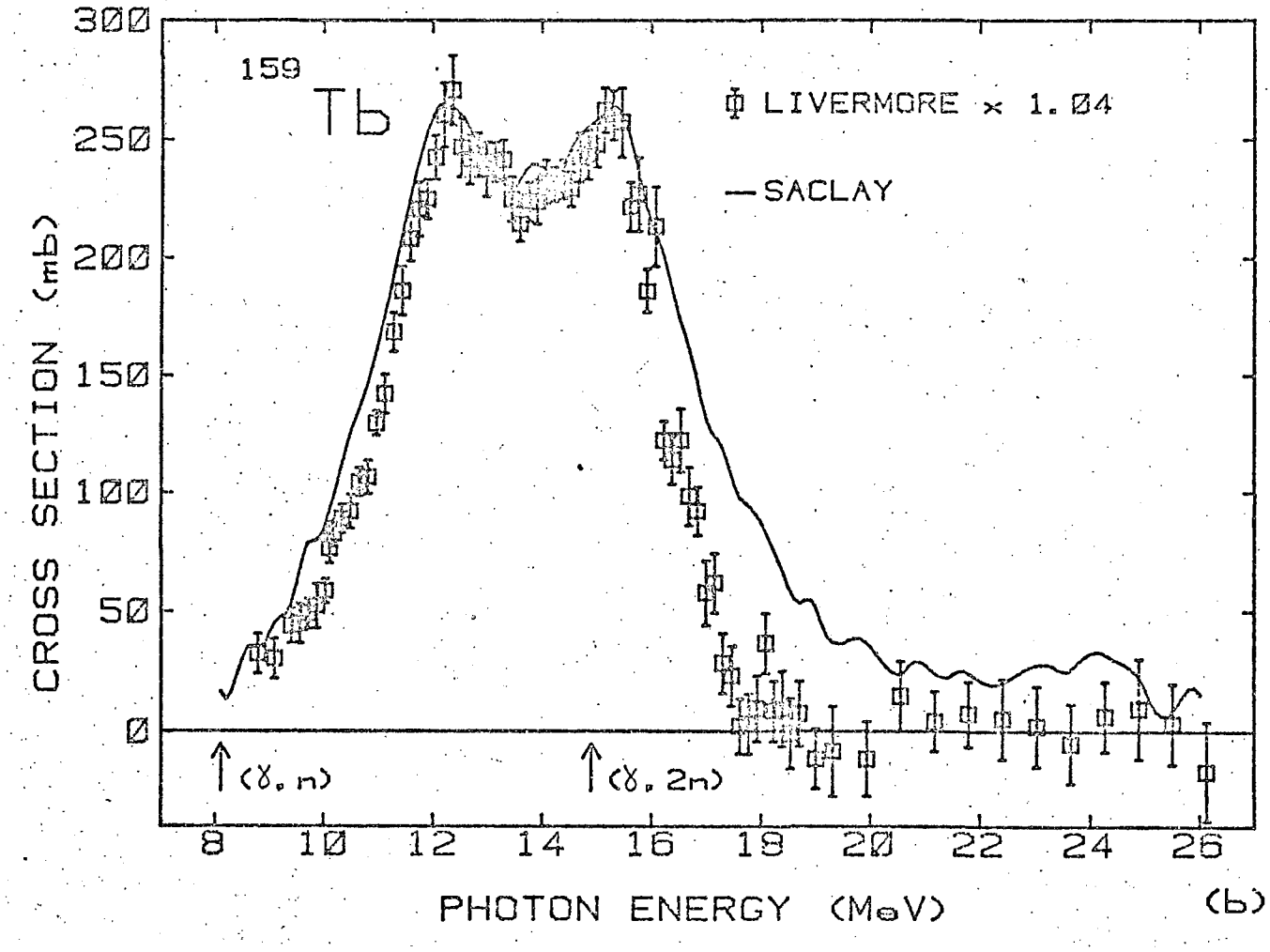
In order to compare the γ,n and γ,2n cross sections from both laboratories in the same absolute scale, we have multiplied the Livermore cross sections by 1.04. Figs. 3-b and 3-c show, respectively, the γ,n and γ,2n data from Saclay (solid line) and the (γ,n) and (γ,2n) data from Livermore multiplied by 1.04 (data points).

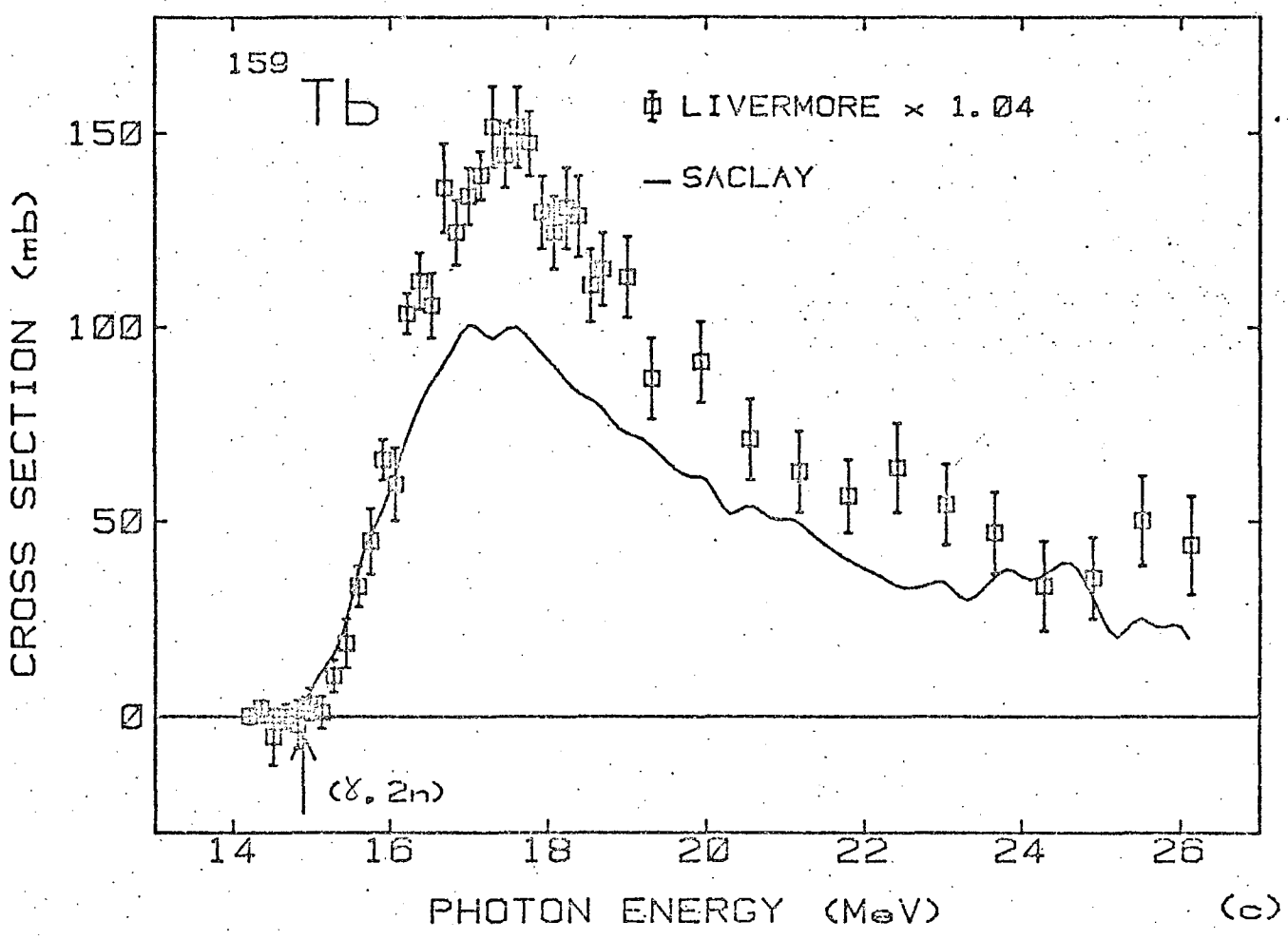
Since both laboratories agree in the total number of neutrons detected, the differences in their γ,n and γ,2n cross sections come from differences in the analysis for separating the total counts into γ,n and γ,2n events (neutron multiplicity sorting).

If we assume that the excess γ,n cross section in the Saclay measurement is due to γ,2n events interpreted as two γ,n events, that is, if we assume that

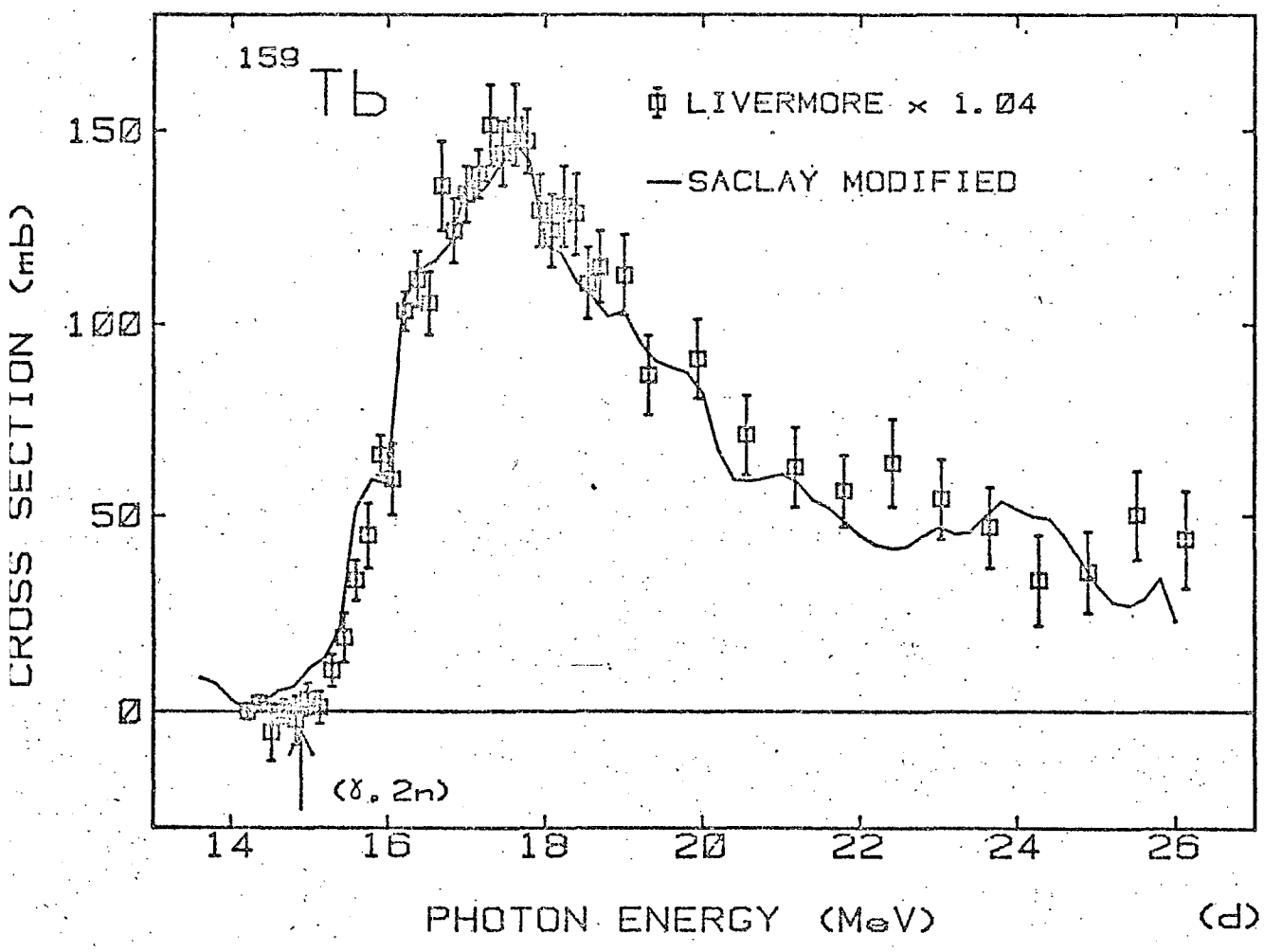
$$\sigma^{S*}_{\gamma,2n} = \sigma^{S}_{\gamma,2n} + \frac{1}{2}\,(\sigma^{S}_{\gamma,n} - 1.04\,\sigma^{L}_{\gamma,n})$$


159 Tb
RATIO (S/L)
R=1.04
PHOTON ENERGY (MeV)
(a)


159 Tb
LIVERMORE × 1.04
SACLAY
CROSS SECTION (mb)
(γ, n)
(γ, 2n)
PHOTON ENERGY (MeV)
(b)


159
Tb
LIVERMORE × 1.04
SACLAY
CROSS SECTION (mb)
150
100
50
0
(γ, 2n)
14
16
18
20
22
24
26
PHOTON ENERGY (MeV)

(c)


159
Tb
LIVERMORE × 1.04
SACLAY MODIFIED
CROSS SECTION (mb)
150
100
50
0
(γ, 2n)
14
16
18
20
22
24
26
PHOTON ENERGY (MeV)

(d)

we obtain for $\sigma^{S*}_{\gamma,2n}$ the solid line shown in Fig. 3-d. The obtained $\sigma^{S*}_{\gamma,2n}$ agrees well with the γ,2n measurement from Livermore multiplied by 1.04 (data points).

We have already performed the same analysis described above for ^{89}Y, ^{115}In, ^{120}Sn, ^{127}I, ^{133}Cs, ^{165}Ho, ^{181}Ta, ^{197}Au, and ^{208}Pb (for which we had the experimental points from both laboratories) and came up with similar conclusions. The photoneutron measurements from both laboratories are in good agreement as to the total number of emitted neutrons versus the photon energy (apart from a normalization constant). The differences in shape and magnitude in the γ,n and γ,2n cross sections arise from the analysis which separates the total neutron counts into 1n and 2n events.

Of course, the above analysis does not allow to conclude which set of data is correct. In order to address this important question we are presently performing electro- and photodisintegration measurements for ^{197}Au and ^{181}Ta. These measurements consist of measuring the (e,n) + 2(e,2n) cross sections by detecting the neutrons. The (e,n) cross section is also measured by radioactivity, so that the (e,2n) cross section can be obtained by subtraction of the (e,n) cross section from the total neutron counts. We also plan to perform the radioactivity measurements using bremsstrahlung photons. The measurement of these cross sections by radioactivity offers the advantage that it does not depend on the energy and/or angular distribution of the emitted neutrons. Combining these 3 measurements it will be possible to evaluate the relative magnitudes of the (γ,n) and (γ,2n) cross section.

Our preliminary electrodisintegration results for ^{197}Au and ^{181}Ta show good agreement with the Saclay absolute value (for the

γ,n up to the γ,2n threshold) but require the shape of the γ,n and γ,2n cross sections as obtained by Livermore. We are in the process of taking more electrodisintegration data and we will also repeat the same measurements with bremsstrahlung photons.

3 - NUCLEAR SPECTROSCOPY

3.A - GAMMA-GAMMA ANGULAR CORRELATIONS MEASUREMENTS

(P.R. Pascholati and I.D. Goldman)

In measurements using the automatic table with NaIxGe-Li detectors, of the Electron Linear Accelerator Laboratory, the mixing ratio δ = E2/M1 of some $2'^{+} \rightarrow 2^{+}$ transitions was determined:

^{202}Hg, δ = 1.27(17)

^{80}Kr, δ = 3.87(88)

^{122}Tℓ, δ = - 3.48(9)

The measurements of the ^{202}Hg isotope was performed for the first time; the ^{80}Kr measurement improves an old one, and for ^{122}Tℓ the result confirms some recent measurements.

3.B - THE BETA-DECAY OF ^{92m}Nb

(O.A.M. Helene and I.D. Goldman)

In gamma spectroscopic measurements, performed with ^{92m}Nb(10.15d) sources produced at our Laboratory using (γ,n) reactions, a very weak branch to the 2067 keV excited level was observed with an intensity of $(6.33 \pm 0.18) \times 10^{-3}$%, corresponding to log ft = 7.9. The attribution was possible due to the elimination of the electronic equipment pile-up, the following of the 1132 keV transition, and the measuring of

its life-time.

3.C - THE DECAY OF ^{101m}Rh

The gamma transitions following the ^{101m}Rh decay are studied using Ge-Li and HPGe detectors with singles and coincidence techniques. Several previously assigned transitions to the decay of ^{101m}Rh were not observed. The observed transitions, with energies in keV and errors in eV (in the parenthesis), are: 127.226(9); 157.414(35); 179.636(15); 184.110(46); 233.742(38); 238.271(43); 306.857(5); 311.367(19); 417.857(46), and 545.117(7). The intensities of these transitions are in agreement with the intensities measured by Sieniawski et al.[8], except the 417.9 keV transition for which we found an intensity five times smaller than that observed by Sieniawski. To explain the observed transitions only four excited levels of ^{101}Ru are needed, namely (energies in keV): 127.226; 306.857; 311.367, and 545.117. Also, it was not seen indication for the existence for the 4.5 keV transition between the 311 keV and 307 keV states, as previously indicated by the γ-γ coincidence measurements of Sieniawski et al.[8].

The measurements show, therefore, a simpler level scheme for the ^{101}Ru than previously reported. Also, we point out that our reported intensity for the 417.9 keV transition, between the $7/2^+$, 545 keV state and the $3/2^+$, 127 keV state, shows that does not exist enhancement of this transition. The partial half-life of the 545 keV state associated with this transition, presumably E2, is about one Weisskopf unity.

REFERENCES

1) J.D.T. Arruda-Neto et al., Phys.Rev.C14, 1499(1976).

2) J.D.T. Arruda-Neto et al., Nucl. Phys. A334, 297 (1980).

3) J.D.T. Arruda-Neto et al., Nucl.Phys. A389, 378 (1982).

4) B.C. Cook, Nucl. Instrum.Meth. 24, 256 (1963).

5) B.L. Berman, "Atlas of photóneutron cross sections obtained with monoenergetic photons", preprint UCRL-78482.

6) R. Bergère et al., Nucl.Phys. A121, 463 (1968).

7) R.L. Bramblet et al., Phys.Rev. 133, 869 (1964).

8) J.Sieniawski et al., Z.Physik 245, 81 (1971).

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INSTITUTO DE ESTUDOS AVANÇADOS
CENTRO DE DADOS NUCLEARES
SÃO JOSÉ DOS CAMPOS, BRASIL

1. INTRODUCTION

The objective of the "Centro de Dados Nucleares"(CDN) at the "Instituto de Estudos Avançados(IEAv)" is to coordinate and execute when necessary, the activities related to measurements, compilation, evaluation, processing and distribution of nuclear data.

The activities of the CDN are divided into four areas:

1- The Data Bank: Compilation and filing of experimental and evaluated data, verification and manipulation of data, generation of multigroup libraries for neutronic/reactor calculations.

2- Integral Analysis: Determination of the quality procedures through sensitivity studies and bench mark calculations.

3- Evaluation: Theoretical evaluation of experimental data for improving the quality of the evaluated data file.

4- Measurements: Obtention of new experimental data in the regions where the data are insufficient or unreliable.

2. CURRENT STATUS

The objectives described above are very vast and only a small part of it has been realized todate. The activities of the Data Bank are fairly well on its way,having implemented most of the evaluated data files along with the utility programs necessary to manipulate them. Several verification and comparison studies were performed on the evaluated data files.

The capability for producing multigroup libraries for the more frequently employed diffusion and transport codes starting from ENDF-B4 and other data file has been established. Development of improved resonance data processing for generation of multigroup constants is also being studied.

Initial studies are in progress with a view to defining a systematic procedure for sensitivity analysis and the employment of covariance data in the ENDF files.

As a first step towards the evaluation of nuclear data, the calculations of the neutron cross section with the help of different nuclear model codes have been initiated. Comparison of theoretical and experimental cross sections and

adjustment procedures are being investigated.

Design of a 15 Mev linear electron accelerator for neutron production is in progress, the installation of which is scheduled for 1986. Possibility of neutron cross section measurements utilizing the other facilities available elsewhere in Brazil is under evaluation.

3. PERSONNEL

The CDN is composed of fifteen Nuclear Engineers, five theoretical nuclear physicists and four experimental physicists, 30% of the personnel being of doctoral level. In addition, the personnel of the "Centro de Processamentos de Dados (CPD)" provide assistence on computer system related problems.

4. FACILITIES

The CDC CYBER 170/750 of the "Centro de Processamentos de Dados (CPD)" is the primary tool for the activities of the CDN.

The experimental personnel are presently being trained at other laboratories with a view to acquiring the necessary experience in performing experimental measurements with the linear accelerator in future.

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