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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

PROGRESS REPORT FOR BRAZIL FOR THE PERIOD 1989/90

Compiled by Roberto David Martinez Garcia

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IAEA NUCLEAR DATA SECTION, WAGRAMERSTRASSE 5, A-1400 VIENNA

Introduction

This report has been prepared by request of the International Nuclear Data Committee (INDC) for presentation at the 18^{th} INDC meeting during 15-19 October 1990 in Vienna.

Contributed summaries describing current work on nuclear data in Brazil are attached. They were received as answers to a letter sent to a group of scientists spanning all the institutions engaged in nuclear research in the country. These scientists were also asked to contact colleagues and to encourage them to submit summaries.

The relatively small number of summaries received shows that few researchers are presently active in the field of nuclear data in the country. To modify this situation, government agencies, research institutes and universities need to work together on the definition, planning and execution of a long term program on nuclear data measurements, evaluations and processing methods for applications. Such program should contemplate the needs of the ongoing nuclear applications programs and the establishment and support of research groups integrated into the international effort on nuclear data coordinated by the IAEA.

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Brazilian Liaison Officer
July 25, 1990

The IEAv L-Band Electron Linear Accelerator: A Progress Report

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The Instituto de Estudos Avançados (IEAv) has an ongoing program to design and construct an L-band linac which will be used both for low-energy (<30 MeV) industrial applications and for neutron induced cross sections measurements. Such experiments will be part of the program of the Nuclear Data Center which is installed at the IEAv.

The accelerator will consist of four modules; each one will have two 2-m long accelerating structures of constant gradient, $2\pi/3$ design, powered by a klystron TV2022B of THOMSON. The final parameters are: no-load energy of 130 MeV, electron pulse width from 10 ns to 2μs, short/long pulse current of 10/1 A, repetition rate up to 1000 pps, total peak/average RF power of 80 MW/240 kW. We are now working on the first accelerating module.

The accelerator will be installed in an underground gallery (7-m deep); the main linac building has been completed but it still needs additional work to be safely occupied. The electron gun has been finished and the injection system is now being optimized; the RF system (300 kW klystron modulator and microwave network) is in the final steps of completion; the cavities of the first accelerating structure have been machined in a ultra-high precision lathe and will be assembled by an electroforming technique developed at the IEAv; the focussing system, consisting of four 800-Kg solenoids capable of generating a magnetic field of 1200 gauss, has been completed. The control system is partially implemented and the components of the vacuum and cooling systems are being fabricated.

We hope to complete the first two-structures accelerating module by the end of 1991 and we think that, with the experience we have accumulated so far, we can complete the three next modules until 1995 if the financial support is increased to an adequate level.

Evaluation of Thorium, Iron and Uranium Isotopes

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Work has continued on the evaluation of thorium - 232 and the iron and uranium isotopes. It has been concentrated on improving the description of the total, elastic and inelastic cross sections in the continuum region through the inclusion of a parametrized dispersion term in the optical potential. The spherical optical codes, SCAT2 and CRAPONE, and the coupled channels codes, JUPITOR, CIRCE and BIGLAZY, were modified for this purpose. The results obtained for iron are encouraging while those for the actinides are much less so. In the latter case, we haved yet to conclude whether the problem lies with the parametrization of the dispersion term or with the data sets used to obtain the fits.

A PROLOG RETRIEVAL SYSTEM FOR ISOTOPE IDENTIFICATION

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In neutron activation analysis the isotope identification is made by studying the energies of the characteristic gamma radiation.

At present, the analysis is made through a manual search on tables printed on manuals or journals (e.g. compilation of F. Adams and R. Dams, J. Radioanal. Chem. Vol 3, 1964, pp 99-125). The search process is slow, tiring and subject to human errors.

An effort is being made to automatize this process by the use of a PC-computer. The data from printed tables is being organized in a data base to speed the retrieval. A dialogue user interface is being planned to make the task easy and accessible. It will be possible to retrieve the data either by gamma energy or by isotope. The artificial intelligence language Prolog is being used because it was considered the ideal language for this kind of application.

The data from the tables mentioned in the reference above are going to be checked and updated.

Average Neutron Cross Section Measurements in U-235 Fission Spectrum

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Average cross sections ($\bar{\sigma}$) measurements for the following threshold reactions: $^{58}Ni(n,2n)^{57}Ni$, $^{63}Cu(n,\alpha)^{60}Co$, $^{127}I(n,2n)^{126}I$ and $^{31}P(n,p)^{31}Si$, are being performed in a U-235 fission spectrum obtained at the core of the IEA-R1 2MW pool type research reactor. The activation method has been selected due to the favorable and well known decay characteristics of the product nuclei. A careful characterization of the neutron spectrum is being realized in order to compare measured and calculated results, using the neutron dosimetry system SAIPS for the spectrum analysis. The average cross sections will be reported with details of the involved uncertainties, including correlations as well as statistical and systematical uncertainties. It is expected that the new results allow to reduce the overall uncertainties as well as discrepancies between measured and calculated $\bar{\sigma}$ values for these reactions in order to improve the International Reactor Dosimetry File (IRDF-85).

Integral Cross Section Measurements for (n,t) Reactions in Light Nuclei

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Average cross section ($\bar{\sigma}$) measurements for tritium production are being performed in a Cf-252 fission spectrum and around 14MeV, for the following reactions: $^{6}Li(n,t)\alpha$, $^{7}Li(n,n't)\alpha$, $^{10}B(n,t)2\alpha$, $^{11}B(n,t)^{9}Be$ and $^{14}N(n,t)^{12}C$. The α,t track registration technique in CR-39 and Makrofol E was chosen to determine the tritium formation and the activation method was selected for neutron monotoring during the irradiations. The average cross sections will be reported with the respective covariance matrix and with details about the involved statistical and systematical uncertainties.

CORRELACAO ANGULAR GAMA-GAMA PARA TRANSICOES NO ^{72}GE

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The technique of directional gamma-gamma angular correlations has been used to investigateded the decay of $Ga^{72}$to levels in Ge^{72}.The coincidence measurements were performad using HPGe-Ge(li) spectrometers.

The radioactive samples of ^{72}Ga ($T_{1/2}$ = 14.1 h) were produced by irradiating 5mg of natural Galium in the form of GaO_2 in the IEA-R1 reactor at IPEN.The sample were allowed to decay for a period of 2h in order to reduce the activity due to the presence of $Ga^{70}$with ($T_{1/2}$=21 min).The measurements were made on for 6 direct an 11 skip cascades all involving the 834 keV $2^+ \longrightarrow 0^+$ transition. The results are given in table 1.

TABLE 1

CASCADE(keV)	A_{22}	A_{44}
630-834	-0.101(07)	0.306(10)
894-834	0.129(12)	0.027(19)
2109-834	0.057(58)	-0.068(88)
2202-834	0.273(14)	-0.041(22)
2491-834	-0.058(30)	0.025(45)
2508-834	0.182(22)	-0.046(34)
600-630-834	0.017(16)	-0.096(24)
736-894-834	0.222(54)	-0.091(85)
786-894-834	-0.109(19)	-0.046(28)
1000-630-834	-0.035(40)	0.029(59)
1050-630-834	0.059(17)	0.018(26)
1215-894-834	-0.066(50)	0.071(74)
1230-894-834	-0.554(41)	0.105(54)
1572-894-834	0.232(57)	-0.085(82)
1596-894-834	-0.054(24)	0.098(37)
1681-630-834	0.128(58)	0.020(90)
1860-630-834	0.008(28)	-0.025(41)