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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

PROGRESS REPORT TO

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August 1971

F. Gama Carvalho, Editor
Junta de Energia Nuclear
Laboratório de Física e Engenharia Nucleares
Sacavém - PORTUGAL

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The work reported in this document has been performed or is under way at the nuclear research center of the portuguese Junta de Energia Nuclear:

Laboratório de Física e Engenharia Nucleares
Estrada Nacional Nº 10
Sacavém/PORTUGAL

A. Neutron Physics

1. Thermal Neutron Diffusion Parameters

(E. Martinho e M.M. Costa Paiva)

(a) Diffusion parameters of thermal neutrons in water were determined from diffusion length measurements in twenty-two boron-poisoned aqueous solutions. A uniform plane source of thermal neutrons and a parallelepipedal polymethyl methacrylate container with a buckling of $B^2 = 9.1 \times 10^{-2}$ cm^{-2} were used. The derived values of the diffusion parameters of thermal neutrons in water at 22°C are: $D_o = 36304 \pm 180$ cm^2/sec, $C = 3213 \pm 110$ cm^4/sec and $F = 373 \pm 97$ cm^6/sec. These results[1] are found to be in good agreement with recent calculations by Dorning[2].

(b) Diffusion parameters measurements in organic moderators by a static method have been initiated recently.

2. Neutron Time-of-Flight Structure Spectrometer

(F. Carvalho, J. Salgado, A. Henriques, A. Vallêra)

A series of test measurements on well known samples has been carried out in order to establish the spectrometer's performance (Al, Si, ZnO, Ag_2O, α-Fe_2O_3). In the case of ZnO the estimated accuracy in the determination of the oxigen position was .3%. A new ^{3}He-detector bank at 25° scattering angle (in addition to the present one at 90°) and a liquid nytrogen cryostat will soon be installed in order to improve the instrument's capabilities for magnetic structure investigation.

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(1) E. Martinho and M.M. Costa Paiva: Thermal-Neutron Diffusion Parameters in Water by the Poisoning Method (to be published in Nuclear Science and Engineering).

(2) J. Dorning, Nucl. Sci. Eng. 41, 22-28 (1970).

B. Nuclear Physics

1. Electromagnetic Properties of ^{28}Al

(J.M. Cunha, M.G.F. Dias and C.M. da Silva)

The analysis of the reported Doppler shifts has been completed and estimates and limits were obtained for the half lives of several excited states. A computer algoritm was developed to deal with the situation in which the recoil slows down in two adjoining media (target and backing). An upper limit of 50fs was put on the half lives of levels 5,8 and 11 while lower limits of 100 and 1 500fs were put on levels 5' and 10; level 8 was estimated to have an half life of 90 $\pm$ 80fs.

2. Low lying states of ^{29}Si

(M. C. Vouga and M.F. da Silva)

The Si^{28} (d,p)Si^{29} reaction is being used to get more information of the first seven excited states of Si^{29}, concerning mixing ratios and half-lives. Coincidence gamma rays detected with Ge-Li detector were obtained for the first four excited states and further experimentation is being pursued.

3. Deuteron breakup effects in deuteron elastic scattering

(A. S. Fonseca, F.D. Santos)

The optical potential of the deuteron is expressed in terms of the neutron and proton optical potentials using' the operator formalism of Feshbach. Calculations have begun in order to estimate the connections to the deuteron optical potential arising from breakup in the ground state of the target and to fit differential cross sections and polarization data with the predicted potential.

4. Irreducible tensor operator expansion of exp $(\vec{a}.\vec{b})$

(F.D. Santos)

A generalization of Rayleigh's expansion of a plane wave exp$(\vec{a}.\vec{b})$ to cases where

$\vec{a}$ and $\vec{b}$ can be vector operators was derived. From it we obtain irreducible tensor operator expansions of the rotation and translation operators. The application of the latter expansion in approximations to finite range effects and nonlocality in direct nuclear reaction theory was considered. Results will be published shortly.

5. Algebraically generated Schwinger terms and sum rules
(R.V. Mendes)

Algebraically generated Schwinger terms for the quark model current algebra are obtained by covariant deformations of the vector and axial vector currents inside a local U(12) algebra. The model is free from the symmetry diseases found for a previously proposed U(12) model. Sum rules following from the new currents commutators, were studied. A deviation from Adler's result for the high energy limit of the difference of neutrino and anti-neutrino cross-sections is predicted.

C. Instrumentation

1. On-line Data Accumulation and Reduction

- A PDP 15/20 computer was installed in Dec. 1970. The system's fast memory was recently extended to 16 k and a third DEC-Tape unit was added. Although the computer is intended primarily for on-line use it has been extensively used for off-line data reduction and analysis using FORTRAN.

- A nuclear ADC was interfaced to the computer in the Increment Memory Mode; the prototype interface worked satisfactorily after some modifications were performed in the computer (H. Coelho, J.Vicente and C.M. da Silva).

- A Modular Data Handling and Acquisition Programm has been devised and a useful version is already operational. The modular system allows easily the introduction of new function subroutines and the user may define initially which functions he is going to use, thus making his choice of storage space against utility functions. (M.G.F. Dias and C.M. da Silva).

2. Van de Graaff Accelerator

- The Van de Graaff accelerator has had a long period of maintenance mainly due to defficient tube isolation from surface absorption and to instabilities in the corona stabilization system. The belt charging assembly has been modified and the accelerator performance is returning to normal.

- A new line for (p,γ) reactions has been designed and is in the setting up stage. It includes a 90^{o} bending magnet and two quadrupoles that transport the beam over a length of approximately 20 metres.

3. Nuclear Electronics

Improvements have been made in the NIM standard modules previously described and new modules have been developed. These include a digital integrator, a digital mixer, charge preamplifiers and a bin and type V/L power supply.