EANDC (OR)-55 "L"

PROGRESS REPORT TO EANDC FROM AUSTRIA

January 1967

P. Weinzierl, Editor

This report contains partly preliminary data. The information given is to be considered as private communication and is not to be quoted.

1. ATOMINSTITUT DER OESTERR. HOCHSCHULEN, VIENNA

1.1 Cold Neutrons

1.1.1 Cold Neutron Source at the TRIGA Reactor Mark II

H. Rauch

For the cold neutron source (benzene moderator, 5 cm thick at liquid nitrogen temperature) a two rotor chopper system with curved slits and an optimum resolution is in construction.

1.1.2 Total Neutron Cross Section of Cold Neutrons for Polyethylene and Polystrol between $4.2^{o}K$ and $300^{o}K$.

H. Rauch and F. Lasinger

A remarkable increase of the cross sections between $77^{o}K$ and $4.2^{o}K$ by about 15 barn is observed. The experimentally determined cross sections are compared to the Goldman-model. The evaluation of this temperature dependence required a separate study on the density change of these materials in order to correct for this effect which has a comparable magnitude.

1.1.3 Total Reflection of Cold Neutrons on Curved Soller Slits

K. Binder, W. Fiala, H. Rauch

Experimental work was continued on the transmission properties of such slits changing geometrical parameters and materials. The aim especially at the construction of neutron focusing devices comprising several soller slit systems with opposite sense of curvature. The loss in intensity deviating cold neutrons by about 1.5^{o} is less than 10 %.
Theoretical work on these transmission properties is carried out at the same time. It allows to predict as well the neutron deflection as the filter properties of such systems. The calculation of the fraction of neutrons undergoing a certain number of

reflections is especially important for the use in magnetic mirror systems.

1.2 Polarized Neutrons

The work reported in EANDC (OR)-46 has been published by H. Rauch Z.f.Phys. 179, 373 (1966) and 179, 389 (1966).

1.3 Neutron Diffusion

1.3.1 Comparison of Non-Stationary Methods for the Determination of Diffusion Parameters.

C.N. Fleck, F. Kopitsch (Acta Phys. Austr. 23, 350, 1966)

Three non-stationary methods with different time behaviour of the thermal neutron source density (sinus, δ-function, exponential), are discussed and compared to the usual methods of fast pulse neutron sources and stationary experiments in poisoned moderators.

1.4 Neutron Detectors

1.4.1 A New Detector for Slow Neutrons

H. Rauch, F.Grass, B. Feigl (Nucl.Instr. and Meth.,in print)

Using a thin Gadolinium foil and a surface barrier detector measuring the conversion electrons after the capture process in Gd a neutron detector could be developed with an efficiency up to 70 %. Its small size and very low γ-sensivity is of importance for many applications.

1.4.2 Single Crystals of Lithiumborate as Neutron Detectors

E.Seidl, W. Schwertführer (Atomkernenergie 11, 155, 1966)

The electric conductivity of lithiumborate single crystals is changed by intense thermal neutron irradiation. A linear response in the range 10^8 - 10^{12} n/cm^2 sec was observed in a reactor core. The effect of γ-radiation amounted to only 1 %.

2. PHYSIKINSTITUT, REAKTORZENTRUM SEIBERSDORF, OESTERR.STUDIENGESELLSCHAFT FUER ATOMENERGIE GMBH.

2.1 Electromagnetic Mass-Separation

2.1.1 Separation of Stable Isotopes

L.Balcarczyk, F.Edl, E.Formann, F.Viehböck, H.Wotke

For the determination of pile neutron capture cross sections, the isotopes of Dy, Er, Gd, Sm and Yb were separated. For (n,γ) studies quantities between 20 and 50 mg of very high enriched Gd-155, Eu-151 and Eu-153 were delivered to research institutes in Sweden and Germany.
The collection and recovering technique of the separated isotopes from high purity aluminum collector pockets has been improved.
By using a special collector based on trapping the ions on cooled charcoal, 10 mg of Xe-131 were separated with a purity of 99.5%.
The development of a new type of ion source for long time separations of stable isotopes is in progress.

2.1.2 Pile Neutron Capture Cross Sections of Selected Rare Earth Isotopes

R.Dobrozemsky, E.Formann, F.Pichlmayer, F.Viehböck, H.Wotke

The determination of pile neutron capture cross sections has been continued. The accuracy can be considerably increased by the use of electromagnetically separated isotopes of very high purity.

The results obtained are:

Isotope	σ pile (barn)	Σ' (barn)
Gd-154	105 ± 11	303 ± 31
Gd-156	6.3 ± 1.0	78 ± 21
Yb-170	92 ± 11 x)	
Yb-171	69 ± 8 x)	
Yb-172	3.3 ± 0.4	18 ± 7
Yb-173	41.4 ± 2.3	390 ± 42

x) *values from a preliminary experiment*

Measurements on cross sections of some isotopes of Dy, Er and Sm are in progress.

2.1.3 Production of Self-Supporting Targets of Stable Isotopes

E. Formann, F. Viehböck, H. Wotke

For nuclear reaction studies isotopic targets of high purity are produced in the mass-separator directly. The focused ion beam hits a graphite reflector and is sputtered together with the reflector substance. The sputtered material is collected on a thin foil. Angular distribution and yields for different incident angles were measured by a neutron activation method.
Based on these results several targets of Gd-157 with a diameter of 1.6 cm and thicknesses between 0.5 and 2 mg/cm^2 were produced. In addition to the desired isotopes the targets contain about 30 % weight of graphite.

2.2 Nuclear Physics

2.2.1 Measurement of the Angular Correlation Coefficient in the Neutron β-Decay x)

R. Dobrozemsky, W.Kubischta, H.Paul, P.Riehs, P.Weinzierl

A measurement of this angular correlation coefficient is in preparation by means of a precise spectrum measurement of the decay protons. A cylindrical volume of high neutron flux in a

x) This project is supported in part by the US-Government

tangential beam tube will serve as source volume for the decay protons. A first design for a respective beam tube insert ensuring high vacuum (10^{-7} mm, oilfree) excellent magnetic shielding (10^{-4} Oe) was finished. Protons will be analyzed at the beam tube exit by means of an electrostatic spherical condenser spectrometer.

2.2.2 Experimental study of parity mixtures in nuclear states.

F. Dydak, P. Riehs, H. Woda

The forward-backward asymmetry in the β-γ-angular correlation due to a possible parity mixture in the excited states is to be investigated. Preliminary measurements on A-41 and Hg-203 did not give significant results due to electronic deficiencies of the system. A new fast electronic multiple coincidence system has been designed and is in construction for new experiments on Hg-203.

2.2.3 Non-Destructive Measurement of the Pu-Content in Fuel Samples

F. Depisch, H.Hick, P. Weinzierl

An attempt is made to determine the Pu-content of irradiated natural or low enriched fuel samples by means of a neutron transmission method. A heavily shielded neutron chopper system is being installed at the ASTRA reactor beam tube. The change in the time-of-flight spectrum observed in the region of the 0.3 eV resonance is expected to yield quantitative information on the Pu-content.

2.3 Solid State Studies Using Slow Neutron Scattering

2.3.1 Pressure Induced Phonon Frequency Shifts in Pb Measured by Inelastic Neutron Scattering [x)]

R. Lechner, G. Quittner

The shifts of frequencies of six selected phonons in lead pro-

---

x) This project is supported in part by the US-Government.

duced by the application of a hydrostatic pressure of 3000 atm have been measured by the technique of inelastic scattering of neutrons. The results expressed as microscopic Grüneisen parameters $\gamma_{q,j}$ of the modes q,j are compared with the temperature shifts of phonon frequencies as measured by B.N. Brockhouse and with the macroscopic Grüneisen parameter γ_G.

2.3.2 Rotating Crystal Spectrometer [x)]

O. Eder, H. Fiedler, H. Rieder

The instrument has been equipped with a SiO_2 single crystal filter, the previously used velocity selector has been removed and it is planned to run a chopper synchronous with the single crystal in order to reduce the background. The electronics has been developed further making the amplifiers faster and the differentiation stronger and improve in this way the neutron-γ pulse shape discrimination and the neutron-noise discrimination. The following measurements have been performed:

1. Study of surface effects on the frequency spectrum of MgO single crystal grains (grain size: 5.10^5 Å, 1250 Å).
2. Study of impurity modes in the Pt+Cu (5 Atom% Cu) system.

---

x)This project is supported in part by the US-Government.