International Atomic Energy Agency

INDC(GDR)-16/G

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

Progress Report

to the

International Nuclear Data Committee

from the

German Democratic Republic

Compiled by

D. Seeliger

June 1981

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

Reproduced by the IAEA in Austria
August 1981
81-4115

INDC(GDR)-16/G

Progress Report

to the

International Nuclear Data Committee

from the

German Democratic Republic

June 1981

Compiled by D. Seeliger

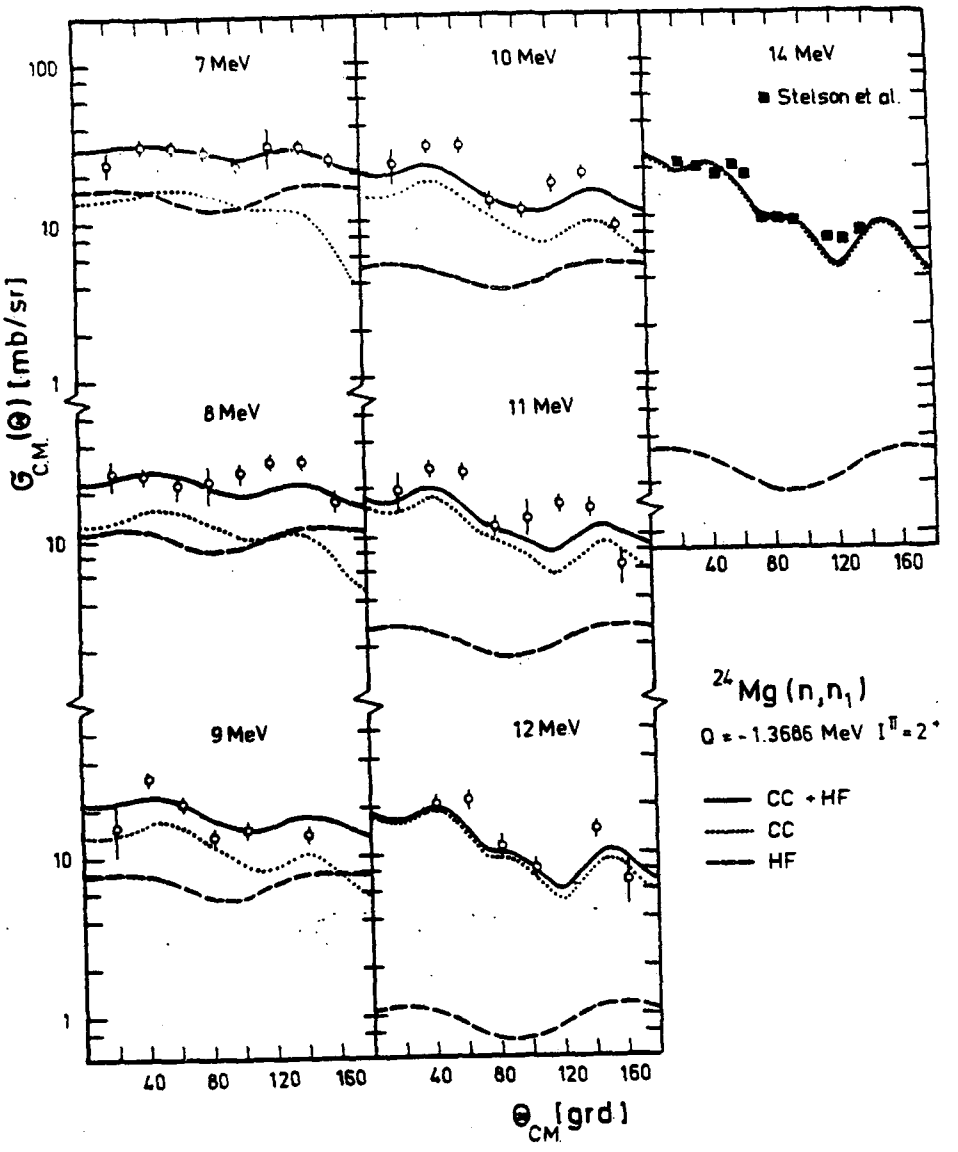
C O N T E N T S

ANALYSIS OF NEUTRON SCATTERING ON 24-MG IN THE ENERGY RANGE FROM 7 TO 14 MEV

H. Förtsch, D. Schmidt, D. Seeliger, T. Streil
Technical University Dresden

At bombarding energies 7, 8, 9, 10, 11 and 12 MeV angular distributions of partial cross sections were measured corresponding the 0^+(g.s.), 2_1^+(1.37MeV), 3^+(5.24MeV), 4_2^+(6.01MeV) and unresolved $4_1^+ + 2_2^+$(4.12, 4.24MeV) states, respectively. The data of STELSON et al. [1] are included into the interpretation.
The elastic scattering can be described well in the full energy range in the frame of the optical model using parameters from FERRER et al. [2] as well as in the coupled channels representation. Than the coupling within the ground state rotational band is realized with deformation parameters $\beta_2 = {}^{+}0.55$ and $\beta_4 = {}^{-}0.05$, whereby β_2 can be fixed between 0.50 and 0.60.

The inelastic scattering data can be described in the frame of a super-position of collective and compound contributions. In the collective model the 0^+, 2_1^+ and 4_1^+ states can be understood as a K=0 rotational band. The 2_2^+, 3^+, 4_2^+ states are described as members of a K=2 rotational band based on a quadrupole vibration with $\beta_2' = 0.7$.
The imaginary part of the optical potential must be chosen energy - dependent for the coupled channels calculation as well as the Hauser-Feshbach part [3] . In this way, a consistent and good description of all data in the full energy range is obtained. Figure 1 gives the (n,n_1) angular distributions as an example.



[1] P.H. STELSON et al., Nucl.Phys. 68(1965) 97
[2] J.C. FERRER et al., Nucl. Phys. A275(1977) 325
[3] H. FÜRTSCH, thesis, Techn. University of Dresden (1981)

ANALYSIS OF NEUTRON SCATTERING ON 28-SI IN THE ENERGY RANGE FROM 6.8 TO 14.8 MEV

D. Schmidt, D. Seeliger, T. Streil
Technical University Dresden

At bombarding energies 6.8, 7, 8, 9, 10, 11 and 12 MeV angular distributions of partial cross sections were measured corresponding the 0_1^+(g.s.), 2_1^+(1.79MeV), 4_1^+(4.61MeV), 0_2^+(4.98MeV), 3^+(6.27MeV) and unresolved $3^- + 4_2^+$(6.88, 6.89MeV), $2_2^+ + 2_3^\mp$(7.38, 7.42MeV), respectively. The data of SEELIGER [1] are included into the interpretation.

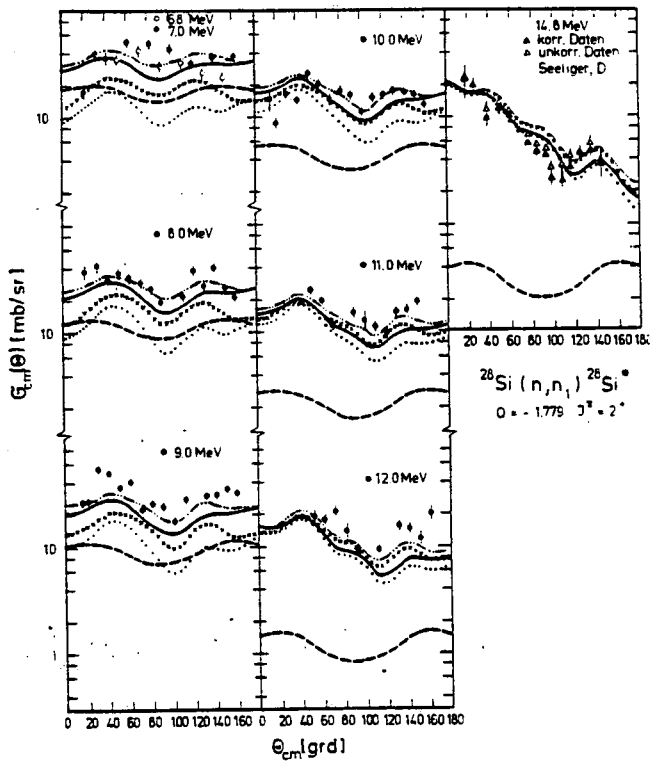
The elastic scattering can be described well in the full energy range in the frame of the optical model using parameters from OBST et al. [2] as well as in the coupled channels representation. In this case, the coupling within the ground state rotational band is realized with deformation parameters $\beta_2 = 0.48 \pm 0.07$ and $\beta_4 = -0.3 \pm 0.1$.

The inelastic scattering is described by superposition of direct and compound contributions. The calculations in the frame of the collective model are based on the following structure:

0_1^+, 2_1^+, 4_1^+	:	K=0 ground state rotational band, $\beta_2 = 0.48$, $\beta_4 = -0.3$
3^+	:	quadrupole vibrational state coupled to the g.s. with spin-flip, $\beta_2 = 0.2$
0_2^+	:	monopole vibrational state, $\beta_0 = 0.25$
3^-	:	octupole vibrational state, $\beta_3 = 0.3$
4_2^+	:	hexadecapole vibrational state, $\beta_4 = 0.25$
0_3^+, 2_3^+	:	K=0 rotational band with deformation in opposite to the g.s., $\beta_2 = -0.48$
$2_2^\mp$	:	quadrupole vibrational state coupled to the second band, $\beta_2 = 0.30$

The imaginary part of the optical potential must be chosen energy - dependent $W_D = 0.6E$ for the coupled channels calculation as well as

the Hauser-Feshbach part [4]. In this way, a consistent and good description of all data in the full energy range is obtained. Figure 1 gives the (n,n_1) angular distributions as an example



[1] D. SEELIGER, thesis, Techn. Univ. Dresden (1968)
[2] A.W. OBST & J.L. WEIL, Phys.Rev. C7 (1973) 1076
[3] S. DAS GUPTA & M. HARVEY, Nucl. Phys. A94 (1967) 602
[4] M.R. MANNING & A.B. VOLKOV, Phys. Letters 26B (1967) 60
[5] T. STREIL, thesis, Techn. Univ. Dresden (1981)

NEUTRON SCATTERING ON LITHIUM ISOTOPES AT ENERGIES BETWEEN 7 AND 10 MeV

H. Förtsch, D. Schmidt, T. Streil
Technical University Dresden

Neutron scattering has been investigated on the isotopes 7-Li (at 7 and 10 MeV) and 6-Li (at 8 MeV) [1] at 8 angles.

7-Li

The n_0 and n_1 groups couldn't be resolved, the n_2 neutron group has been measured at 10 MeV bombarding energy only. The results from the (n_0+n_1) group are in good agreement with the data from HOGUE et al.[2], but the n_2 data differ in the forward angle region. The present data are corrected against disturbing neutron peaks from the neutron source due to (d,n) reaction on carbon and oxygen contaminations. In ref. [2] such corrections are not denoted.

6-Li

The n_0 and n_1 groups are resolved, the cross sections are in good agreement with interpolated values from HOGUE et al. [2]. Furthermore, the neutron continuum for neutron energies above 2 MeV has been determined. The integrated cross section including the inelastic scattering of $\sigma_{cont.}=(435\pm17)$mb is in the same order as the value $\sigma_{cont.}=(394\pm46)$mb from COOKSON et al. [3] at 10 MeV bombarding energy.

[1] H. FÖRTSCH et al., YAD. KONST. (in russian), in print
[2] H.H. HOGUE et al., Nucl.Sci.Eng. 69(1979) 22
[3] J.A. COOKSON et al., Nucl. Phys. A91(1967) 273

MEASUREMENT OF FISSION NEUTRON SPECTRA

W. Grimm, H. Märten, D. Seeliger and B. Stobinski
Technical University Dresden

A high-sensitive neutron spectrometer described in ref. 1 is used for the determination of fission neutron spectra in a wide energy range by the two-dimensional measurement of neutron time of flight and scintillator proton recoil energy. In this way, one is able to select the optimum (regarding background conditions) proton threshold energy for a given time of flight channel resp. channel range. The suppression of the experiment-specific and the cosmic background is realized by the use of a heavy shielding and the electronic n/γ- resp. n/μ-discrimination method.

The 4096 channel analyser working two-dimensionally is coupled to the minicomputer KRS 4200 via SI 1.2 and CAMAC. A FORTRAN 4000/4200 program system including CAMAC application (control and data processing) arranges the data transfer as well as the check, correction, concentration and analysis of the measured spectra.

The detector efficiency as a function of neutron energy and proton recoil energy bias was calculated by the use of the Monte-Carlo-code NEUCEF /2/ acceptin the light output data of Verbinski et al. /3/. Fig. 1 shows the spontaneous fission neutron spectrum of Cf-252 (preliminary results). This measurement was an excellent confirmation of the calculated absolute detector efficiency (spectrum of comparison from ref. 4).
Furtheron, the spectrometer is used for the determination of fast fission neutron spectra /5/.

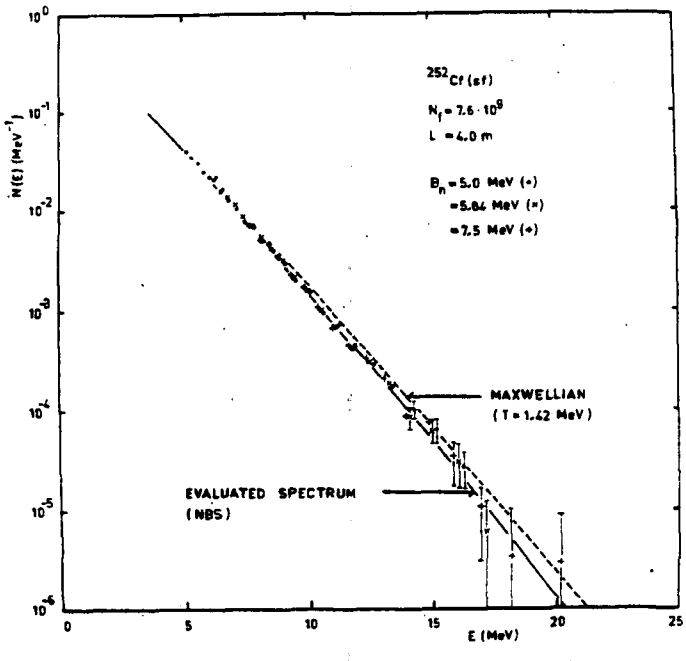


Fig. 1
Cf-252(sf) fission neutron spectrum (preliminary res.)

[1] W. Grimm, et al., 5th Conf. on Neutron Physics, Kiev 1980, part 3, 3

[2] D. Hermsdorf, rep. ZfK-315(1977)192,
Stanton, N.R., rep. COO-1545-92(1971)

[3] V.V. Verbinski, et al., Nuc. Instr. Meth. 65(1968)8

[4] J.A. Grundl, Evaluation of Fission Neutron Spectra (unpubl.)

[5] H. Märten and D. Seeliger, Proc. Int. Symp., Gaußig (GDR), 1980, in print

Resonance Interaction of Neutrons with Molecular Gas and Crystals

K. Seidel, A. Meister, D. Pabst[+], L.B. Pikelner[+], W. Pilz[+]
Technical University Dresden
and
Joint Institute for Nuclear Research Dubna[+] (USSR)

At the IBR-30 pulsed reactor transmission spectra of polycrystalline UO_3 and gaseous UF_6 samples have been measured in the vicinity of the 6.67eV resonance of ^{238}U employing the time-of-flight technique. The experimental results obtained for the influence of molecular vibrations on the resonance cross section are compared to theoretical data. Since different models for the gas and solid-state samples must be used in the respective calculations the comparison between the theoretical and experimental results may be used to access the validity of both models. The final conclusion reached is that the application of either model does not lead to any major systematic error. The results also indicate that the method for eliminating the lattice-vibration effects described in earlier papers on the chemical shift of neutron resonances has been correct.

The work has been published in:
Communications of the JINR P3 - 81 - 89
and is in print in:
Yadernaya fizika.

An approach for a consistent description of γ-ray spectra from (n,xγ)-reactions induced by fast neutrons

B. Basarragtscha, D. Hermsdorf, E. Paffrath
Technical University Dresden, Department of Physics

Analyzing the γ-ray spectra produced in the course of nuclear reactions induced by neutrons with incident energies above 10 MeV clearly two components can be distinguished. A soft low-energetic part up to γ-ray energies of about $E_\gamma \sim E_n$ is superimposed a high-energetic tail arising from γ-deexcitation of highly excited residual nucleus formed by neutron capture.

As has been shown formerly by the authors /1/ this distribution can be understood well in terms of the compound nucleus reaction model including multi-step emission of particles and γ-quanta.

On the other hand the statistical capture mechanism as well as the direct-semidirect model fails in an interpretation of the whole γ-spectrum emitted after neutron capture.

In this work an attempt has been undertaken to apply a pre-equilibrium γ-emission mechanism elaborated and calculated by Běták /2/ to describe the hart part of the γ-emission spectrum.

The agreement of calculated and measured spectra is very satisfactory in absolute value as well as in spectral shape as can be seen in figs. 1 and 2.

A more detailed discussion will be published in the next future /3/.

References

/1/ B. Basarragtscha, D. Hermsdorf, D. Seeliger, Proc. of 2nd Int. Symp. of Neutron Induced Reactions, Physics and Applications, Vol. 6, p. 381, Bratislava, 1980

/2/ E. Běták, J. Dobeš, Phys. Lett. 84B (1979) 368
E. Běták, private communication, 1981

/ 3/ B. Basarragtscha, D. Hermsdorf, E. Paffrath, submitted to J. of Physics G: Nuclear Physics

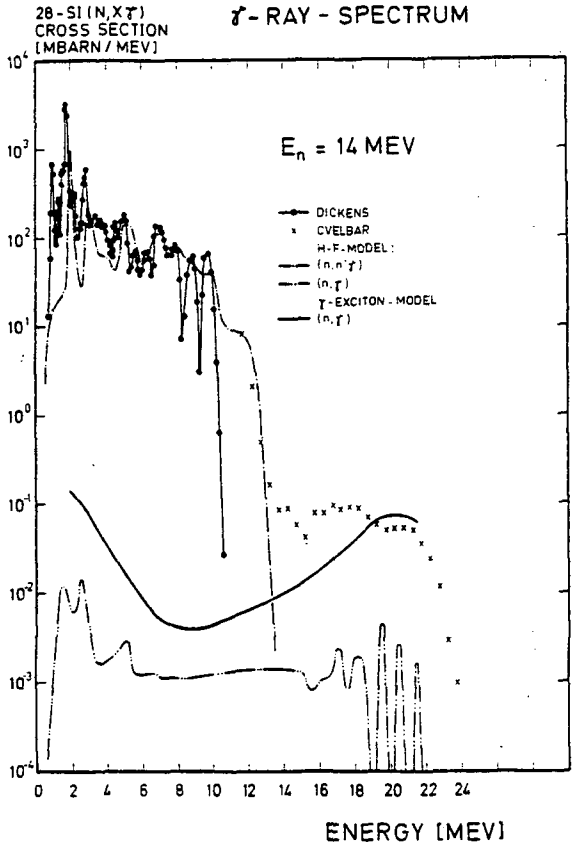


Fig. 1 γ-ray spectrum produced by neutron induced reactions in ^{28}Si at 14 MeV. Experimental results taken from Dickens and Cvelbar are compared with theoretical calculations in terms of CN and PE reaction models.

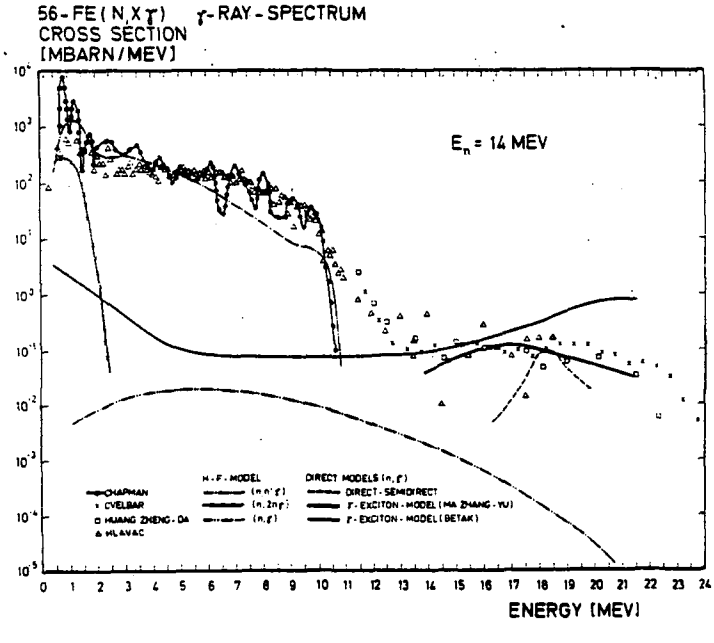


Fig. 2 γ-ray spectrum produced by neutron induced reactions in ^{56}Fe at 14 MeV.
Experimental results taken from Hlaváč, Chapman and Huang Zheng-da are compared with theoretical calculations in terms of CN and PE reaction models.
Other calculations basing on direct-semidirect model and PE model have been obtained by Cvelbar and Ma Zhang-Yu.

Evaluation of γ-production cross sections of neutron induced reactions in Si

D. Hermsdorf, E. Paffrath
Technical University Dresden, Department of Physics

Basing on the statistical model γ-production cross sections were calculated using the code STAPRE /1/. Applying a consistent set of parameters found for description of particle channels /2/ γ-emission parameters (strength functions, GDR parameters) have been adjusted using experimental data available at present.

By this procedure, γ-emission cross sections for ^{28,29} and ^{30}Si resulting from (n,γ), (n,nγ), (n,$\alpha\gamma$), (n,pγ) and (n,2nγ) reactions have been obtained and compared to measured values.

The agreement is very satisfactory for excitation functions of discrete γ-transitions (fig. 1), the γ-production cross section (fig. 2) and γ-ray spectra (fig. 3). The accuracy of the predicted (n,γ) cross sections can't be criticized because of a terrible deficiency of measurements (fig. 4).

In all cases available recommended data were also included in this study presented at the Xth Int. Symposium in Gaussig /4/.

References

/1/ M. Uhl, B. Strohmaier, Report IRK-76/01, 1976
/2/ D. Hermsdorf, L. Neumann, Proc. IXth Int. Symp., Gaussig, 1979, Report ZfK-410, 1980, 147
/3/ V. Benzi et al., Report RT/FI (69) 44, 1969
/4/ D. Hermsdorf, E. Paffrath, Proc. Xth Int. Symp. Gaussig, 1980, in press

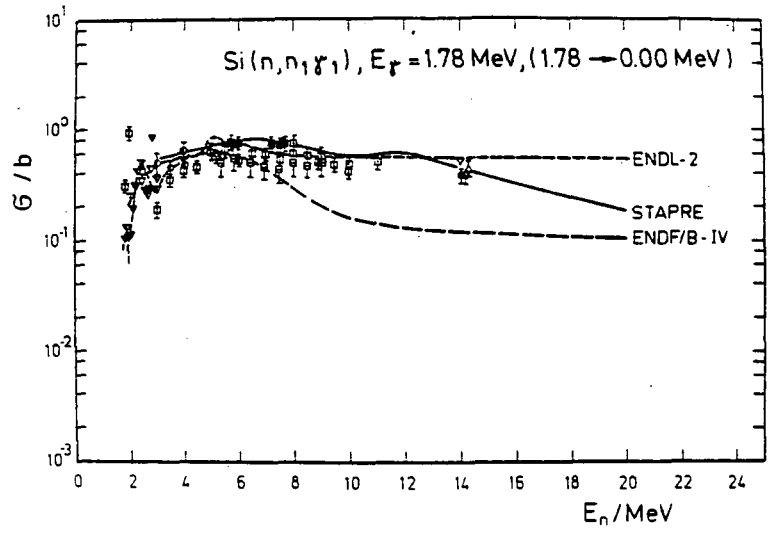


Fig. 1 Excitation function for the emission of 1.78 MeV γ-quanta resulting from the $2_1^+ \rightarrow 0_1^+$ transition in ^{28}Si.

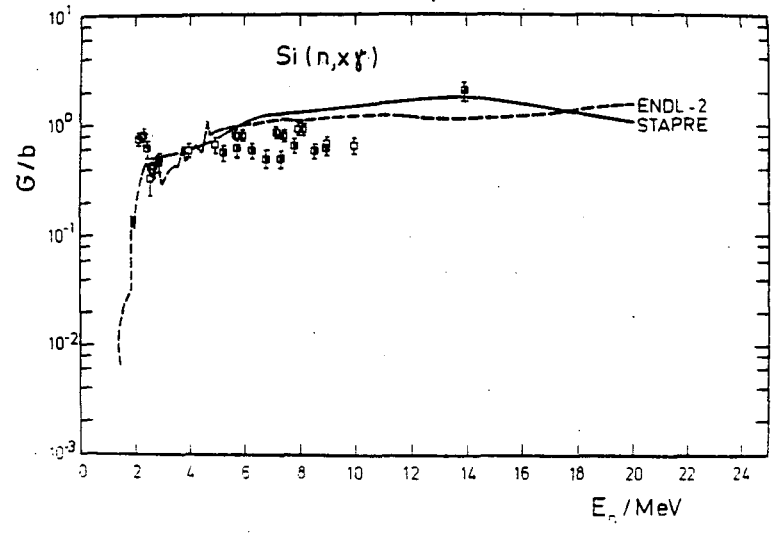


Fig. 2 Excitation function of the γ-production cross section of natural Si.

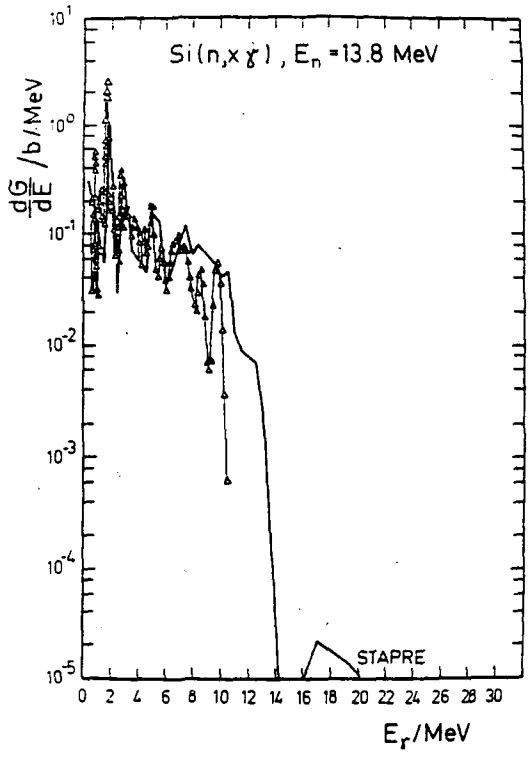


Fig. 3 Spectrum of γ-quanta emitted by natural Si following nuclear reactions induced by 13.8 MeV neutrons.

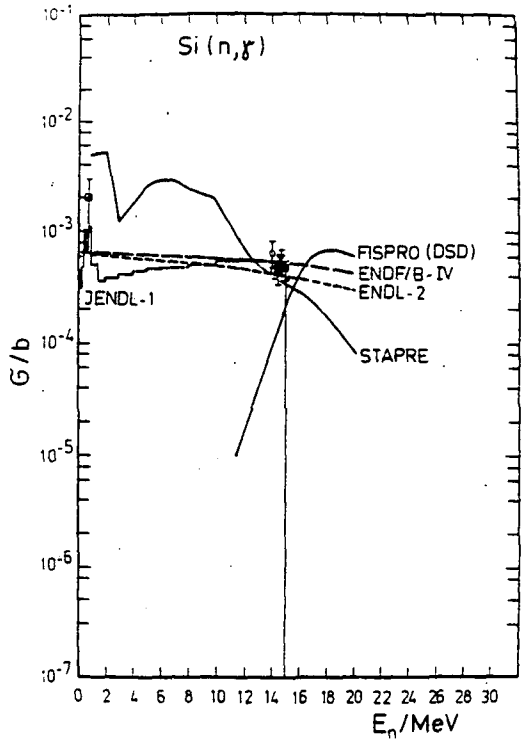


Fig. 4 Neutron capture cross section for natural Si. A contribution from the direct-semidirect model has been obtained using the code FISPRO /3/.

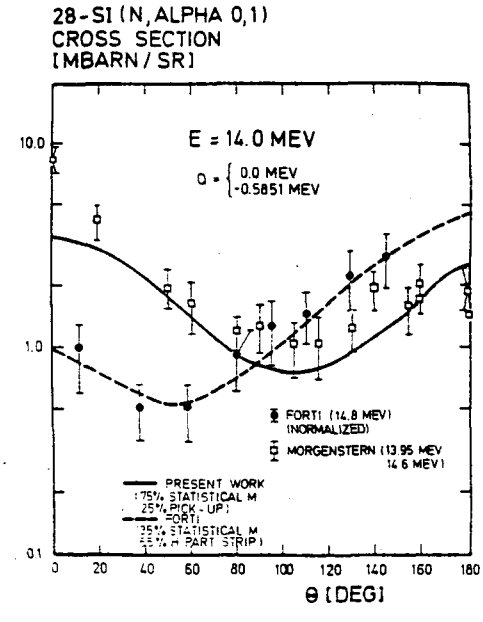
Investigation of direct reaction contributions to $^{28}Si(n,\alpha)^{25}Mg$

D. Hermsdorf
Technical University Dresden, Department of Physics

Resulting from a study of evaluated neutron nuclear data for Si carried out formerly strongly deviating recommended data for the (n,α) channel as well as an unsatisfactory interpretation of the experimental data in terms of the statistical model have been found /1/. Especially difficulties arise from the description of angular distributions and excitation functions of partial cross sections (n,α_i) (i=0,1 ... 4) indicating contributions from direct reaction modes clearly.

Unfortunatly, the experimental data base is either contradictory (see fig.1) or unsufficient. Therefore theoretical methods should be applied to draw final conclusions.

Fig. 1 Angular distribution for the $\alpha_0 + \alpha_1$-groups at 14 MeV neutron incident energy. Discrepant experimental data taken from Forti /4/ and Morgenstern /5/ can be interpreted in terms of statistical models and direct reactions.



Assuming the (n,α) reaction on light nuclei to proceed via a ^3He-pick-up process calculations have been carried out using the zero-range DWBA code CHUCK /2/.

The calculated results have been added incoherently to the compound reaction contributions to fit experimental angular distributions and excitation functions for the first five α-particle transitions to ^{25}Mg simultaneously.

The agreement between the reliable experimental data and theoretical results is fairly well and discrepancies could be cleared up (see figs. 2 and 3).

In more detail the results were discussed at the Xth International Symposium in Gaussig /3/.

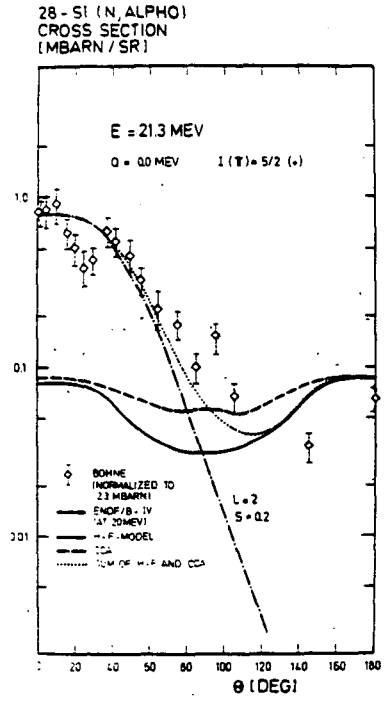


Fig. 2 Angular distribution for the α_0-group at 21.3 MeV. Experimental data taken from Bohne /6/ can be well understood by a incoherent superposition of contributions from statistical reaction model (HF) and ^{3}He-pick-up mechanism (CCA).

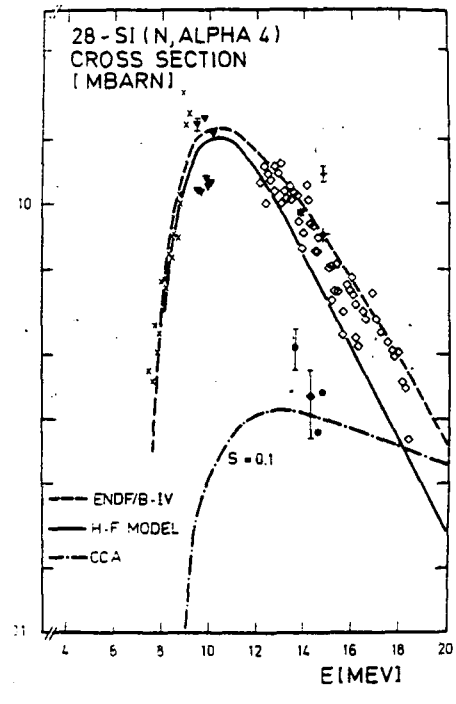


Fig. 3 Excitation function for the α_4-group.
A superposition of statistical model contributions (H-F) and a ^{3}He-pick-up component (CCA) fits the gross of experimental data.

References

/1/ D. Hermsdorf, L. Neumann, Proc. IXth Int. Symp. on Interaction of Neutrons with Nuclei, Gaussig, 1979; Report ZfK-410, 1980, 147

/2/ P.D. Kunz, private communication, 1978

/3/ D. Hermsdorf, Proc. Xth Int. Symp., Gaussig, 1980, in press

/4/ P. Forti, E. Gadioli, A. Marini, Nuov. Cim. B1 (1966) 244

/5/ H. Morgenstern, D. Hilscher, J. Scheer, Nucl. Phys. 83 (1966) 369

/6/ W. Bohne, D. Hilscher, H. Hohmeyer, H. Morgenstern, J.R. Scheer, Nucl. Phys. A 111 (1968) 417

The Absolute Determination of the Fission Cross Section of ^{235}U at E_n = 2.56 MeV[+)]

R. Arlt, M. Josch, G. Musiol, H.-G. Ortlepp,
R. Teichner, W. Wagner
Technical University of Dresden, GDR
L. V. Drapchinsky, V. N. Dushin, O. I. Kostochkin,
S. S. Kavalenko, K. A. Petrzhak, V. I. Shpakov
V. G. Khlopin-Radium Institute, Leningrad, USSR

An associated particle counting system for the low energy ^{3}He particles of the D (d,n) ^{3}He reaction at a deuteron energy of some 120 keV was developed at the Technical University of Dresden. The fission cross section of ^{235}U has been determined employing the time correlated associated particle method and a computer coupled data acquisition system /1/. After two independent experiments the final value of (1.215±0.019) barns was obtained. This value supersedes our preliminary results given earlier /2,3/.

[+)] Preprint Technische Universität Dresden, Sektion Physik 05-43-80 to be published in Kernenergie

References

/1/ R. Arlt, W. Grimm, W. Meiling et al., NIaM 169 (1980) 381

/2/ R. Arlt, W. Wagner, W. Grimm et al., Proc. VIII Int. Symp. on the Interaction of Fast Neutrons with Nuclei, Gaussig 1978, GDR, Report ZfK-382, 1979

/3/ R.Arlt, W.Grimm, M. Josch et al., Proc.Int.Conf. on Nucl. Cross Sections for Technology,Knoxville 1979, NBS 594 page 990, 1980

Absolute Fission Cross Section Measurements on ^{235}U and ^{237}Np at E_n = 8.4 MeV

R. Arlt, M. Josch, G. Musiol. H.-G. Ortlepp,
R. Teichner, W. Wagner
Technical University of Dresden, GDR
I. D. Alkhazov, L. V. Drapchinsky, O.I.Kostochkin,
S. S. Kovalenko, K. A. Petrzhak, V. I. Shpakov
V. G. Khlopin-Radium Institute, Leningrad, USSR

Absolute fission cross section measurements on ^{235}U and ^{237}Np have been carried out employing the time correlated associated particle counting system developed at the Technical University of Dresden /1/. The measurements have been performed at the 5 MV Tandem Generator of the CINR Rossendorf.

For ^{235}U the fission cross section at the neutron energy of 8.4 MeV was determined to be (1.801 ± 0.043) barns /2/. The evaluation of the ^{237}Np measurement is under way.

References

/1/ W. Wagner, Dissertation, TU Dresden 1981

/2/ to be published in the Proc. X Int. Symp. on the Interaction of Fast Neutrons with Nuclei,
Gaussig 1980, GDR

Absolute Fission Cross Section Measurements on ^{233}U and ^{242}Pu at E_n = 14.7 MeV

R. Arlt, M. Josch, G. Musiol, G. Pausch,
H.-G. Ortlepp, W. Wagner
Technical University of Dresden, GDR
L. V. Drapchinsky, O. I. Kostochkin,
S. S. Kovalenko, K. A. Petrzhak, V.I. Shpakov
V.G. Khlopin-Radium Institute, Leningrad, USSR

The fission cross sections of ^{233}U and ^{242}Pu have been measured at the neutron energy of 14.7 MeV employing the time correlated associated particle method. The same equipment was used as in a series of earlier fission cross section measurements at E_n = 14.7 MeV /1/. The new measurements continue former experiments at the same neutron energy on $^{235,238}U$, ^{237}Np and ^{239}Pu targets /2/. The evaluation of the data is under way. The relative error of the final results is less than about 2 per cent.

References

/1/ R. Arlt, W. Grimm. W. Meiling et al., NJaM 169 (1980) 381

/2/ R. Arlt, W. Meiling, H.G. Ortlepp et al., Kernenergie 2 (1981) 48

Precise Determination of Areal Density of Fission Targets

R. Arlt, K. Merla, H.-G. Ortlepp
Technical University of Dresden, GDR

The determination of the areal density and the layer nonuniformity of the fissile deposits delivers the dominant error in absolute fission cross section measurements by means of the time correlated associated particle method /1/. Therefore, a low geometry alpha counting system was developed at the Technical University of Dresden in order to perform independent measurements of the areal density of sample deposits produced and assayed at the V.G. Khlopin-Radium Institute in Leningrad, USSR. Various sets of diaphragmas have been designed and optimized for high and low activity samples. The relative errors of the solid angle measurements were reduced to values less than 0.3 per cent. A typical value of the relative error in a areal density measurement of a ^{235}U sample amounts to about 0.5 per cent.

References

/1/ R. Arlt, W. Meiling, H.-G. Ortlepp et al., Kernenergie 2 (1981) 48

Radiation Spectra of Radionuclides Measured by Semiconductor Detectors

Ts. Vylov, G.J. Beyer (and others)
Central Institute for Nuclear Research, Rossendorf

Spectra of alpha, gamma and electron radiation of 192 nuclides measured by defined semiconductors are compiled in an atlas. Data are given from neutron-rich and neutron-deficient isotopes and figured in succession with increasing weight.

Half life, type of radiation and type of reactions are listed in a table.

Methods of production, chemical and mass separation, as well as the analysis of measured spectra are shortly described.

Some characteristic specialities of the precision spectrometry and possible effects are discussed. The altlas will be supplemented by a catalog with precise measured radiation energies and intensities.

Evaluation of Cd-data by integral experiments /1/

B. Böhmer, K. Führmann, E. Lehmann
Central Institute for Nuclear Research, Rossendorf

For building-up a special fast-thermal coupled system /2/ some variants of the fast substituted lattice (SEG-IV), which differ by the number of Cd-pellets in the unit-cell, were investigated. It has been found that the central reactivity-worths of pure scattering materials, like graphite, polyethylene and deuterized polyethylene, very sensitively depend on the Cd-contents in this case.
The measurements were performed by means of the pile-oscillator method using very small samples in order to compare the experimental with theoretical results obtained on the basis of first order perturbation theory. The group fluxes (Φ_i, Φ_i^+) were determined starting from cell-calculations followed by onedimensional 26-group diffusion calculations of the unperturbed systems. Cd was treated in 3 ways: 1. Use of Cd-data (group cross sections, f-coefficients) derived from the KEDAK-3 file; 2. Use of Cd-data from the ABBN-78 set; 3. Use of Cd-cross sections given by Bachmann et al. /3/, which proved identical with those from KEDAK, but without f-coefficients.
The experimental reactivity-worths are dropping about linearily with increasing Cd-contents. The results based on KEDAK-data agree rather well with this behaviour whereas the slopes are by far more steeply and the curves shifted to lower Cd-contents for the other two cases. This is due to the neglection (case 3) respectively to a serious underestimation (ABBN-78) of the resonance shielding effects in Cd. It should be mentioned that the same conclusions may be drawn from the direct determination of the adjoint spectrum by neutron sources.

/1/ Report on a Specialists Meeting, Warna, 26.-29.5.1981
/2/ K. Führmann, E. Lehmann, A fast-thermal coupled system with energy independent adjoint flux, to be published in Kernenergie
/3/ H. Bachmann et al., Evaluated microscopic neutron cross sections and 26 group constants for Cd, KFK 1080 (1969)

Investigation of the Neutron Spectrum in the Reference Spectrum ΣΣ-ITN by means of Spherical Proton Recoils Counters.

D. Albert, W. Hansen
Central Institute for Nuclear Research, Rossendorf

In the fast reference spectrum ΣΣ-ITN measurements of the neutron spectrum were carried out by means of the Rossendorf proton recoil counter spectrometer. Spherical proportional counters were applied. The energy range of 8...1400 keV was covered, that corresponds to about 85 % of the total lethargy flux.
The results have been compared with other experiments (carried out by Magurele and Karlsruhe groups), with calculations (ANISN, 100 groups, ENDF/B-III) and with the recommended ΣΣ-spectrum. The agreement with the results of other experiments is rather good. The low energy limit could be decreased from about 20 keV - as reached up to now - to 10 keV. In the low energy region there are deviations from the recommended spectrum.

Effective resonance integral of ^{133}Cs in reactor fuel elements

H.-C. Mehner
Central Institute for Nuclear Research, Rossendorf

In the field of burnup investigations calculated fission product concentrations ratios $^{134}Cs/^{137}Cs$ differ from experimental ones. It was supposed that the differences are caused by self-shielding of the ^{133}Cs resonances. But our estimations showed that the self-shielding alone cannot explain the observed differences. Therefore in our calculations (1) the shielding of ^{133}Cs resonances by ^{238}U resonances has been taken into account, since the major resonances of both nuclides overlap each other.
The spatial energetic shielding is expressed by the ratio of the effective macroscopic resonance integral I_{eff} of ^{133}Cs to the infinite dilution resonance integral I

$$\frac{I_{eff}}{I_\infty} = \frac{\int_{E_{Cd}}^{\infty} \frac{dE}{E} \Sigma_a^{Cs}(E)\, F(E)}{\int_{E_{Cd}}^{\infty} \frac{dE}{E} \Sigma_a^{Cs}(E)}$$

where

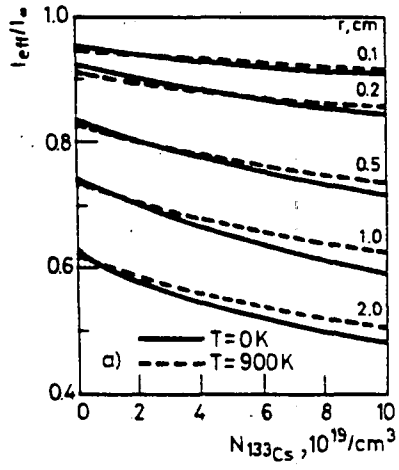
E_{Cd} - cadmium cut-off-energy

Σ_a^{Cs} - macroscopic absorption cross-section of ^{133}Cs

$F(E)$ - flux perturbation factor

The resonance parameters are taken from BNL-325 3rd ed. (1973). Both the overlapping of the major resonances (5.9 eV of ^{133}Cs and 6.67 eV of ^{238}U) and of the next higher resonances (22.6 eV of ^{133}Cs and 21 eV of ^{238}U) have been taken into account. The calculations performed made evident that (a) the major contribution to the shielding is caused by the lower resonances and (b) the effective resonance integral changes only insignificantly if the Doppler

broadening is taken into consideration. I_{eff} of ^{133}Cs has been calculated for different fuel types and fuel temperatures in dependence on the ^{133}Cs concentration in the fuel. Fig. 1 shows I_{eff}/I_{∞} for uranium dioxyde with various fuel radii r.



(1) H.-C. Mehner, Radiochem. Radioan. Letters 43(1980)77

EVIDENCE FOR DEFORMED STATES IN ^{75}Br *)

G. Winter, J. Döring, W.D. Fromm, L. Funke, P. Kemnitz,
H. Prade and E. Will

Zentralinstitut für Kernforschung Rossendorf, 8051-Dresden, DDR

The excited states in ^{75}Br have been studied via the reactions ^{74}Se(p,γ), ^{74}Se(d,n), ^{74}Se(^{3}He,pn) and ^{74}Se(α,p2n) by using in-beam γ-ray spectroscopy. In addition to measurements of γ-γ coincidences, excitation functions and angular distributions of γ-rays also ns lifetime measurements have been carried out. As a result 19 levels have been identified up to spin (17/2) and excitation energies up to 2.6 MeV. The B(E2) value of 88 W.u. derived for the 88.4 keV γ-ray indicates strong collectivity within a positive-parity band. A comparison of the excitation energies of the unique-parity states in ^{75}Br and ^{77}Br with those in ^{153}Tb and ^{155}Tb reveals that the average deformation increases when going from ^{77}Br (N = 42) to ^{75}Br (N = 40).

*) published in Nucl. Phys. A (in print)

DEFORMATION DEPENDENCE OF MAGNETIC MOMENTS IN THE ODD TRANSITIONAL NUCLEI $^{117-125}$Te *)

L. Käubler, H. Prade, F. Dönau, U. Hagemann and F. Stary

Zentralinstitut für Kernforschung Rossendorf, 8051-Dresden, DDR

K.-G. Rensfelt

Research Institute for Physics, Stockholm, Sweden

The magnetic moments of the $5/2^+_1$ state in ^{117}Te at 274.4 keV and of the $7/2^+_1$ state in ^{121}Te at 443.1 keV have been determined as $/\mu_{exp}(5/2^+) = -0.75(5)$ n.m. and $/\mu_{exp}(7/2^+) = +0.63(7)$ n.m., respectively, using the TDPAD method and the reactions ^{115,119}Sn(α,2n)^{117,121}Te. An evaluation method is described which provides, in case of the normalized time differential pattern R(t) exhibits less than half of an oscillation period, a unique value of the Larmor frequency. The comparison of the measured magnetic moments with Nilsson-, soft rotor Coriolis- as well as core-particle coupling calculations gives valuable hints on the shape dependence of magnetic moments and, consequently, on the deformation of different states in the odd transitional nuclei $^{117-125}$Te. In the light of the core-particle coupling model the positive parity states of ^{117}Te and ^{121}Te are interpreted as the members of $\Delta J = 1$ and $\Delta J = 2$ bands built on the $s_{1/2}$, $d_{3/2}$, $d_{5/2}$ and $g_{7/2}$ single-particle states, respectively.

*) Z. Physik A299 (1981) 251

IN-BEAM STUDY OF ^{80}Kr; QUASIPARTICLE EXCITATIONS IN NUCLEI AROUND MASS 80 *)

L. Funke, J. Döring, F. Dubbers, P. Kemnitz, E. Will and G. Winter
Zentralinstitut für Kernforschung Rossendorf, 8051-Dresden, DDR
and
V.G. Kiptilij, M.F. Kudojarov, I.Kh. Lemberg, A.A. Pasternak and A.S. Mishin
Physico-technical Institute "A.F. Joffe", K-21 Leningrad, USSR
and
L. Hildingsson, A. Johnson and Th. Lindblad
Research Institute of Physics, S-10405 Stockholm, Sweden

The excited states in ^{80}Kr have been studied in the reactions ^{77}Se(α,n), ^{78}Se(α,2n), ^{80}Se(α,4n) and ^{65}Cu(^{18}O,p2n) by using in-beam γ-ray spectroscopy. In addition to $\gamma\gamma$-coincidences, excitation functions and angular distributions also linear polarization of γ-rays and conversion electrons were measured. All together, 32 levels have been identified up to spin 14 at an excitation energy of 6.7 MeV in ^{80}Kr. For 21 of these levels the mean lifetime could be determined by Doppler shift methods and by the pulsed beam γ-timing method. The B(E2) values of 30-60 W.u., derived for many transitions, indicate strong collectivity and the existence of several band structures is suggested. Above 2.5 MeV 2 quasiparticle (qp) excitations become important. The excitation energies of ^{80}Kr and its neighbours ^{77,78,79}Kr, ^{77}Br and ^{81}Rb have been analysed in terms of the cranked shell model. In ^{78,80}Kr two-proton excitations have been found to be responsible for the observed band crossing. Quasiparticle excitations strongly influence the pairing and stabilize the deformation. The anomalies in the negative-parity bands of ^{81}Rb and ^{77}Br are interpreted as a crossing of a 3qp and a 1qp band and the relatively low frequency of the crossing point is ascribed to the blocking effect.

*) published in Nucl. Phys. A355 (1981) 228-260

IN-BEAM STUDY AND STRUCTURE OF THE N = 82 NUCLEUS ^{141}Pr *)

H. Prade, W. Enghardt, H.U. Jäger, L. Käubler, H.J. Keller and F.Stary

Zentralinstitut für Kernforschung Rossendorf, 8051-Dresden, DDR

High-spin states in ^{141}Pr have been studied in the reactions ^{139}La(α,2n)^{141}Pr and ^{140}Ce(d,n)^{141}Pr. Using in-beam spectroscopic methods energies, intensitites, excitation functions, γ-γ coincidences, time and angular distributions and the linear polarization of γ-rays as well as conversion electron spectra were measured. Positive- and negative-parity states of ^{141}Pr have been established for spin values up to J = 27/2 and E_x = 4700 keV including 19 new levels. For three levels ns-lifetimes were determined. The experimental data on positive-parity states are in remarkable agreement with shell-model predictions. In the case of positive-parity states no evidence for particle-core coupling is found. The shell-model investigations suggest, however, that the negative-parity states in ^{141}Pr as well as in ^{143}Pm can be explained by particle-core coupling.

*) submitted to Nucl. Phys. A

Installation of a Database for Nuclear Structure and Decay Data

L. Jankowski, K. Friedrich, B. Letz

Central Institute for Isotopic and Radiation Research (ZfI)
Information and Computing Center

1. Content of the Database

In 1979 the Information and Computing Center of the Central Institute for Isotopic and Radiation Research (ZfI) at Leipzig started with the installation of a computerized database for nuclear structure and decay data (NSDD). For it the institutes ES 1040 computer with the operation system OS is used. After working out the software für handling and retrieval of the data at the end of 1980 the following international NSDD-files had been available:

	records	datasets
ENSDF	6.741	287.867
GAMDAT'78	2.049	55.178
WAPSTRA	1(1.992)	1.992
ENDF/B-4 FPL	824	105.009
NSR		69.548 Refs.

ENSDF - Evaluted Nuclear Structure Data File edited and maintained by the Nuclear Data Project. Oak Ridge National Laboratory

GAMDAT'78 - File of gamma rays based ond Erdtmann and Soyka (sometimes called JUELGAM)

WAPSTRA	- 1978 Atomic mass evaluation of Wapstra and Bos
ENDF/B-4	- only fission products library
NSR	- Nuclear Structure References

ENSDF, WAPSTRA and ENDF/B are used in their original formats. For handling GAMDAT on own internal data-format had been developed. NSR is converted into a format demanded by the used software system.
All this files the Information and Computing Center recieved from the Nuclear Data Section of the IAEA Vienna.

2. Work with ENSDF

The Evaluated Nuclear Structure Data File (ENSDF) ist the international standard for NSDD data. For its handling a number of PL1 programmes had been developed:

RECH1	retrieval in ENSDF
LIST	printing on "Edited Listing" of datasets
DLIST	printing datasets with some comfort
TEST	printing a catalogue of ENSDF-file

For editing data catalogues the information retrieval system USS is used. As a special data catalogue e.g. a "Catalogue of Half-Lives in ENSDF" was edited and distributed.

3. Handling of GAMDAT

In 1979 the Information and Computing Center recieved the GAMDAT-file produced by Erdtmann and Soyka. We suppose the record length of 100 byte and the exchange format of this file to be relatively unfortunately for a computerized surch. An own internal structure for GAMDAT had been developed. It has the following characteristics:

- record length 48 bytes
- each record has an 11 byte identifier field
- to get an unique data access in the different files of the institutes database ENSDF like

element names are used (English names and left adjusted)
the names of the describing fields are explicitly given in the corresponding records.

GAMDAT is splitted into two internal data files. One file contains the datasets of nuclides and the other one energy sorted records. A third file contains a description of GAMDAT and a list of abbrieviations. The records of the energy sorted file contain energy, intensity, half-life, Z,A and element name.
For handling this files the programm system USS (series USS-3) is applied. The same procedures developed for GAMDAT also are used for its new version GAMDAT'78.

4. First steps with NSR

In 1980 the effort to make available the NSR file for the users was continued. NSR was converted from external ADSEP format into the L1-structure demanded by the information retrieval system USS. This fields that contain a limited (normal) character set had been used.
For a retrieval all this fields and also parts of them may be used. The NSR version of the Central Institute of Isotopic and Radiation Research contains the references from 1910 to 1979 with a small gap 1969 and 1970 resulting from an error an the exchange tape. The file is stored on magnetic tape and the surches are made in a sequential manner. The first experiences showed that NSR fulfils most of the needs arising from nuclear structure physics and also from nuclear reaction research. In a special case (internal conversion coefficients) it was difficult to find the correspondence between NSR and ENSDF.

5. Use of the Database in 1980

The standard output from the database for nuclear structure and decay are listings of datasets and computer-

edited data catalogues printed upon user requests. In 1980 also primary literature (e.g. IAEA reports) was given to the unsers. First steps to use NSR had been done.

The following table should give some details:

. user requests	39	
. datasets and references printed	2.550	(among them 264 refs.)
. surches in datafiles	65	
. surches in NSR	19	
. special catalogues printed upon user request	10	
. primary literature for users	9	
. users information	1	

For the next time we will continue in working out new programmes and procedures for handling ENSDF. After recieving the ne NSR-format we will apply it and improve the retrieval possibilities.