

International Atomic Energy Agency

INDC(HUN)-021/G

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INTERNATIONAL NUCLEAR DATA COMMITTEE

Progress Report

on

Nuclear Data Activities in Hungary

1983/1984

July 1984

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

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July 1984

Reproduced by the IAEA in Austria
July 1984

84-03822

INSTITUTE OF EXPERIMENTAL PHYSICS

KOSSUTH UNIVERSITY

Debrecen

STANDARD MEASUREMENTS AROUND 14 MeV

J. Csikai

A guide-line has been compiled for the activation cross section measurements around 14 MeV. The following topics are discussed: preparation of samples, properties of D-T neutron sources, methods for the determination of neutron flux, determination of average energy and energy spread of neutrons, measurements of the activity, sources of errors, status of standard data. Paper will be distributed by the IAEA among the 14 MeV CRP participants.

DETERMINATION OF NEUTRON ENERGY AROUND 14 MeV

J. Csikai and Zs. Lantos

Thick target neutron energy from a D-T source at 150 keV D^+ -beam has been determined as a function of emission angle between 0° and 176.5° . The method described by Lewis and Zieba¹ was improved by approximating the available relative excitation function for the $^{90}\text{Zr}/n,2n/^{89}\text{Zr}$ reaction using the Weisskopf formula with $T=1.3$ MeV as well as accepting the relative values of the fluence standard reactions² as $^{93}\text{Nb}/n,2n/^{92m}\text{Nb}$, $^{181}\text{Ta}/n,2n/^{180m}\text{Ta}$ and $^{197}\text{Au}/n,2n/^{196g}\text{Au}$. The neutron energy obtained varies between 14.75 and 13.43 MeV in the 0° - 180° angle interval. The angular dependence of the neutron energy and the angular anisotropy of neutrons are in good agreement with the values obtained by calculations for thick target. The ratio of the neutron yield as a function of the angle measured by the Nb, Ta and Au is constant, within the $\pm 1\%$ limits of errors, around the unity.

References

1. V.E. Lewis, K.J. Zieba, Nucl. Instrm. Meth. 174 /1980/ 141
2. J. Csikai, in Proc. of the Int. Conf. on nuclear Data for Science and Technology, 6-10 September 1982. Antwerpen, p.414.

REMOVAL CROSS SECTIONS FOR 14.8 MeV NEUTRONS ^x

L. Vasváry, F. Divós⁺, G.C. Pető, J. Csikai and
N.K. Mumba⁺⁺

The removal cross section of brick, gravel, sand, river sand, reinforced concrete and water has been measured /1/ by activation threshold detector technique. These materials were used in the construction of the new neutron generator laboratory at the Institute.

The removal cross section of paraffin has been calculated /2/ by Monte Carlo method as a function of maximum scattering angle. The rapid change of the removal cross section at low scattering angles confirm that this concept might give only a rough estimate in the shielding designs.

References

1. L. Vasváry, F. Divós, G. Pető, J. Csikai and N.K. Mumba: Investigations on Fast Neutron Interactions with Constructional Materials, to be published.
2. F. Divós: Estimate of Removal Cross Section by Monte Carlo Method, ATOMKI Report X/4, 1983. /in Hungarian/

x This work was supported in part by IAEA

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++ Permanent address: National Council for Scientific
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COMPILATION AND EVALUATION OF $/n,t/$ AND $/n^3,He/$ CROSS SECTIONS⁺

Z.T. Bődy /Kossuth University/

K. Mihály /Nuclear Training Reactor, Technical University of Budapest/

Continuing the $/n,t/$ cross section programme integral data have been used to check excitation functions [1, 2] obtained formerly [3-5]. These investigations show that the ENDF/B IV data for $^{27}Al/n,t/$ are wrong.

The need for further measurements in the case of $/n,^3He/$ reactions is far more accentuated owing to the fact that the number of experimental points is less than the half of $/n,t/$ data points. No excitation function has been measured for $/n,^3He/$ process up till now.

References

1. Z.T. Bődy, K. Mihály: A calculation of integral $/n,t/$ cross section data from excitation functions and a comparison with experimental data /in Russian/. VI. Soviet Conference on Neutron Physics, Kiev, Oct.2-6,1983 /to be published/
2. Z.T. Bődy and K. Mihály: $/n,t/$ cross sections around 14 MeV. /to be published in Helvetia Phys. Acta/
3. Z.T. Bődy, P.Cserpák, J. Csikai, S. Sudár, K. Mihály: Measurement and evaluation of $/n,t/$ cross sections. Nuclear Data for Science and Technology, pp.368-370,1983. Ed.: K.H. Böckhoff, ECSC, EES, EAEC, Brussels and Luxemburg.
4. Z.T. Bődy, K. Mihály: Compilation and Evaluation of $/n,t/$ Cross Sections. Report ZfK-491 /1982/201-203.
5. Z.T. Bődy, K. Mihály: A compilation and evaluation of $/n,t/$ cross sections. Unpublished report, Inst.Exp.Phys.Kossuth University, Debrecen, pp. 1-44, 1983.

+ Supported in part by the International Atomic Energy Agency, Vienna.

DIFFUSION PARAMETER MEASUREMENTS BY NEUTRON PULSE METHOD

K.M. Dede, A. Demény, L. Vas

Experimental arrangement for measuring thermal diffusion parameters in non-thermalizing media /structural materials and rocks/ has been tested. Results for iron show that the method is feasible. A statistical method for evaluating the measurements has been adapted, correction for non-asymptotic decay has been developed. Theoretical investigations on the influence of diffusion cooling are carried on; measurements of rock samples are planned.

Reference

1. J. Csikai et al.: Some Applications of Atomic and Nuclear Methods in Geology and Mining

Proceedings of the IAEA Consultant's Meeting on Nuclear Data for Bore-Hole and Bulk-Media Assay Using Nuclear Techniques, Krakow, Poland, 14-18 November 1983

A JUMPING SPARK COUNTER FOR VARIOUS APPLICATIONS

S. Juhász, L. Vasváry, M. Várnagy

The jumping spark counter /JSC/ constructed in the Institute of the Experimental Physics /1/ has been developed. The JSC is applicable for counting simultaneously the perforation of five thin /5-20 μm / polymer foils. The JSC was combined with a multichannel pulse height analyser and multiscaler to determine automatically the best parameters and procedures for spark counting. The HV supply can be operated in two modes. In the first mode the voltage starts from 200 V and increases continuously to a maximum voltage 1000 V. The increase-time can be varied between 70 and 400 s. In the second mode the voltage can be adjusted to optional value between 200 and 1600 V. In these modes sparks can be counted, spark amplitude distribution can be recorded, decay of sparking rates can be established or the number of sparks can be plotted against sparking voltage. The supply voltage is between 12-80 Volts. The track density interval studied was 0-10000 tracks/cm². The reproducibility of counting is better than 1%. The possibility of the adaption of JSC for evaluation of angular distribution of fission fragments was tested. Application possibility for radon dosimetry is in progress.

Reference

1. M. Várnagy, L. Vasváry, E. Gyarmati, S. Juhász, T. Scharbert, T. Sztraricskai, Nucl. Instr.Meth. 141 /1977/ 489

DEVELOPMENT OF A TIME OF FLIGHT SPECTROMETER FOR THE
MEASUREMENT OF SECONDARY NEUTRONS AND GAMMAS⁺

L. Vasváry, G.C.Pető, T. Sztaricskai

A detailed description of the neutron generator is to be published /1/. The gamma branch of the spectrometer has been tested using a true-coax Ge/Li/ detector. 6 ns time-resolution has been achieved with ORTEC electronic units.

The attenuation of primary neutrons and gammas originating from the target head has been studied in addition to the measurements on the thickness dependence of the secondary gamma yield from extended samples of Al, Fe, Pb, paraffin and reinforced concrete /2/.

References

1. L. Vasváry, T. Sztaricskai, G.C. Pető and B.V. Dewkin: PNG-300, a Nanosecond Pulsed Neutron Generator, to be published.
2. L. Vasváry, F. Divós, G. Pető, J. Csikai and N.K. Mumba: Investigations on Fast Neutron Interactions with Constructional Materials, to be published.

+ This work was supported in part by International Atomic Energy Agency.

INSTITUTE OF NUCLEAR RESEARCH
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HUNGARY

STATUS REPORT ON CYCLOTRON LABORATORY PROJECT

A. Valek and A. Paál

The realisation of the cyclotron project of our institute began in 1978. The construction work of the cyclotron building started in 1982, the concrete shielding walls of basement floor have been built and the laying the foundations in other part of the building are in progress. The transportation and the assembling of the cyclotron, manufactured by the D. Efremov Scientific Research Institute of Electrophysical Apparatus in Leningrad, is expected in 4th quarters of 1984.

Data acquisition and analysis will be based on a computer network system with a host computer analogous to PDP-11/44 (Fig.1.). Its installation is expected on the first half of 1984. During 1983 the main emphasis has been put on the design of the data acquisition station. Each satellite station consists of a small number of components: a CAMAC crate, a terminal, LSI-11/23 computer including processor, memory, CAMAC crate controller, display board and network interface.

Development of the network software, probably the most complex part of the system, is nearly complete. Nuclear analog signals are digitized with 13 bit ADCs purchased from SILENA. Data from ADCs are stored in a 16K dedicated CAMAC memory. Separately from the high speed data collection it is allowed to the experimenter to start and stop the experiment, or displays of experimental parameters, data, and data histograms for experiment monitoring.

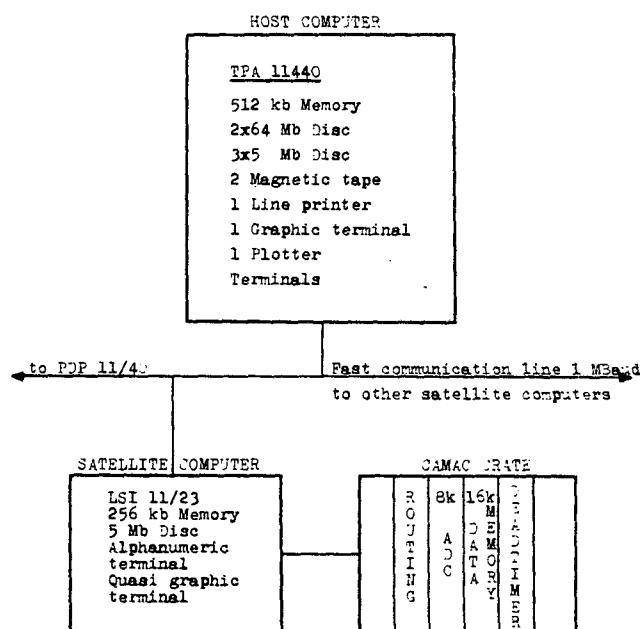


Figure 1. Hardware Layout of the Data Acquisition System

PERFORMANCE AND DEVELOPMENT OF THE 5 MILLION VOLT VAN DE GRAAFF ACCELERATOR

L. Bartha, Á.Z. Kiss, E. Koltay, I. Papp, Gy. Szabó

Status report

There has been an increasing demand for the use of the accelerator during 1983. The calculated total time was 2279 hours: of these 2228 hours were used for experiments and 51 hours for machine tests. Table 1. shows the distribution of machine time between different experimental fields. The weight of analytical studies and atomic physics increased further this year.

In 1983 a new species of ion $^3\text{He}^+$ was used for the first time in the laboratory for nuclear physical experiments. The distribution of operating time versus ion species is shown in table 2.

In the middle of December the accelerator was stopped for changing the accelerating tube and the belt.

In 1983 development works were mainly limited to the inserting of gas stripper target unit with differential pumping in two different locations of beam transport system near the analysing magnet. Pre-analyser and post-analyser strippers [1] are prepared for regular use in ion-atom collision research.

[1] I. Hunyadi, Á.Z. Kiss, I. Kiss, E. Koltay, Gy. Szabó; Nuclear Instruments and Methods, in press.

Table 1.

Field	hours	%
Nuclear physics	505	22.2
Atomic physics	466	20.4
Analytical studies	995	43.7
Other experiments	262	11.5
Machine tests	51	2.2
total:	2279	100.0

Table 2.

Species	hours	%
H^+	1459	65.5
$^3\text{He}^+$	160	7.2
$^4\text{He}^+$	546	24.5
N^+	63	2.8

ION-INDUCED L_3 -SUBSHELL ALIGNMENT OF ARGON

D. Berényi, I. Cserny, I. Kádár, Á. Kövér, S. Ricz, L. Sarkadi, D. Varga, and J. Végh

Submitted to J. Phys. B: At. Mol. Phys.

The angular distribution of the argon $L_3-M_{2,3}^2(^1S_0)$ Auger electrons has been measured relative to the isotropic $L_2-M_{2,3}^2(^3P_{0,1,2})$ transition for proton impact in the energy range 0.8-3.0 MeV, and for H_2^+ and He^+ ion impact at 0.8 MeV/amu. From the measured anisotropies alignment parameters (A_2) have been deduced. The results have been compared to the data measured by DuBois and Ródbro [1] as well as PWBA calculations including electron capture [2].

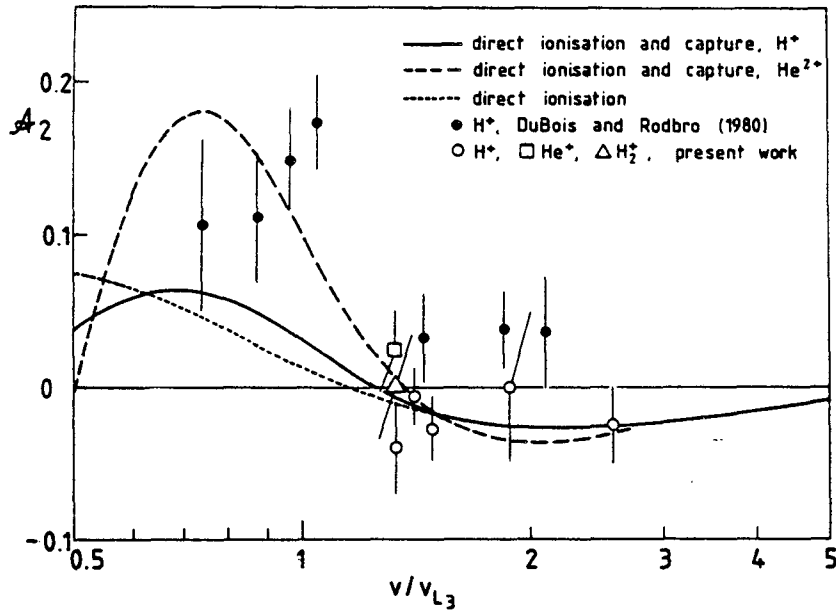


Fig. 1. L_3 -subshell alignment parameters of argon for ion bombardment as a function of the relative collision velocity.

References

- [1] R. DuBois and M. Ródbro, J. Phys. B: At.Mol.Phys. 13 (1980) 3739
- [2] E. G. Berezhko, V. V. Sizov and N. M. Kabachnik, J.Phys.B: At.Mol.Phys. 14 (1981) 2635

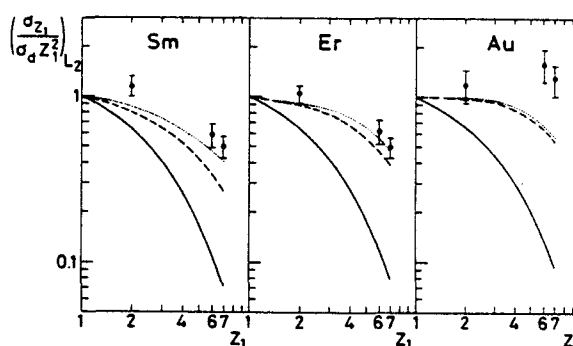
INVESTIGATION OF THE PROJECTILE ATOMIC NUMBER DEPENDENCE OF THE L-SUBSHELL IONIZATION

Tibor PAPP, József PÁLINKÁS, László SARKADI, Bálint SCHLENK, István TÖRÖK and Károly KISS

Paper presented at the Third Workshop on Inner Shell Ionization by Light Ions, Linz, Aug. 4-5, 1983, Austria.

Submitted to the Nucl. Instrum. and Meth.

Relative L-subshell ionization cross sections have been measured using a series of ions at a fixed collision velocity in order to study the projectile nuclear charge dependence. Thin Sm, Er, and Au targets were bombarded by 2H^+ , 4He^+ , 12C^+ , and 14N^+ ions at 0.2 MeV/amu impact energy. The cross sections were normalized to the data obtained by deuterons. The experimental results have been compared with the predictions of the direct ionization theory using the CPSSR model as well as with the recent second order calculations. Particularly large discrepancies have been found for the L_2 subshell comparing the CPSSR results with the measured values. These discrepancies have been reduced significantly with the inclusion of the second order effects. See the figure.



L_2 -subshell ionization cross sections for different bombarding ions, relative to deuteron. Experimental data: ●, theoretical curves: — CPSSR, - - - - second order calculations, second order calculations using the united atom approach.

HIGHER ORDER PROCESSES IN L-SHELL IONIZATION

L. Sarkadi and T. Mukoyama*

*Institute for Chemical Research, Kyoto University, Kyoto, Japan

Submitted to Nuclear Instruments and Methods

The time-dependent perturbation theory has been applied to the description of the L-shell ionization of atoms by heavy charged particles in the independent-particle model approximation. A second order correction factor to first order (e.g. PWBA) cross sections has been derived considering transitions at an average impact parameter and with minimum energy transfer as dominant ionization processes in low-velocity collisions. Numerical calculations have been performed for light- and heavy ($Z_1 \leq 8$)-ion impact ionization of gold in the energy range 0.15-2.0 MeV/amu. The results are in a satisfactory agreement with the experimental data for the L_3 - to L_2 - and L_1 - to L_2 -subshell ionization cross section ratios. The model seems to account also for the anomalous behaviour of the L_3 -subshell alignment observed recently at heavy-ion impact.

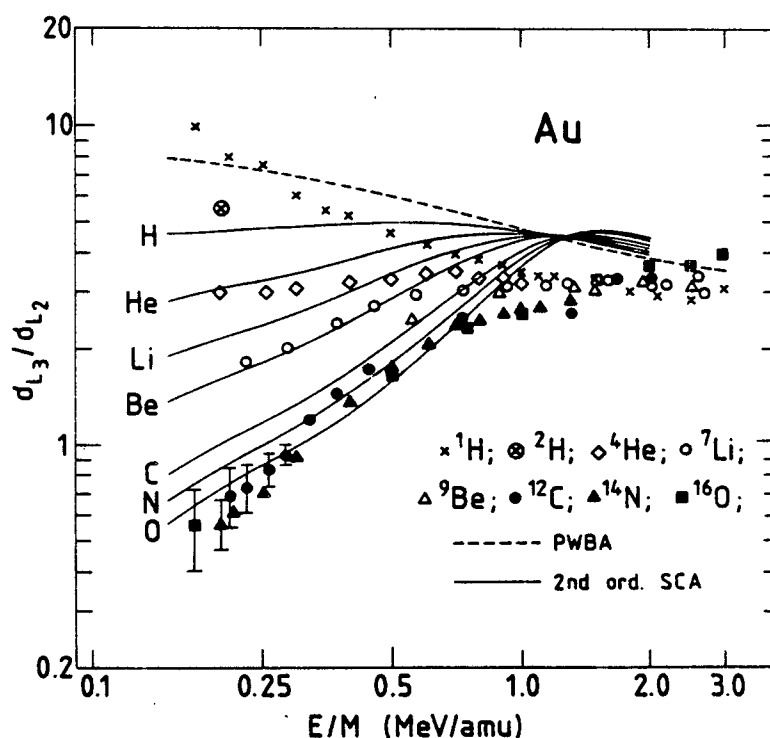


Fig.1. Comparison of the results of the present calculations with the experimental data for the L_3 to L_2 ratio. The target is gold.

XPS INVESTIGATION OF AIR POLLUTION EJECTED BY A COAL-FIRED POWER PLANT

L. Kövér and J. Tóth

Submitted to: Atmospheric Environment

A method for sampling and investigating the aerosol particulates and gaseous pollutants of the air is described. The pollutants were collected on silver (Ag), copper (Cu) and graphite surfaces placed in the neighbourhood of a coal-fired power plant. The study of the composition of the aerosol and gaseous pollutants was carried out by means of XPS method, as a function of the distance from the power plant.

The aerosol particulates ($1\ \mu\text{m}$ in diameter) were stuck on the surface of the samples mentioned above, but they did not form an unbroken layer on them, that is why we were able to assign not only the components of the aerosol particulates, but the gaseous pollutants of the air on the basis of their chemical reactions with the sample material measuring the photoelectron lines of the samples material of its own as well.

We could assign the photoelectron lines of different types of air pollutants (S, N, Cl, F, Mg, Al, Si, Na, I, C).

The main pollutant was the sulfur. The sulfur could be found at every sampling place and on every sample surface. Far from the centre of the power plant the sulfur was mainly in sulphate form.

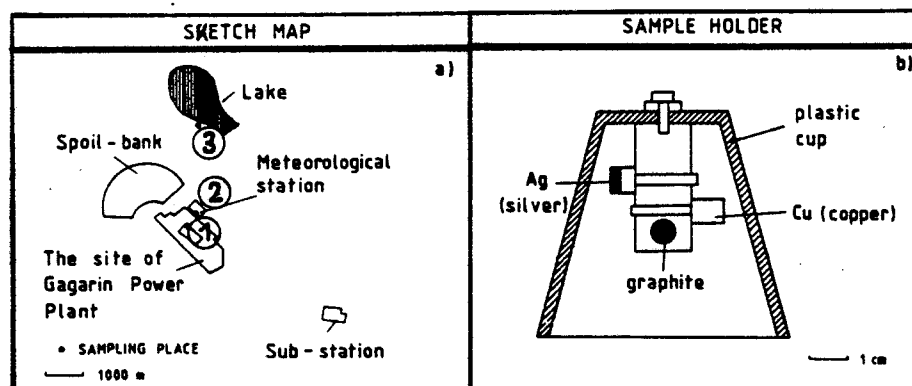


Fig. 1.

- The scheme of the map which shows the sampling places in the environment of the Gagarin Powerplant in Hungary. The sampling points: 1,2,3.
- The sample holder was a plastic cup opened towards the ground, so the fine particulates of the air can reach indirect way onto the sample surface.

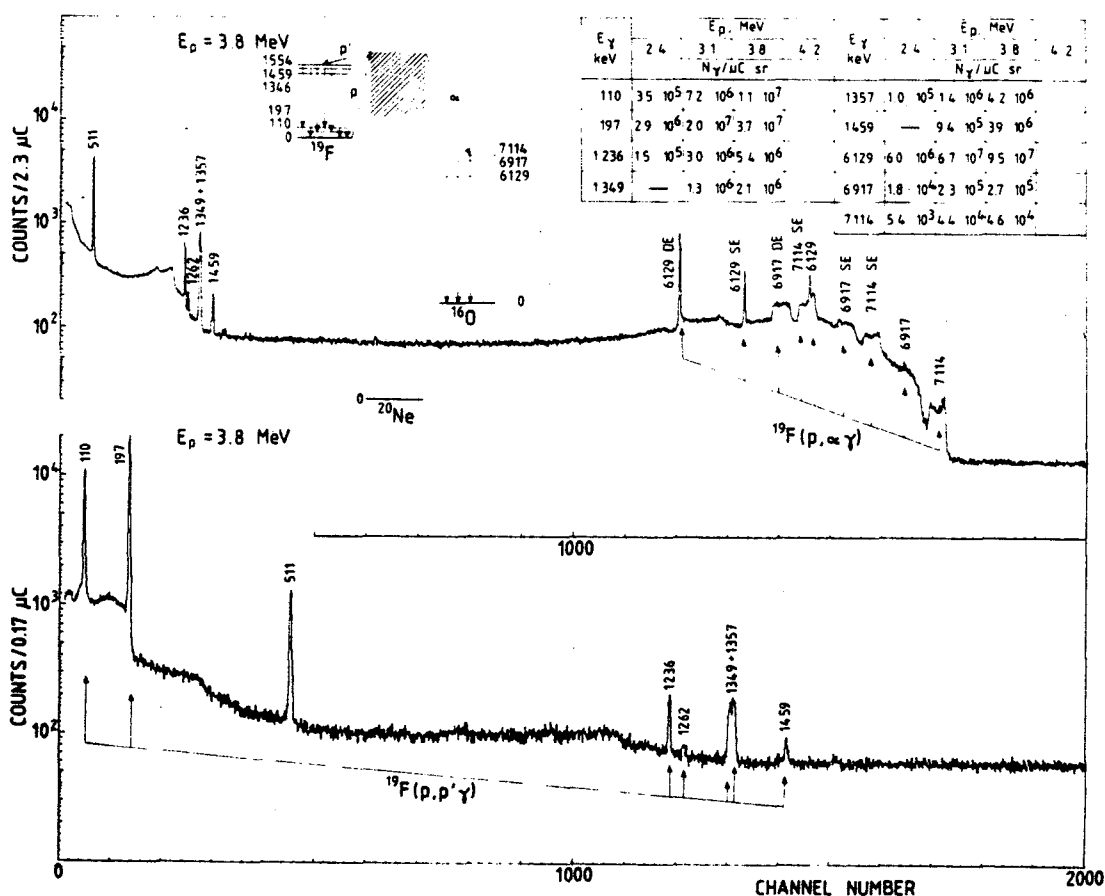
MEASUREMENTS OF RELATIVE THICK TARGET YIELDS FOR PIGE ANALYSIS ON LIGHT ELEMENTS IN THE PROTON ENERGY INTERVAL 2.4 - 4.2 MeV

A.Z. Kiss, E. Koltay, B. Nyakó, E. Somorjai, A. Anttila¹⁾, J. Räsänen¹⁾

1) Department of Physics, University of Helsinki, SF-00170 Helsinki 17, Finland

Submitted to: Journal of Radioanalytical Chemistry

In order to extend the energy range of the systematic investigation on relative thick target yields performed by Anttila et al [2] for $1 \leq E_p \leq 2.4$ MeV bombarding energies gamma spectra and yield data are presented for elements $Z=3-9$, 11-17, 19-21 in the energy range $2.4 \leq E_p \leq 4.2$ MeV and the results are discussed from the point of view of PIGE analysis.



LEVELS IN ^{23}Na EXCITED BY THE $^{19}\text{F}(\alpha, \alpha)^{19}\text{F}$, $^{19}\text{F}(\alpha, \gamma)^{23}\text{Na}$ AND $^{19}\text{F}(\alpha, p)^{22}\text{Ne}$ REACTIONS

J. Cseh, E. Koltay, Z. Máté, E. Somorjai and L. Zolnai

Submitted to Nuclear Physics A

Excitation functions have been measured at five angles for $^{19}\text{F}(\alpha, \alpha)^{19}\text{F}$ up to $E_\alpha = 3.7$ MeV. The excitation curves for the $^{19}\text{F}(\alpha, \gamma)^{23}\text{Na}$, $^{19}\text{F}(\alpha, p_0)^{22}\text{Ne}$ and $^{19}\text{F}(\alpha, p_1\gamma)^{22}\text{Ne}$ reactions were also obtained in simultaneous measurements. Multi-level R-matrix calculation was used to analyse the elastic scattering data yielding parameters for 16 resonances. 60 resonances corresponding to levels in ^{23}Na were seen in the different reactions. A comparison of resonance energy and total width data is given.

The $^{19}\text{F}(\alpha, \gamma)^{23}\text{Na}$ reaction below $E_\alpha = 2.3$ MeV was studied also with the help of thick target measurements. Decay scheme for two resonances are given. The α -particle strength is discussed.

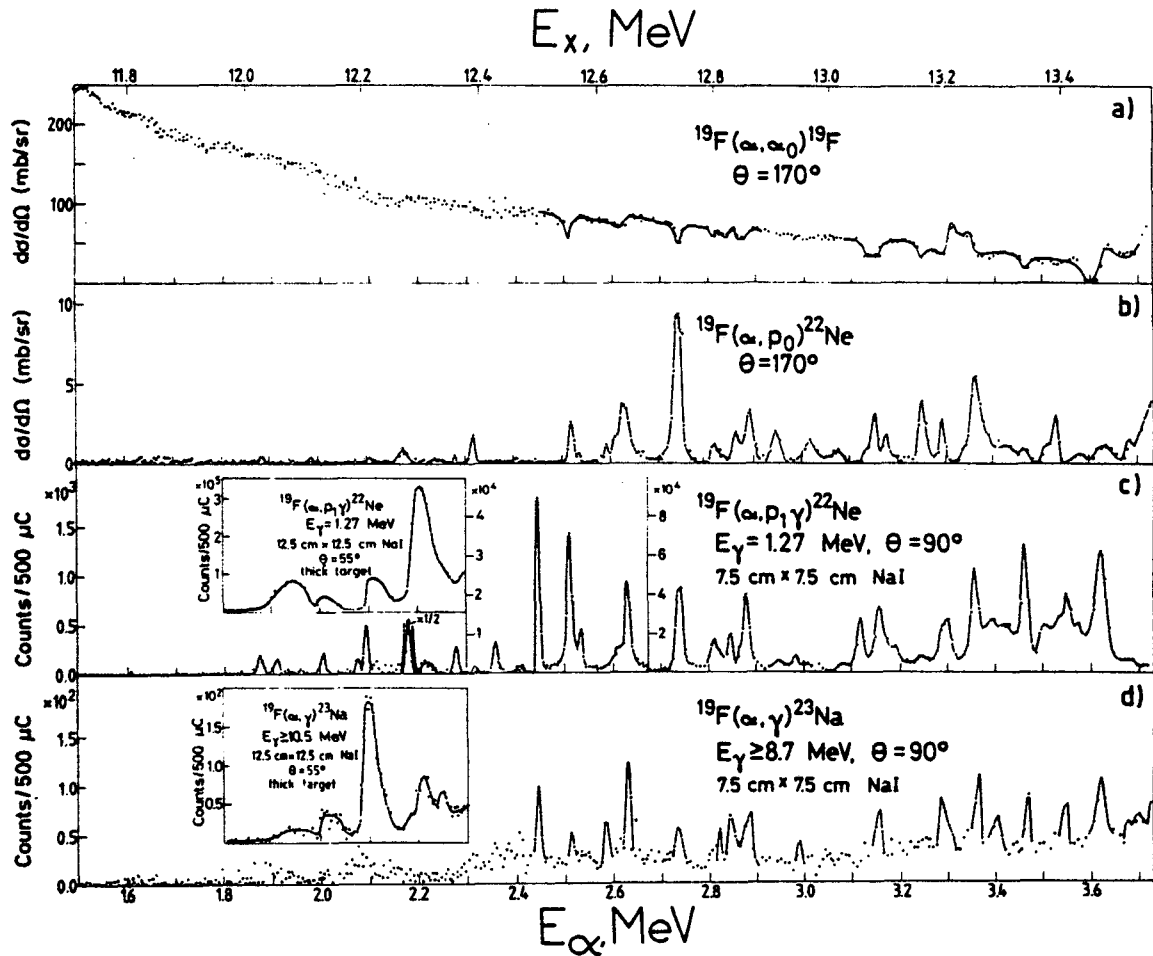


Fig.1. Comparison of excitation functions simultaneously measured in the different $^{19}\text{F}+\alpha$ processes. Thick target yields are also shown on inserts. The solid line is a theoretical fit in part (a) and a guide to the eyes on other parts

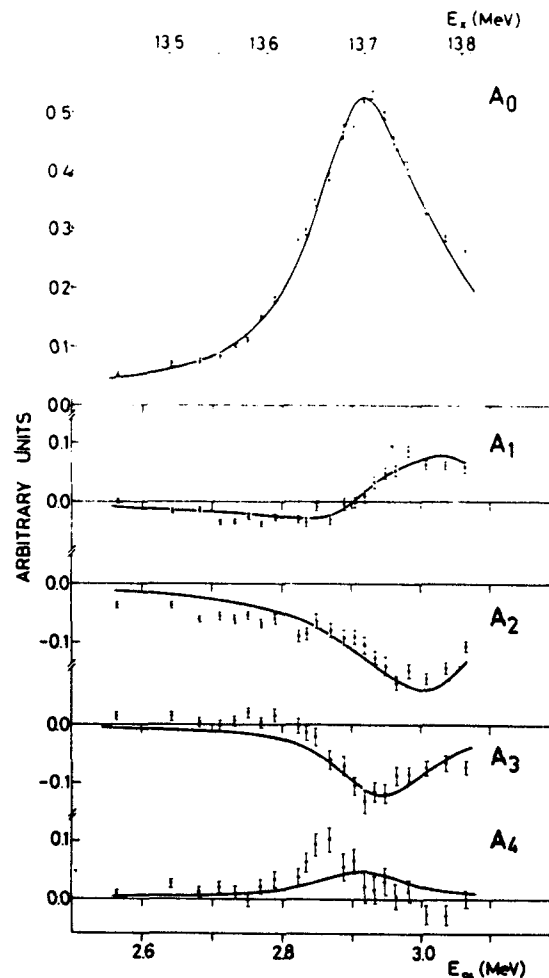
LEVELS OF ^{14}N NEAR 13.7 MeV EXCITATION FROM THE ANALYSIS OF DOPPLER
BROADENED γ -LINE SHAPES IN THE $^{10}\text{B}(\alpha, p\gamma)^{13}\text{C}$ REACTION

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¹⁾Clinic of Radiology, Dept. of Radiation Therapy, Medical University,
Debrecen, Hungary

Nuclear Physics A410 (1983) 147-155

Excitation function has been measured in the $^{10}\text{B}(\alpha, p\gamma)^{13}\text{C}$ reaction by γ -detection. Enriched target and Ge(Li) detector have been used. The Doppler broadened γ -line shape has been analysed resulting in the angular distribution of protons in each energy point. Via R-matrix analysis of these distributions parameters of three resonances have been determined.



The Legendre coefficients A_L for $L=0$ to 4 as the function of α -energy, in arbitrary units. The solid lines represent the best fit from the R-matrix analysis.

EXCITED STATES OF ^{82}Br FROM $(p, n\gamma)$ REACTION

T. Fényes, Z. Gácsi, J. Gulyás, T. Kibédi, A. Krasznahorkay, S. László, D. Novák, S. Brant* and V. Paar*

*Prirodoslovno-matematički fakultet, University of Zagreb, 41000 Zagreb, Yugoslavia

Submitted to Physica Scripta

γ -ray and internal conversion electron spectra of the $^{82}\text{Se}(p, n\gamma)^{82}\text{Br}$ reaction were measured with Ge(Li) and superconducting magnet transporter Si(Li) spectrometers respectively, at 3.5 and 4 MeV bombarding proton energies. The level scheme of ^{82}Br , multipolarities of 11 transitions, γ -branching ratios, level spin and parity values have been deduced. The energies of ^{82}Br levels were calculated on the basis of the parabolic rule derived from the cluster-vibrational model. This calculation provided a simple classification of several multiplet states in ^{82}Br (see Fig.).

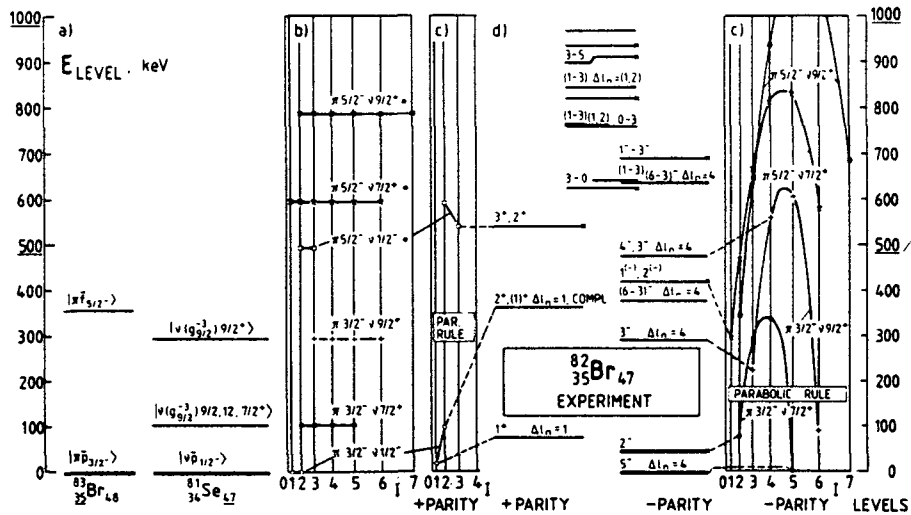


Fig. Multiplet states in ^{82}Br .

- a/ Experimental level energies and probable configurations.
- b/ The zeroth-order classification of several ^{82}Br multiplets. I is the spin of the nuclear state.
- c/ The splitting of the multiplets due to quadrupole and spin vibrational phonon exchange.
- d/ Experimental levels of ^{82}Br below 1000 keV. (The Δl_n values were taken from (d, p) reaction studies.)

EXCITED STATES OF THE ^{70}Ga NUCLEUS

T. Fényes, J. Gulyás, T. Kibédi, A. Krasznahorkay, J. Timár, S. Brant* and V. Paar*

*Prirodoslovno-matematički fakultet, University of Zagreb, 41000 Zagreb, Yugoslavia

Submitted to Nuclear Physics A

The γ -spectrum of the $^{70}\text{Zn}(p,n\gamma)^{70}\text{Ga}$ reaction was measured with Ge(Li) spectrometers at 3, 3.5 and 4 MeV bombarding proton energies. 47 γ -rays were assigned to ^{70}Ga and the energies (E_γ) and relative intensities (I_γ) of γ -rays were determined. The electron spectrum of the reaction was measured with high transmission superconducting magnet transporter Si(Li) and mini-orange Si(Li) spectrometers. Internal conversion electron coefficients were determined for eight ^{70}Ga transitions. The level scheme of ^{70}Ga , γ -branching ratios, multipolarity of transitions, level spin and parities were deduced. The energies of low-lying ^{70}Ga levels were calculated on the basis of the parabolic rule derived from the cluster-vibration model. This calculation provided a simple classification of several multiplet states in ^{70}Ga for the first time (Fig. 1).

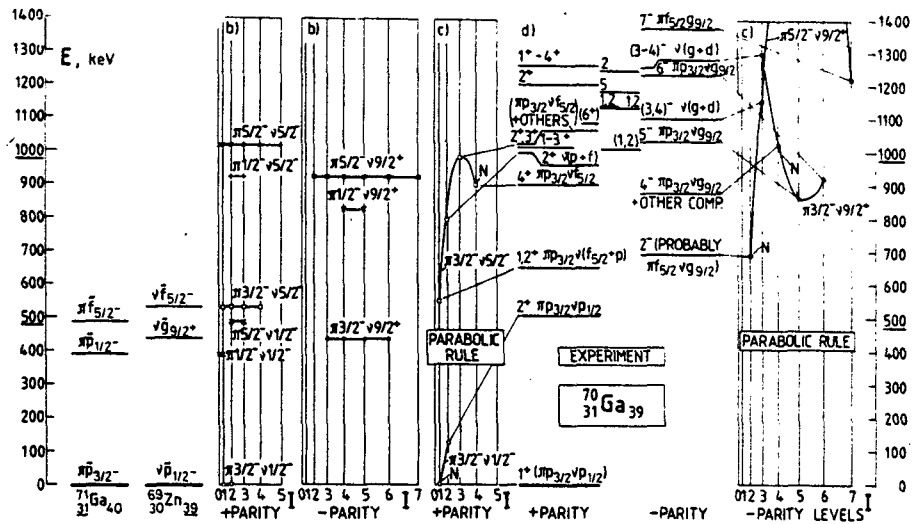


Fig. 1. Proton-neutron quasi-particle multiplet states in ^{70}Ga .

- Experimental level energies and configurations of the lowest three states of the ^{71}Ga and ^{69}Zn nuclei.
- The zeroth-order classification of the low-lying ^{70}Ga states. I is the spin of the nuclear state.
- The splitting of some states of Fig. 1b due to quadrupole and spin vibrational phonon exchange. N means normalization point.
- Experimental levels of ^{70}Ga below ≈ 1300 keV.

ADAPTATION OF A SUPERCONDUCTING SOLENOID TRANSPORTER Si(Li)-Si(Li) SPECTROMETER FOR IN-BEAM STUDIES OF INTERNAL-PAIR TRANSITIONS

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Submitted to Nucl. Instr. and Meth.

The Debrecen superconducting magnetic spectrometer (SMS) has been adapted for in-beam internal-pair studies. Test measurements have been carried out using a ^{207}Bi radioactive source and the $^{19}\text{F}(p,\alpha\gamma)^{16}\text{O}$, $^{23}\text{Na}(p,\alpha\gamma)^{20}\text{Ne}$, $^{27}\text{Al}(p,p'\gamma)^{27}\text{Al}$, and $^{42}\text{Ca}(p,p'\gamma)^{42}\text{Ca}$ reactions (at bombarding energies $E_p=3.5\text{--}4.0$ MeV). Convenient spectrometer parameters and backscattering of electrons and positrons from one detector to the other have been investigated. Experimental values of $(14\pm3)\%$, $(12\pm3)\%$, and $(14\pm2)\%$ for the one detector pair-line efficiencies were determined for the $^{20}\text{Ne}(\text{E2}; 1634 \text{ keV})$, $^{42}\text{Ca}(\text{E0}; 1836 \text{ keV})$, and $^{27}\text{Al}(\text{M1+E2}; 2211 \text{ keV})$ transitions, respectively. The observed pair-line detection efficiencies for two detectors operated in sum-coincidence mode were $(35\pm7)\%$ and $(34\pm6)\%$ for the $^{42}\text{Ca}(\text{E0}; 1836 \text{ keV})$ and $^{27}\text{Al}(\text{M1+E2}; 2211 \text{ keV})$ transitions, respectively. The energy resolution of the spectrometer was $\sim 0.5\%$ in singles and $\sim 0.6\%$ in sum-coincidence measurements for the 2211 keV M1+E2 pair line of ^{27}Al . Effective pair-formation coefficients for one-detector and opposite two-detector geometries have been calculated theoretically for various multipoles. Different methods for the determination of the multipolarity of internal-pair transitions have been investigated. Optimum multipole discrimination effects have been discussed. The experiments show that a good multipole discriminating power can be achieved with the SMS. See fig.

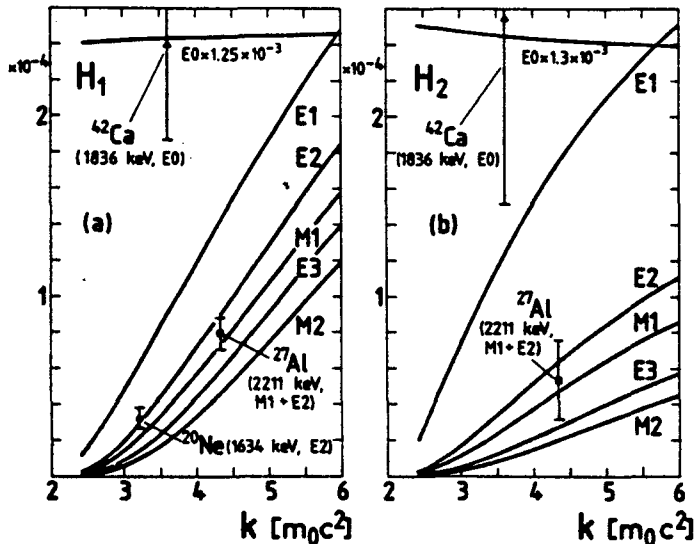


Fig. The transition energy dependence of effective pair formation coefficients in one-detector (H_1) and opposite-detector (H_2) geometries. Curves: results calculated in zero order Born approximation. Points with error bars: experimental data.

INDUSTRIAL APPLICATION OF MASS SPECTROMETRY TO MONITORING FERMENTATION

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* BIOGAL Pharmaceutical Works, H 4042 Debrecen, Hungary

Submitted to:

Third European Congress on Biotechnology, München, 10-14 September 1984.

A measuring and controlling system has been developed in the pilot plant of the BIOGAL Pharmaceutical Works. One essential part of this system is a quadrupole mass spectrometer (QMS). (S. Bohátka, K. Pólya, G. Langer, J. Szilágyi: 1983, Advances in Fermentation, London)

The QMS system has operated excellently in industrial circumstances, during several long term fermentation processes. High correlation was found between the values of QMS and traditional sensors. (i.e. dissolved oxygen, O₂ and CO₂ content in the exhaust gases, NH₃ content in the fermentation broth)

Following up the dissolved CO₂ content of the fermentation broth we received important data in the experiments made for improving the yield of fermentation.

Our experiences were important - among others - in OTC fermentation. First we examined the solubility of CO₂ in the function of pH. Then we made parallel fermentations where the dissolved CO₂ were controlled at different levels by changing the air ration, pH and the CO₂ content of the inlet air. The dissolved CO₂ concentration has a significant effect on the process of OTC fermentation.