ORO-3346-281

NUCLEAR CHEMISTRY RESEARCH AND SPECTROSCOPY WITH RADIOACTIVE NUCLEI

24th Annual Progress Report and Final Report
U.S. Department of Energy
Contract DE-AS05-76ERO-3346

R. W. Fink
Professor of Chemistry Emeritus and Principal Investigator

August 31, 1988

GEORGIA INSTITUTE OF TECHNOLOGY
A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA
SCHOOL OF CHEMISTRY
ATLANTA, GEORGIA 30332

ORO-3346-281

NUCLEAR CHEMISTRY RESEARCH AND SPECTROSCOPY WITH RADIOACTIVE SOURCES

24th Annual Progress Report and Final Report
U. S. Department of Energy
Contract DE-AS05-76ERO-3346

R. W. Fink
Professor of Chemistry Emeritus
Principal Investigator

August 31, 1988

School of Chemistry
Georgia Institute of Technology
Atlanta, Georgia 30332

Telephone (404) 894-4030

ABSTRACT

NUCLEAR CHEMISTRY RESEARCH AND SPECTROSCOPY WITH RADIOACTIVE NUCLEI

This research involves the study of far-from-stable radioactive nuclei mass separated with the UNISOR facility on-line to heavy ion beams from HHIRF at Oak Ridge. The purpose is to investigate low-spin (< 21/2), low-energy (< 3 MeV) nuclear structures, most of which are not generally accessible by in-beam methods. Experiments of interest center on cases where an odd valence nucleon or valence pair act as probes of the underlying core. This leads to observations of abrupt shape changes, shape coexistence, and shell-model intruder states a low nuclear excitation energies. In particular, two distinct neutron-deficient regions are under investigation, one around the Z = 82 closed shell (^{183,185}Au decays, etc.) and the other in the rare earths around the new region of deformation N < 76 and Z > 56 (^{133,135}Sm and rotational gamma-bands in even-even nuclei, ^{132,134}Eu, ^{130,132}Nd decays, etc.) Detailed singles and $\gamma\gamma t$, $e^{-}\gamma t$, $X\gamma t$, $\alpha\gamma t$ coincidence measurements are performed. Nuclear orientation with the ^{3}He/^{4}He dilution refrigerator on-line to the isotope separator will begin this year for measurements of nuclear spins, g-factors, and magnetic moments. Initial on-line studies will be on the decays of oriented ^{189m,g}Hg, ^{199,201}Po, and ^{183,185}Au nuclides. The results of these nuclear spectroscopic and orientation experiments, when combined with those from available in-beam spectroscopy, permits critical testing of competing theoretical concepts and nuclear model calculations.

1.0 INTRODUCTION AND FINAL WORD

This 24th and Final Annual Report summarizes our research progress since the previous annual report [ORO-3346-278, August 31, 1987], together with a list of graduate students, postdoctorates, and publications supported since February 1, 1965, under this, the longest-running contract or grant at Georgia Tech.

In the report of the most recent UNISOR workshop [June 21 - 22, 1988], the following comments on the manpower aspects of nuclear science appeared:

"Over the past few decates, much of the growth in the United States efforts in medium- and high-energy particle physics has been at the expense of research programs in nuclear structure... Many university faculty have "crossed over" into what they perceived to be...a better funded research environment, and they were followed by a large share of graduate students. (This is in contrast to the European effort, in which nuclear structure is well supported and maintained at university and national laboratories.)

"In the opinion of the UNISOR workshop participants, maintenance of a viable research program in nuclear structure is essential to the U.S. national interest, not necessarily because of the information directly gained, but because a pool of talented university researchers and their students will provide a continuing source of expertise...Nuclear structure research will not survive unless university researchers continue their efforts." Without support at both the university and national laboratory level, "university faculty will seek other research fields and the supply of graduate students will dwindle, thereby further reducing the number of future workers."

"Despite the erosion of support for basic research in nuclear science, the need for trained workers continues to increase. Examples of current interest include the following: (1) Environmental applications, such as radon monitoring; (2) Material science, including implanting and alloying radioactive atoms, which are needed as dopants to study new materials such as high T_c superconductors, thereby providing one of the few probes of the microscopic (vs. bulk) properties of materials; and (3) Nuclear medicine and other biomedical applications. Workers in these areas, among others, received their training as nuclear scientists or were trained by university nuclear science faculty and use techniques or instruments developed by nuclear scientists. Finally, ...a time will come in the not too distant future when we may be forced to resort to nuclear power." This is becoming especially obvious by the greenhouse effect of CO_2 from fossil fuels. "The only pool of nuclear scientists trained to handle the situation will be those in nuclear research."

With the ending of DOE support for nuclear chemistry research at Georgia Tech (August 31, 1988), our two large nuclear laboratories in the Chemistry Building have been converted to X-ray diffraction laboratories for protein crystallography for biochemistry research. Although we retain our small radiochemistry "hot" lab, nuclear chemistry, for lack of Federal support, has been discontinued as a field of graduate study at Georgia Tech, and <u>no additional graduate students will be accepted in this field, nor will the graduate level courses in nuclear chemistry continue to be taught</u>. Thus, one of the few remaining sources of PhD nuclear chemists in the U.S. has been closed.

Upon the termination of the Chemistry Dept. nuclear laboratories, we delivered to UNISOR a considerable quantity of state-of-the-art NIM modules, bins, cables, power supplies, etc. and radioactive sources, valued at more than $12,000, on permanent loan. This will also facilitate the continued participation in UNISOR research on a personal basis of R. W. Fink and R. A. Braga, even though the School of Chemistry will no longer have any connection with nuclear research.

Finally, we have one outstanding graduate student, Mr. Johannes Schwarzenberg, who will complete his PhD in nuclear chemistry about June, 1989, based on UNISOR research. He is the last one.

2.0 NUCLEAR SPECTROSCOPIC AND STRUCTURE STUDIES

2.1 Decay of Mass Separated ^{195}Bi to Levels in ^{195}Pb

An extensive report on ^{195}Bi decay was given in last years Annual Progress Report [ORO-3346-278], based on the PhD thesis of Dr. J. C. Griffin. These results are being prepared for full publication [Nucl. Phys. A] and an abstract was presented at the Nashville, Tennessee meeting of the American Physical Society.

The radioactive decay of ^{195}Bi to ^{195}Pb has been studied with mass separated sources from the UNISOR facility. Time-sequenced spectra of γ-rays, X-rays, and conversion electrons have been obtained, together with $\gamma\gamma t$, γXt, e^-Xt, and $e^-\gamma t$ coincidence data. From this information, a decay scheme has been constructed, consisting of 26 excited states and 34 transitions. Electric monopole, E0, transitions, strongly indicative of shape coexistence, have been found to de-excite positive-parity levels at 1125.8 and 1177.0 keV above the 13/2+ isomeric level in ^{195}Pb. The ground-state decay energy of ^{195}Bi is deduced to be Q_{EC} = 4980 ± 600 keV from a γ-ray-gated K/β^+ ratio.

[J.C. Griffin, R. W. Fink, J. L. Wood, and other UNISOR coauthors], Bull. Am. Phys. Soc. 32, 2145 (19870.

2.2 Decay of Mass Separated ^{185}Au to Levels in ^{185}Pt

This research constitutes part of the PhD thesis of Mr. Johannes Schwarzenberg in nuclear chemistry. The decay of 4.2 min ^{185}Au (5/2-) to ^{185}Pt has been studied with mass separated sources from the UNISOR facility. The ^{185}Au activity was produced by the reaction ^{181}Ta(^{12}C,8n) at the Holifield Heavy Ion Research Facility. Multiscaled spectra, as well as $\gamma\gamma t$, $X\gamma t$, $e^-\gamma t$, and e^-Xt coincidence data,were obtained. These data are of high statistical quality (215 million $\gamma\gamma$ and 152 million $e^-\gamma$ coincidence events). A number of very highly converted low-energy (300 - 600 keV) transitions have been identified and located in a level scheme for ^{185}Pt. We find significant disagreement with a previous study[1]. These very converted transitions are consistent with E0 + M1 multipolarity, contrary to ref. 1. The structure

[1] B. Roussiere, et al., Nucl. Phys. A438, 93 (1985)

of ^{185}Pt, and in particular the E0 transitions, are discussed in terms of shape coexistence in this mass region. A preliminary report will be presented at the Santa Fe meeting of the American Physics Society in October, 1988.

2.3 Decay of Neutron-Deficient Rare Earth Nuclei

Leander and Moeller [1] have predicted the existence of large deformations in neutron-deficient nuclei with N < 82 and Z > 50. This region of deformation is close enough to the line of stability in the neutron-deficient Sm and Pm isotopes that the possibility of producing and studying their structure exists. Macroscopic calculations by Ragnarsson, et. al. [2] around the neutron-deficient Sm, Gd nuclei have predicted stable prolate shapes except for the N=76 isotones where the gamma-degree of freedom is expected to give major effects. The nucleus 138Sm has been found [3] to have not only a small prolate-oblate energy difference, but also a triaxial equilibrium shape.

Our interest in this region involves the systematic study of the change from spherical, through transitional, to deformed nuclei as the proton drip line is approached. In addition, the rotational gamma-bands in many of the even-even nuclei have yet to be identified. A transition from spherical to deformed shape in Sm isotopes with N < 82 has long been predicted on the basis of elementary shell structure considerations [4], and has been borne out by measurements [5] of yrast level energies down to N=72. The detailed nature of this shape transition is of interest in nuclear structure for comparison with the analogous shape transition at N > 82. Papers on the transition through triaxial shapes of the light Sm isotopes and on the structure of the gamma-soft 136Pm nucleus have been published [3,6].

These studies support the characterization of the 136,138,140Sm nuclei in terms of a triaxial intrinsic shape. Furthermore, the large change in the 2+ energy between 134Sm and 140Sm can be understood within the framework of the deformed shell model by taking into account triaxial rotation of the heavier isotopes, which tends to increase the 2+ energy.

Our studies of even-even rare-earth nuclei consisted of a series of experiments carried out using the He-jet transport system on-line to HHIRF. While the He-jet system has the advantage of enhancing the yields of rare-earth activities, it is at the sacrifice of mass identification. The activities were produced by bombarding enriched 92Mo foil targets with 250MeV 46Ti ion beams and 112Sn targets with 190MeV 28Si beams. The data consisted of gamma-gamma-t coincidence and time-sequenced gamma-ray sprectra, with typical counting rates of 12,000 and 40,000 counts/sec, respectively.

Our studies of odd-mass nuclei in this deformed region centers on the 135 and

137 mass chains. Of particular interest are the studies of the decay of 137Sm to levels in 137Pm and of 135Pm to levels in 135Nd.

It is in the N=76 isotones that the gamma-degree of freedom is expected to come into play. The activities of 137Sm were produced by bombarding stacked foils of natural Mo with 48Ti beams with on-line mass separation at UNISOR. The experiments consisted of gamma-gamma-t and ce-gamma-t coincidence as well as gamma-ray singles and ce- singles spectrometry. The level scheme is in essential agreement with that of Redon, et. al.[7] with the exception of the spin-parity assignments, which in their case were based solely on systematics. Whereas in the heavier odd-mass Pm isotopes, the 11/2- state is observed to be an excited state, in 137Pm, this odd-proton state drops in energy to become the ground state.

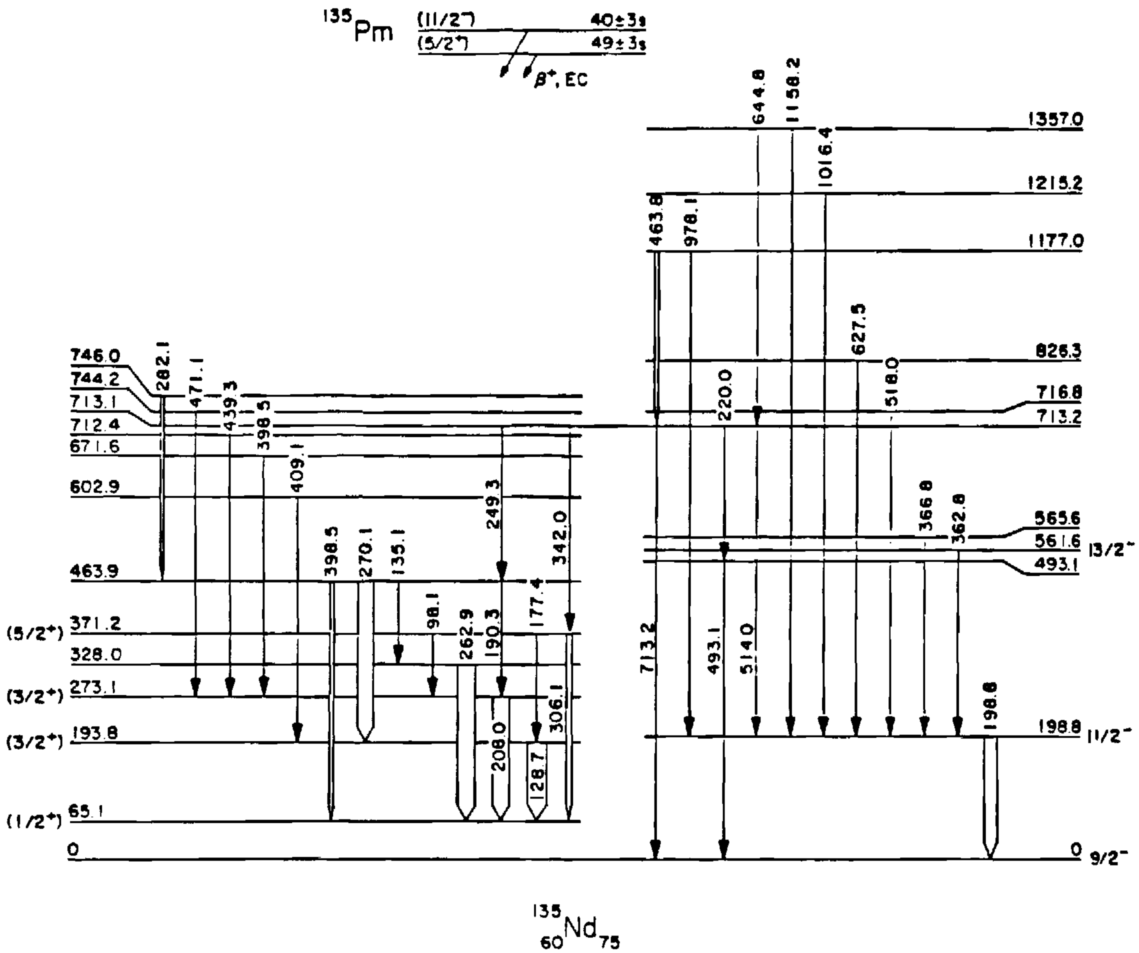
The 11/2- assignment for the ground state of 137Pm is of particular interest in relation to the heavier odd-mass Pm isotopes. In the heavier odd-A Pm isotopes, E3 transitions are observed between the 11/2- excited state and the 5/2+ ground state. In 137Pm, however, no transition with E3 multipolarity is established. The lack of this observation reinforces our conclusion that, as with other N=76 isotones, a decoupled band structure exists with both the 11/2- and 7/2- members coming low enough in energy to both be below the 5/2+ state. A paper on the decay of 45 sec 137Sm to levels in 137Pm is in preparation.

The non-yrast structure of 135Nd has been studied following the beta-decay of mass-separated 135Pm. The parent 135Pm has 11/2- and 5/2+ isomers with halflives of 40 +/- 3 sec and 49 +/- 3 sec, respectively. The low-spin structure opf 135Nd (Fig. 1) is shown to consist of a group of levels which decay to a 65.1-keV isomeric state, not populated in the yrast cascade. The expected 65.1-keV, (1/2+) ⟶ 9/2-, highly converted M4 transition was not observed.

Besides this low-spin, positive-parity structure, a number of transitions populating a negative parity band were observed. The strongest of these gamma-rays is the 198.8-keV transition deexciting the 11/2- state and populating the 9/2- ground state. This transition is also observed in the yrast ground-state band. The 713.2-keV level is the only level observed to decay to both band structures, thus connecting the two structures. A short paper on the decay of 135Pm to levels in 135Nd has been submitted for publication [8].

[1] G. Leander and P. Moeller, Phys. Lett. 110B, 17 (1982)

[2] I. Ragnarsson, et. al., Nucl. Phys. A233, 329 (1974)
[3] B. D. Kern, R. A. Braga, R. W. Fink, et.al., Phys. Rev. C36, No. 4, 1514 (1987)
[4] R. K. Sheline, Revs. Modern Phys. 32, 1 (1960)
[5] C. J. Lister, et. al., Phys. Rev. Lett. 55, 810 (1985)
[6] B. D. Kern, R. A. Braga, R. W. Fink, et.al., Z. Physik A330, 37 (1988)
[7] N. Redon, et. al., Z. Physik A325, 127 (1986)
[8] M. O. Kortelahti, R. A. Braga, R. W. Fink, and other UNISOR coauthors, Z. Physik (1988) (submitted)


135Pm
(11/2⁻) 40±3s
(5/2⁺) 49±3s
β⁺, EC
1357.0
1215.2
1177.0
826.3
716.8
713.2
565.6
561.6
493.1
13/2⁻
198.8 11/2⁻
0 9/2⁻
746.0
744.2
713.1
712.4
671.6
602.9
463.9
(5/2⁺) 371.2
328.0
(3/2⁺) 273.1
(3/2⁺) 193.8
(1/2⁺) 65.1
0
282.1
471.1
439.3
398.5
409.1
398.5
270.1
135.1
98.1
262.9
190.3
249.3
177.4
342.0
208.0
128.7
306.1
463.8
978.1
644.8
1158.2
1016.4
220.0
627.5
518.0
366.8
362.8
713.2
493.1
514.0
198.8
135 60 Nd 75

LIST OF POSTDOCTORATES SUPPORT IN FULL OR IN-PART SINCE February 1, 1965

Dr. Robert A. Braga (Presently: Staff Member, Chemistry, Georgia Tech)
Dr. John L. Wood (Presently: Assoc. Prof., Physics, Georgia Tech)
Dr. Kenneth R. Baker (Presently: Nuclear Regulatory Commission, Washington, D. C.)

Dr. H. U. Freund (Presently: Battelle Institut, Frankfurt, West Germany)
Prof. E. Kondaiah (Presently: Retired; Former ly: Tata Institute for Fundamental Research, Bombay, India; NSF Senior Postdoctorate under this contract)
Dr. K. W. D. Ledingham (Presently: Professor, Physics, Univ. of Glasgow, Scotland)
Dr. J. C. McGeorge (Presently: Research Associate, Physics, Univ. of Edinburgh, Scotland)
Prof. J. G. Pengra (Presently: Professor, Physics, Whitman College, Walla Walla, Wash.)

Dr. N. RanaKumar (Presently: Professor, Physics, Southern Tech Univ.,Marietta, Georgia)
Prof. P. Venugopala Rao (Presently: Professor, Physics, Emory Univ., Atlanta, Georgia)
Dr. M.S. Rapaport (Presently: Soreq Nuclear Research Center, Yavne, Israel)
Dr. W.D. Schmidt-Ott (Presently: Professor, Univ. of Göttigen, West Germany, and GSI, Darmstadt, West Germany)
Dr. Mustafa Tan (Presently: Assoc.Prof., Univ. of Ataturk, Physics, Erzurum, Turkey)
Dr. Warren R. Western (Presently: Nuclear Data Corp., Schaumburg, Illinois)

Dr. Alexander C. Xenoulis (Presently: Nuclear Research Center Demokritos, Athens, Greece)
Dr. E. Vatai (Presently: Inst. of Nuclear Physics, Hungarian Academy of Science, Debrecen, Hungary)
Dr. R. E. Wood (Presently: Computer Operations, Southern Railroad, Atlanta, Georgia) (Formerly: Asst. Prof., Physics, Emory Univ., Atlanta, G eorgia)

LIST OF GRADUATE STUDENTS WHO OBTAINED DEGREES UNDER THIS CONTRACT SINCE Feb. 1, 1965

Johannes Schwarzenberg, PhD, Nuclear Chemistry (expected completion: June, 1989)

Dr. Paul Semmes, PhD, Nuclear Chemistry (June, 1985)(Presently: Inst. of Theoretical Physics, Univ. of Lund, Sweden)
Dr. Jeffrey C. Griffin, PhD, Nuclear Chemistry (1986)(Presently: Savannah River Laboratory, Aiken, South Carolina)
Dr. Bruce E. Gnade, PhD, Nuclear Chemistry (1982) (Presently: Texas Instrument Co., Dallas, Texas)
Major Allen D. Strouphauer, M.S. (June,1983) (Presently: Sandia Lab, Albuquerque, N.M.) Nuclear Chemistry
Dr. William M. Chew, M.S.(March,1972) and PhD (June,1974), Nuclear Chemistry (Presently: Chevron Oil Field Research Co.,California)
Dr. Gregory M. Gowdy, PhD, Nuclear Chemistry,(December, 1976) (Presently: South Carolina Electric and Gas Co., Nuclear Division; Formerly: Postdoct. at ORAU, GSI, Darmstadt, West Germany, and ORSAY, France)
Dr. Harald Genz, PhD, Nuclear Physics, Emory Univ.,(November, 1971) (Presently: Prof. Physics, Technisches Hochschule, Darmstadt, West Germany)
Dr. Dale W. Nix, PhD, Nuclear Chemistry (August,1974) (Presently: Radiochemist, TVA Nuclear Reactors, Sequoia, Chattanooga, Tennessee)
Ali Saleh, M.S., Nuclear Chemistry, Georgia Tech (August,1976); PhD, Nuclear Chemistry, Univ. Arkansas (1981) (Presently: Asst.Prof.,Chemistry, Univ. of Tripoli, Libya)
Dr. Marvin A. Grimm, Jr.,PhD, Nuclear Physics (Nov. 1978) (Presently: Private Company)
Dr. Florian Tolea, PhD, Nuclear Chemistry (June, 1974) (Presently: Professor, Chemistry, Babesh-Bolyai Univ., Cluj, Romania)
Dr. J. Steven Hansen, PhD, Nuclear Engineering (March,1971) (Presently: Theoretical Physics Division, Los Alamos Scientific Laboratory, Los Alamos, New Mexico)
Dr. Esko I. Kartunnen, PhD, Nuclear Engineering (Feb. 1971) (Presently: Prof., Dept. of Radiochemistry, Univ. of Helsinki, Finland)

Dr. Saradamandiram Mohan, PhD, Nuclear Engineering (Sept.,1972) (Presently: Assoc. Prof. Physics, Regional Engineering College, Calicut, Kerela State, India)
Dr. Alice K. Hankla, PhD, Nuclear Physics (June, 1971) (Vanderbilt Univ.)
Dr. Wen-deh Lu, PhD, Nuclear Chemistry (August, 1970) (Presently: Institute of Nuclear Energy Research, Taiwan, Republic of China)
Jean Paul Renier, M.S. Nuclear Chemistry (June, 1975) (Presently: Consultant in Nuclear Power, Oak Ridge, Tennessee)
Major John Uecke, M.S. Nuclear Chemistry (June, 1975). (Presently: U.S. Army)
Major Jerry C. Pate, M.S., Nuclear Chemistry (June,1974) (Presently: U.S. Army)
I. Unus, M.S. Nuclear Engineering (1972), Georgia Tech, and PhD, Nuclear Physics, Emory Univ.)

OTHER STUDENTS:

Cesar P. Perez, Nuclear Chemistry (1983-1988) Completing M.S. degree
Chris Papanicolopulos, Nuclear Chemistry (1975-1980) Completed PhD degree in Nuclear Physics (1987). (Presently: Georgia Tech Research Institute, Atlanta, Georgia)

LIST OF PUBLICATIONS SINCE FEB. 1, 1965, RESULTING FROM THIS CONTRACT
(Publication number is that on the master list going back to 1950)

274) "$L_{2,3}$-Subshell X-ray Fluorescence Yields and Coster-Kronig Transition Probabilities of Nd and Yb," M. Tan, R. A. Braga, R. W. Fink, and P.V. Rao, Phys. Scripta 37, 62 - 65 (1988)

273) "Decay of Mass Separated ^{195}Bi to Levels in ^{195}Pb: Possible Shape Coexistence in Odd-Mass Pb Isotopes," J. C. Griffin, R. W. Fink, R. A. Braga, J. L. Wood, and other UNISOR coauthors, Nucl. Phys. (in preparation) (1988); Bull.Am.Phys.Soc. 32, 2145 (1987)

272) "Energy Levels of Neutron-Deficient Rare Earth Nuclei via Beta Decay," M.O. Kortelahti, B.D. Kern, R. A. Braga, and R. W. Fink, Bull.Am.Phys.Soc. 32, 2146 (1987)

271) "Energy Levels and Structure of Light Rare Earth Nuclei via Beta Decay: ^{136,138,140}Sm and ^{132,134,136}Nd," R.L. Mlekodaj, G.A. Leander, H.K. Carter, M.O. Kortelahti, E. F. Zganjar, B.D. Kern, R. A. Braga, R. W. Fink, C.P. Perez, P.B. Semmes, and W. Nazarewicz, Prof. 5th Int.Conf. Nuclei far from Stability, American Institute of Physics Conf. Proceedings No. 164 New York, 1988); pp. 441-444

270) "Transition through Triaxial Shapes of the Light Sm Isotopes and the Beta Decay of ^{136,138,140}Eu," B.D. Kern, R.L. Mlekodaj, G.A. Leander, M.O. Kortelahti, E.F. Zganjar, R. A. Braga, R. W. Fink, C.P. Perez, W. Nazarewicz, and P. B. Semmes, Phys. Rev. C36, 1514 - 1521 (1987)

269) "Decay of ^{136}Sm and ^{136}Pm Isobars," B.D. Kern, R. L. Mlekodaj, M.O. Kortelahti, E.F. Zganjar, R. A. Braga, R. W. Fink, and C.P. Perez, Z. Physik A 330 37 - 43 (1988)

268) "Beta Decay of Light Rare Earth ^{130,132}Pr and ^{132,134}Pm Nuclei," M. Kortelahti, E.F. Zganjar, R. L. Mlekodaj, B. D. Kern, R. A. Braga, R. W. Fink, and C.P. Perez, Z. Physik A237, 231 - 232 (1987)

267) "The L_2-L_3 Coster-Kronig Transition Probability for Z = 54," P. B. Semmes, J. C. Griffin, R. A. Braga, and R. W. Fink, Phys.Rev. C35, 749 - 751 (1987)

266) "Decay of the Low-Spin Isomer of ^{195}Pb," C.R. Bingham, R. A. Braga, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 31, 1236 (1986)

265) "Decay of Mass Separated 7.4 min ^{203}At," P.B. Semmes, R. A. Braga, R. W. Fink, J.L. Wood, and J.D. Cole, Nucl. Phys. A464, 381 - 394 (1987)

264) BOOK REVIEW: "Americium and Curium Chemistry and Technology," edited by Edelstein, Navratil, and Schulz (D. Reidel Publishing Co., Holland, 1985) R. W. Fink, J. Am. Chem. Soc. 108, 5048 (1986)

263) "Band Structure in ^{189}Au from ^{189m,g}Hg Decay," M. Kortelahti, E. F. Zganjar, J.L.Wood, R. A. Braga, R. W. Fink, H.K. Carter, and R.L. Mlekodaj, Bull.Am.Phys.Soc. 31, 874 (1986)

262) "Shape Coexistence in ^{185}Au," E.F. Zganjar, C. C. Papanicolopulos, J. L. Wood, R. A. Braga, R. W. Fink, and other UNISOR coauthors, Proc. Symp. Nuclei far off Stability, American Chemical Society Symposium Series 324, 245 -251 (1986)

261) "Coexisting Collective Structure in ^{185}Au," J. L. Wood, R. A. Braga, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 30, 1275 (1985)

260) "Decay of ^{137}Sm and Deformation in the Light Pm Region," R. A. Braga, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 30, 1264 (1985)

258) "Decay of ^{188}Tl and Observed Shape Coexistence in the Bands of ^{188}Hg," J.D. Cole, J.H. Hamilton, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Phys. Rev. C30, 1267 - 1275 (1984)

257) "Decay of Mass Separated ^{201m}Po and ^{201g}Po," R. A. Braga, P. B. Semmes, W. R. Western, and R. W. Fink, Nucl. Phys. A459, 359 - 373 (1986)

256) "Halflife of the $h_{9/2}$ Shell-Model Intruder State Isomer ^{187m}Au," R. A. Braga, B. E. Gnade, R.W.Fink, and H. K. Carter, Nucl. Phys. A410, 441 - 444 (1983)

254) "L_2 and L_3 Subshell X-ray Fluorescence Yields and Coster-Kronig Transition Probabilities for Z = 60 and 70," M. Tan, R. A. Braga, R. W. Fink, and P.V. Rao, Bull.Am.Phys.Soc. 32, 1050 (1987) (see publication no. 274)

253) "The Decay of Mass Separated ^{203}At," P.B. Semmes and R. W. Fink, Bull.Am.Phys. Soc. 27, 705 (1982) (see publication no. 265)

252) "The Lifetime of the 724.3 keV Level and Shell-Model Instruder State in ^{109}Ag," R. A. Braga and R. W. Fink, Phys. Rev. C26, 1302 - 1303 (1982)

251) "Orbital Electron-Capture Probability and Decay Energy in ^{207}Bi Decay," M. Tan, P.V. Rao, R. A. Braga, and R. W. Fink, Bull.Am.Phys.Soc. 26, 1236 (1981) and Nucl. Phys. A388, 498 - 504 (1982)

250) "X-ray Fluorescence Yields and Coster-Kronig Transition Probabilities of the L_1, L_2, and L_3 Subshells of Pb," M. Tan, R. A. Braga, R. W. Fink, and P. V. Rao, Bull.Am.Phys.Soc. 26, 1235 (1981) and Phys. Scripta 25, 536 - 542 (1982)

249) "Lifetime of the 120.7 keV Isomer in 2.3 sec ^{187m}Au," R.A.Braga and R. W. Fink, Bull.Am.Phys.Soc. 26, 1117 (1981)

248) "The Decay of Mass Separated ^{187}Au (8.4 min) to ^{187}Pt," B. E. Gnade, R. W. Fink, and J. L. Wood, Bull.Am.Phys.Soc. 26, 1116 (1981) and Nucl. Phys. A406, 29 - 54 (1983)

247) "Properties of Si and Ge Semiconductor Detectors for X-ray Spectrometry," R. W. Fink (invited paper), in Energy Dispersive X-ray Spectrometry, edited by K.F.J. Heinrich, D.E. Newbury, R.L. Myklebust, and C.E. Fiori (National Bureau of Standards Specl. Publ. No. 604, June,1981); pp. 5 - 34

244) "Excited States in ^{189,190}Pt from the Decays of ^{189m,g}Au and ^{190}Au," B.E. Gnade, J. L. Wood, and R. W. Fink, Bull.Am.Phys.Soc. 25, 740 (1980)

243) "Decays of ^{117}Xe to ^{117}I to ^{117}Te," R.S. Lee, W.D. Schmidt-Ott, A. C. Xenoulis, R. W. Fink, and other UNISOR coauthors, Phys. Rev. C32, 277 - 287 (1985)

242) "Very Slow M4 Transitions and Shell Model Intruder States in ^{199,201}Bi," R. A. Braga, W. R. Western, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Nuclear Phys. A349, 61 - 67 (1980) and "M4 Isomerism and the Observation of the $s_{1/2}$ shell model intruder state in ^{201}Bi,"
241) R. A. Braga, W. R. Western, J. L. Wood, and R. W. Fink, Bull. Am. Phys. Soc. 24, 836 (1979)

240) "An Improved Measurement of the $L_{2,3}$ Subshell X-ray Fluorescence and Coster-Kronig Yields at Z = 64 and 67," B. E. Gnade, R. A. Braga, and R. W. Fink, Bull. Am. Phys. Soc. 24, 835 (1979) and Phys. Rev. C21, 2025 - 2032 (1980); C23, 580 (1981).

239) "Tables of Experimental Values of X-ray Fluorescence and Coster-Kronig Yields for the K, L, and M Shells," R. W. Fink and P. V. Rao, in Handbook of Spectroscopy, Vol. 3, edited by J.W. Robinson (CRC Publishing Co.,Boca Raton, Florida, 1981); pp. 125 - 139

238) "Thermal Neutron Activation Cross Sections," R. W. Fink, in Handbook of Spectroscopy, Vol. 3, edited by J.W. Robinson (CRC Publishing Co., Boca Raton, Florida, 1981); pp. 95 - 123

237) "An Inexpensive Pulser for the Adjustment of Subnanosec Walk in Timing Circuits," R. A. Braga, G. E. O'Brien, and R. W. Fink, Nucl. Instr. Meth. 163, 527 - 529 (1979)

236) "A Fast Beta Transition in ^{183}Pt and the Systematics of Nilsson States in the N = 105 Isotones," A. Visvanathan, E. F. Zganjar, J. L. Wood, R. W. Fink, L. L. Riedinger, and F. E. Turner, Phys. Rev. C19, 282 - 284 (1979)

235) "Determination of Corrections for Tailing in Low-Energy Coincidence Intensity Measurements," B. E. Gnade, R. A. Braga, J. L. Wood, and R. W. Fink, Nucl.Instr.Meth. 164, 163 - 167 (1979) and Bull.Am.Phys. Soc. 24, 754 (1979)

234) "Decay of Mass Separated ^{202}At and ^{202}Po," M.P.M.Ramos,C.R.Bingham, J.L. Wood, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 23, 946 (1978)

233) "Decay of Mass Separated ^{197}Tl (2.83 hours) to ^{197}Hg," R.A.Braga, J. L. Wood, G.M. Gowdy, and R. W. Fink, Phys. Rev. C19, 2305 - 2313 (1979)

227) "Halflives and Decay of ^{197}Pb Isomers," M.S. Rapaport, R. W. Fink, and other UNISOR coauthors, Nucl. Phys. A315, 163 - 168 (1979)

226) "Production of 14 ± 2 MeV Neutrons in a Reactor with an Enriched ^{6}LiD Irradiation Capsule," C. Papanicolopulos and R. W. Fink, Nucl. Instr. Meth. 151, 53 - 60 (1978)

225) "L X-ray Yields from Double Vacancy States in Indium," P.A. Indira, I. J. Unus, P. V. Rao, and R. W. Fink, J. Phys.(London) B12, 1351 - 1356 (1979)

224) "Orbital Electron Capture Ratios in the Decay of ^{205}Pb," J. G. Pengra, H. Genz, and R. W. Fink, Nucl. Phys. A302, 1 - 11 (1978)

223) "Decay of ^{195}Tl (1.13 hours) to ^{195}Hg," G. M. Gowdy, J. L. Wood, and R. W. Fink, Nucl. Phys. A312, 56 - 80 (1978)

221) "The Decay of Mass Separated ^{201m,g}Po," W. R. Western, J. L. Wood, R. A. Braga, and R. W. Fink, Bull.Am.Phys.Soc. 22, 996 (1977)

220) "New Isomers of ^{185,187}Tl and the Departure of the $h_{9/2}$ Intruder State," A.G. Schmidt, G. M. Gowdy, J. L. Wood, and R. W. Fink, and other UNISOR coauthors, Phys. Lett. 66B, 133-135 (1977)

218) "Decay of Mass Separated ^{195,197}Tl," R. A. Braga, G. M. Gowdy, J. L. Wood, and R. W. Fink, Nuclear Chemistry Symp., American Chemical Society, Chicago, Illinois (August, 1977)

215) "Decay of Mass Separated ^{185}Tl, ^{185}Hg, and the Structure of ^{185}Au," A. Visvanathan, E. F. Zganjar, M. A. Grimm, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 22, 615 (1977)

214) "Decay of Mass Separated ^{200}Po," C.R.Bingham, W. R. Western, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 22, 546 (1977)

213) "High and Low Spin Levels in ^{197}Tl," L.L. Collins, M.S. Rapaport, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull.Am.Phys.Soc. 21, 976 (1976)

211) "Evidence for Quadrupole Pairing Deformation," J.L.Wood and R. W. Fink, Bull.Am.Phys.Soc. 21, 1001 (1976)

210) "The K-Shell Conversion Coefficient for the 135.5 keV M4 Transition in ^{193m}Pt Decay," A. I. Saleh, R. A. Braga, and R. W. Fink, Z. Physik A279, 27 - 29 (1976)

208) "Recent Work at UNISOR on Neutron-Deficient Au, Hg, and Tl Nuclei in the Mass Region A = 184 - 197," J.L. Wood, G.M. Gowdy, R. W. Fink, D. A. McClure, M.S. Rapaport, R. A. Braga, and other UNISOR coauthors, Invited Paper, Proc. 3rd Int.Conf. Nuclei far from Stability, Corsica, France, May, 1976 (CERN Rept. 76-13 (1976); pp. 364 - 366

207) "L X-ray Emission from Double Vacancy States in Indium," R. W. Fink, P. A. Indira, I.J. Unus, and P. V. Rao, Bull. Am. Phys. Soc. 21, 818 (1976)(Quebec, Canada, June, 1976)

206) "The Structure of the Light Odd-N Hg and Pt Nuclei," E. F. Zganjar, G. M. Gowdy, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Proc. 3rd. Int. Conf. on Nuclei Far from Stability, (May, 1976, Corsica, France), CERN Report 76-13 (1976)

205) "The L_2-L_3 Coster-Kronig Transition Probability at Z = 96," R. W. Fink and D. W. Nix, Bull. Am. Phys. Soc. 21, 817 (1976) (Quebec, Canada, June, 1976); Z. Physik A278, 239 - 240 (1976)

204) "The Structure of Neutron-Deficient Odd-Mass Nuclei in the Gold-Thallium Region;" "Evidence for Coexisting Triaxial Shapes and a Two-Component Pairing Force," J. L. Wood, R. W. Fink, and other UNISOR coauthors, Proc. 3rd. Int. Conf. on Nuclei Far from Stability, May, 1976, Corsica, France; CERN Report 76-13 (1976)

203) "Decay of Mass-Separated ^{190}Tl and ^{190}Hg," C. R. Bingham, J. L. Wood, G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, Phys. Rev. C14, 1586 - 1600 (1976)

202) "Decay of ^{193}Pb," A. C. Kahler, J. L. Wood, R. W. Fink, and other UNISOR Coauthors, Bull. Am. Phys. Soc. 21, 559 (1976)

201) "Triaxial Band in ^{195}Tl," L. L. Collins, J. L. Wood, R. W. Fink, and other UNISOR Coauthors, Bull. Am. Phys. Soc. 21, 559 (1976)

200) "Systematics of the Levels in the Neutron-Deficient Odd-A Hg Isotopes," G. M. Gowdy, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 21, 559 (1976)

199) "The Decay of Mass Separated ^{193}Tl," A. G. Schmidt, G. M. Gowdy, R. W. Fink and C. R. Bingham, Bull. Am. Phys. Soc. 21, 559 (1976)

198) "Shell Model Systematics near Closed Shells and a Possible New Role of the Pairing Force," J. L. Wood and R. W. Fink, Bull. Am. Phys. Soc. 21, 639 (1976)

197) "Mass Separator Study of the Decay ^{193g}Hg to ^{193}Au," D. A. McClure, J. L. Wood, and R. W. Fink, Bull. Am. Phys. Soc. 21, 559 (1976)

196) "Symmetry between Particle and Hole Level Systems in ^{189}Au," J. L. Wood, R. W. Fink, E. F. Zganjar, and J. Meyer ter Vehn, Phys. Rev. C14, 682 - 684 (1976)

195) "Deformation, Pairing, and Particle-Core Coupling: Z = 76 to 81 and N = 104 to 120," J. L. Wood and R. W. Fink, Bull. Am. Phys. Soc. 20, 1185 (1975)

194) "On-Line Mass Separator Investigation of New Isotope 2.9 sec ^{116}I," G. M. Gowdy, A. C. Xenoulis, J. L. Wood, K. R. Baker, and R. W. Fink, with other UNISOR Coauthors, Phys. Rev. C13, 1601 - 1608 (1976)

193) "Decay of Mass Separated ^{190}Tl and ^{190}Hg," C. R. Bingham, J. L. Wood, G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, Phys. Rev. C14, 1586 - 1600 (1976)

192) "On-Line Conversion Electron Measurements in the Decay of ^{188}Tl," J. H. Hamilton, R. W. Fink, J. L. Wood, G. M. Gowdy, and other UNISOR coauthors, Bull. Am. Phys. Soc. 20, 830 (1975)

191) "Crossing of Near-Spherical and Deformed Bands in ^{188}Hg and New Isotopes ^{186,188}Tl," K. R. Baker, R. W. Fink, G. M. Gowdy, J. L. Wood, A. C. Xenoulis, and other UNISOR coauthors, Phys. Rev. Lett. 35, 562 - 565 (1975)

190) "An Investigation of the L_2 - L_3 Coster-Kronig Transition Probability for Z = 63 to 96," D. W. Nix and R. W. Fink, Z. Physik A273, 305 - 311 (1975)

189) "Decay of ^{195}Pb," L. L. Collins, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 20, 830 (1975)

188) "The Positron Decay of ^{189}Tl, ^{189}Hg, and ^{189}Au," J. L. Weil, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 20, 715 (1974)

187) "New Isotope ^{193}Pb and the Structure of ^{193}Tl; Shape Coexistence in ^{188}Hg and in ^{189}Au; New Ion Source and Recent UNISOR Research,")Review), J. H. Hamilton, R. W. Fink, G. M. Gowdy, K. R. Baker, J. L. Wood, A. C. Xenoulis, and other UNISOR coauthors. Proc. 24th Conf. of Acad. of Sci. USSR on Nuclear Spectroscopy and Structure, Leningrad, January, 1975; Bull. Acad. Sci., Phys. USSR, 40, 2 (1976)

186) "Evidence for an Oblate-Prolate Shape Change through the Triaxial Degree of Freedom," J. L. Wood, R. W. Fink, and E. F. Zganjar, Bull. Am. Phys. Soc. 20, 669 (1975)

185) "Mass Differences of Proton-Rich Atoms near A = 116 and A = 190," J. L. Wood G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, Proc. 5th Int. Conf. on Atomic Masses and Fundamental Constants, Paris, France (1975); in J. H. Sanders and A. H. Wapstra, Atomic Masses and Fundamental Constants Vol. 5 (Plenum Publishing Co.,New York, 1976); pp 81 - 87

184) "Investigation of the A = 189 Decay Chain with an On-Line Mass Separator," E. F. Zganjar, J. L. Wood, R. W. Fink, G. M. Gowdy, and other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 1125 (1974)

183) "Investigation of the A = 191 Decay Chain with an On-Line Mass Separator," G. M. Gowdy, J. L. Wood, and R. W. Fink, Bull. Am. Phys. Soc. 19, 1125 (1974)

182) "Rotation-Aligned Coupling and Axial Asymmetry in $^{189-195}$Au Isotopes," E. F. Zganjar, J. L. Wood, R. W. Fink, and other UNISOR coauthors Phys. Lett. 58B, 159 - 162 (1975)

181) "Systematics of Levels in Odd-Mass Hg and Odd-Mass Tl Nuclei," E. F. Zganjar J. L. Wood, and R. W. Fink, with other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 1019 (1974)

180) "Systematics of Levels and Shape Coexistence in Odd-A Gold Nuclei," J. L. Wood and R. W. Fink, with other UNISOR coauthors, Bull.Am.Phys.Soc. 19, 1018 (1974)

179) "Yrast Band Analysis," J. L. Wood and R. W. Fink, Bull. Am. Phys. Soc. 19, 1079 (1974)

178) "A Gamma-Gamma Coincidence Study of Transitions in ^{239}Np and ^{239}Pu from the Decay of ^{243}Am," J. C. Pate, K. R. Baker, R. W. Fink, D. A. McClure, and N.S. Kendrick,Jr., Z. Physik A272, 169 - 174 (1975)

177) "A Digital Gate Unit for Two-Parameter Multichannel Analysis," G. E. O'Brien K. R. Baker, and R. W. Fink, Nucl. Instr. Meth. 121, 567 - 572 (1974)

175) "Mean M-Subshell Fluorescence Yields at Z = 88, 90, 92, and 94," K. R. Baker, F. Tolea, and R. W. Fink, Z. Physik 270, 1 - 7 (1974)

174) "Spherical and Deformed Shapes in ^{188}Hg," J. H. Hamilton, W. D. Schmidt-Ott, R. W. Fink, J. L. Wood, K. R. Baker, and other UNISOR coauthors, Proc. Int. Conf. on Reactions between Complex Nuclei (Nashville, Tenn. 1974); (North-Holland Publishing Co., Amsterdam, 1974); pp 178

173) "The Decay of Mass Separated ^{189}Tl, ^{189}Hg, and ^{189}Au," J. L. Wood, R. W. Fink, and other UNISOR coauthors, in Reactions between Complex Nuclei, edited by J.H. Hamilton, et al.(North-Holland Pub lishing Co., Amsterdam, 1974); pp. 179

172) "Search for New Isotopes ^{186,187}Tl," W. D. Schmidt-Ott, K. R. Baker, A. C. Xenoulis, J. L. Wood, G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, in Reactions between Complex Nuclei, edited by J. H. Hamilton, et al. (North-Holland Publishing Co., Amsterdam, 1974); p. 177

171) "Radioactive Decay of Mass Separated ^{190}Tl," C. R. Bingham, J. L. Wood, R. W. Fink, A. C. Xenoulis, and other UNISOR coauthors, in Reactions between Complex Nuclei, edited by J. H. Hamilton, et al. (North-Holland Publishing Co., Amsterdam, 1974); pp.180

170) "An Experimental Investigation of the Onset of the L_2-L_3M_4 and L_2-L_3M_5 Coster-Kronig Transitions for $Z > 90$," K. R. Baker, F. Tolea, R.W. Fink, and J. J. Pinajian, Z. Physik 270, 9 - 15 (1974)

169) "High Spin States, Deformation in the Region Z = 77, N = 108, and Some Implications for Backbending," J. L. Wood and R. W. Fink, in Reactions between Complex Nuclei, edited by J. H. Hamilton, et al. (North-Holland Publishing Co., Amsterdam, 1974); pp.169

168) "The L/K Electron Capture Ratio in First-Forbidden ^{81g}Kr Decay," W. M. Chew A. C. Xenoulis, and R. W. Fink and F. J. Schima and W. B. Mann, Nucl. Phys. A229, 79 - 92 (1974); Presented also at Am. Chem. Soc.,Atlantic City, N.J. (1974)

167) "Initial UNISOR Research: New Isotopes ^{186}Tl, ^{188}Tl, ^{116}I; Decays of ^{189,190}Tl, ^{117}Xe and ^{117}I; and Off-Line Atomic and Nuclear Studies," (Review) J. H. Hamilton, W. D. Schmidt-Ott, R. W. Fink, A. C. Xenoulis, K. R. Baker, J. L. Wood, G. M. Gowdy, and other UNISOR coauthors, Izv.Akad.Sci. Ser.Fys. US SR 38, 2036 - 2053 (1974); Bull. Acad. Sci. Phys. USSR, 38. 2036 (1974)

166) "Decay of ^{189}Hg and ^{189}Au," E. F. Zganjar, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 578 (1974)

165) "Decay of ^{190}Tl," C. R. Bingham, J. L. Wood, G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 578 (1974)

164) "Positrons from A = 115 and A = 117 Mass Chains," B. D. Kern, A. C. Xenoulis K. R. Baker, J. L. Wood, G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 452 (1974)

163) "Coexistence of Spherical and Deformed Shapes in ^{188}Hg," J. H. Hamilton, R. W. Fink, J. L. Wood, K. R. Baker, and other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 578 (1974)

162) "Mallmann Curves and Variable Moment-of-Inertia Models for Nuclei," J. L. Wood and R. W. Fink, Nucl. Phys. A224, 589 - 595 (1974)

161) "The Electron Capture Decay of ^{125}I and ^{145}Pm," F. Tolea, K. R. Baker, W. D. Schmidt-Ott, and R. W. Fink, Z. Physik 268, 289 - 292 (1974)

160) "Electron Capture Ratios in Allowed Transitions," H. Genz, R. W. Fink, J. P. Renier, J. B. Siberts, K.W.D. Ledingham, and J. G. Pengra. Invited paper presented at Deutsche Physikalische Gesellschaft, Part A, Nucl. Phys. Heidelberg, West Germany (Feb.19,1973)

159) "Efficiency Calibration of Semiconductor Detectors in the X-ray Region," J. S. Hansen, J.C. McGeorge, and R. W. Fink, Nucl. Instr. Meth. 112, 239 - 241 (1973); Presented at Int. Conf. on Radionuclide Metrology, Herceg-Novi, Yugoslavia (1973)

158) "Confirmation of a New Thallium Isotope of Mass 189," E. F. Zganjar, J. L. Wood, G. M. Gowdy, R. W. Fink, add other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 699 (1974); 18, (1973)

157) "On-Line Study of the Short-Lived Activities ^{115}Xe-^{115}I-^{115}Te," J. Lin W. D. Schmidt-Ott, K. R. Baker, J. L. Wood, A. C. Xenoulis, G. M. Gowdy, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 19, 691 (1974)

156) "M-Subshell Mean Fluorescence Yields and the Onset of L_2-L_3M_4 and L_2-L_3M_5 Coster-Kronig Transitions in the High-Z Region," K. R. Baker, F. Tolea R. W. Fink, and J. J. Pinajian, Bull. Am. Phys. Soc. 18, 1576 (1973)

155) "Study of Some Neutron-Deficient A = 117 Isobars: ^{117}Xe-^{117}I-^{117}Te-^{117}Sb," R. S. Lee, A. C. Xenoulis, W. D. Schmidt-Ott, and R. W. Fink, with other UNISOR coauthors, Bull.Am.Phys.Soc. 18, 1425 (1973)

154) "The Electron Capture Decay of ^{85g}Sr," E. Vatai, A. C. Xenoulis, K. R. Baker, F. Tolea, and R. W. Fink, Nucl. Phys. A219, 595 - 600 (1974)

153) "On-Line Mass Separator Study of ^{116}Xe and ^{116}I," A. C. Xenoulis, K. R. Baker G. M. Gowdy, J. L. Wood, R. W. Fink, and other UNISOR coauthors, Bull. Am. Phys. Soc. 18, 1424 (1973)

152) "Radioactive X-ray Standards," R. W. Fink, Nucl. Instr. Meth. 112, 243 (1973)

151) "Nuclear Matrix Elements from L/K Electron Capture Ratios in ^{59}Ni Decay," W. M. Chew, A. C. Xenoulis, and R. W. Fink, and J. J. Pinajian, Bull. Am.Phys. Soc. 18, 1407 (1973); Nucl. Phys. A218, 372 - 380 (1974)

150) "Recent Experimental Results on Fluorescence Yields and Coster-Kronig Transition Probabilities in the Inner Atomic Shells," R. W. Fink, Invited Paper, Bull. Am. Phys. Soc. 18 (1973)

149) "The UNISOR Project," E. H. Spejewski, R. W. Fink, and other UNISOR coauthors, Proc. 8th Int. Conf. on Electromagnetic Separators, Skövde, Sweden, June, 1973; pp. 318 - 323

148) "X-ray Intensity Ratio $I_{L\alpha}/I_{L\ell}$ in the Region of Z=55 to 94," D. W. Nix J. C. McGeorge, and R. W. Fink, Phys. Lett. A46, 205 - 208 (1973)

147) BOOK CHAPTER: "Tables of Experimental Values of X-ray Fluorescence and Coster-Kronig Yields for the K-, L-, and M-Shells," R. W. Fink and P. V. Rao, in Handbook of Spectroscopy, edited by J. W. Robinson (CRC Press, Boca Raton, Florida, 1974); pp. 219 - 229

146) BOOK CHAPTER: "Proportional Counter Spectrometry," R. W. Fink, in Atomic Inner Shell Processes, edited by B. Crasemann (Academic Press, Inc.,New York, 1974); pp. 169 - 186

145) "Multipolarity Determination from L X-ray Spectra in the Decays of ^{227}Th ^{243}Am, and ^{249}Cf," W. D. Schmidt-Ott, J. C. McGeorge, and R. W. Fink Z. Physik 255, 161 - 174 (1972)

144) "A Multiwire Proportional Counter Technique for Standardization of Low-Energy Photon Sources," W. M. Chew, J. C. McGeorge, and R. W. Fink, Nucl. Instr. Meth. 106, 499 - 501 (1973)

143) "Accurate Efficiency Calibration and Properties of Semiconductor Detectors for Low-Energy Photons," J. S. Hansen, J. C. McGeorge, D. W. Nix, and R. W. Fink, Nucl.Instr. Meth. 106, 365 - 379 (1973)

142) "Coster-Kronig and Fluorescence Yields for the L_2 and L_3 Subshells in the High-Z Region," J. C. McGeorge, D. W. Nix, and R. W. Fink, J. Phys. (London) B6, 573 - 583 (1973)

141) "Mean L-Shell X-ray Fluorescence Yields at Z = 47, 60, and 63," D. W. Nix J. C. McGeorge, and R. W. Fink, Z. Physik 256, 131 - 137 (1972)

140) "L-Subshell Fluorescence and Coster-Kronig Yields at Z = 92 and the Decay of ^{235}Np," J. C. McGeorge, D. W. Nix, R. W. Fink, and J. H. Landrum, Z. Physik 255, 335 - 347 (1972)

139) BOOK: Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, S.T. Manson, J. M. Palms, and P. V. Rao, Volumes 1 - 4, pp. 1 - 2500 (U.S. Atomic Energy Comms. Oak Ridge, CONF-720404 (1973) Proceedings of the conference held in Atlanta, Georgia, April, 1972, R. W. Fink, Chairman

138) "The K-Conversion Coefficient Near Threshold of the 30 keV Isomeric Transition in ^{108m}Ag Decay," W. D. Schmidt-Ott and R. W. Fink, Z. Physik 254, 281 - 285 (1972)

137) "Gamma Branching and Total Conversion Coefficients of Intraband Transitions in the Ground-State Rotational Band of ^{245}Cm," W. D. Schmidt-Ott and R. W. Fink, Z. Physik 253, 13 - 16 (1972)

136) "A Precision Determination of the K-Shell Fluorescence Yield of Arsenic," W. M. Chew, J. C. McGeorge, and R. W. Fink, in Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, et al. (U.S. Atomic Energy Commission CONF-720404, January, 1973); pp. 197 - 205

135) "L_2 and L_3 Subshell Fluorescence and Coster-Kronig Yields for Z = 96 from the Decay of ^{249}Cf," J. C. McGeorge and R. W. Fink, Z. Physik 248, 208 - 219 (1971)

134) "X-Ray Fluorescence Yields and Coster-Kronig Transition Probabilities," (Review) W. Bambynek, B. Crasemann, R. W. Fink, H. U. Freund, Hans Mark, C. D. Swift, R. E. Price, and P. V. Rao, Revs. Modern Phys. 44, 716 - 813 (1972)

133) "Orbital Electron Capture Ratios in the Decay of ^{55}Fe," J. C. Pengra, H. Genz, J. P. Renier, and R. W. Fink, Phys. Rev. C5, 2007 - 2012 (1972); and in Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, et al. (U.S. Atomic Energy Commission CONF-720404, Jan.1973); pp.1988-2003

132) "L_2 and L_3 Subshell Fluorescence Yields for Z = 76 and 78 from the Decay of ^{192}Ir," S. Mohan, W. D. Schmidt-Ott, J. C. McGeorge, and R. W. Fink, in Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, et al (U.S.Atomic Energy Commission CONF-720404, Jan.1973); pp.244-250

131) "Relative X-ray Transition Probabilities to the K-Shell for Z = 81 to 96," W. D. Schmidt-Ott, F. Tolea, and R. W. Fink, in Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, et al. (U.S. Atomic Energy Commission CONF-720404, Jan. 1973); pp.338 - 345

130) "Mean L-Shell X-ray Fluorescence Yields from Z = 55 to 65," D. W. Nix, J. C. McGeorge, and R. W. Fink, in Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, et al. (U.S. Atomic Energy Commission CONF-720404, January, 1973); pp. 206 - 225

129) "Multipolarity Determination from L X-ray Spectra in ^{249}Cf Decay," W. D. Schmidt-Ott, J. C. McGeorge, and R. W. Fink, in Inner Shell Ionization Phenomena and Future Applications, edited by R. W. Fink, et al. (U.S. Atomic Energy Commission CONF-720404, January, 1973); pp.1948 - 1956

128) "Relative X-ray Transition Probabilities to the K-Shell for Z = 81, 92, 94, and 96," W. D. Schmidt-Ott, J. S. Hansen, and R. W. Fink, Z. Physik 250, 191 - 197 (1972)

127) "Precision Determination of High-Z K-Shell Fluorescence Yields from ^{195}Au, ^{207}Bi, and ^{235}Np Decays," J. S. Hansen, J. C. McGeorge, R. W. Fink, R. E. Wood, P. V. Rao, and J. M. Palms, Z. Physik 249, 373-385 (1972)

126) "Bismuth L-Subshell Fluorescence and Coster-Kronig Yields from Decay of ^{210}Pb[RaD]," R. W. Fink and H. U. Freund, Phys. Rev. C3, 1701 - 1702 (1971)

125) "The Determination by an Independent Method of P_K Electron Capture Probabilities in ^{133}Ba and ^{139}Ce Decays; Gamma-decay of ^{133}Ba," W. D. Schmidt-Ott and R. W. Fink, Z. Physik 249, 286 - 293 (1972)

124) "The L_1 Subshell Fluorescence and Coster-Kronig Yields for Z = 96," J.C. McGeorge and R. W. Fink, Z. Physik 250, 293 - 299 (1972) and Bull. Am. Phys. Soc. 16, 847 (1971)

123) "Neutron Activation Cross Sections at 14.4 MeV for Some Naturally-Occurring Heavy Elements in the Region Z = 76 to 82," A. K. Hankla, R. W. Fink, and J. H. Hamilton, Nucl. Phys. A180, 157 - 176 (1972)

122) "M-Subshell Fluorescence Yields and the L_1-L_3 Radiative Transitionat Z = 93 and 96 from ^{241}Am and ^{249}Cf Decays," E. Karttunen, H. U. Freund, and R. W. Fink, Phys. Rev. A4, 1695 - 1705 (1971)

121) "Reevaluation of L_2-Subshell Coster-Kronig and Fluorescence Yields below Z = 81," J. C. McGeorge, S. Mohan, and R. W. Fink, Phys. Rev. A4, 1317 - 1318 (1971)

120) "The L_2 - L_3 Coster-Kronig Transition Probability at Z = 76," J. C. McGeorge and R. W. Fink, Bull. Am. Phys. Soc. 16, 578 (1971)

119) "L_2 and L_3 Subshell Fluorescence and Coster-Kronig Yields in Pt," S. Mohan J. C. McGeorge, and R. W. Fink, Bull. Am. Phys. Soc. 16, 579 (1971)

118) "Gamma Radiation in the Decay of ^{249}Cf," W. D. Schmidt-Ott, R. W. Fink, and P. V. Rao, Bull. Am. Phys. Soc. 16, 494 (1971)

117) "High-Z K-Shell Fluorescence Yield Measurements with Cooled, Windowless Si(Li) Detectors," J. S. Hansen, J. C. McGeorge, R. W. Fink, P. V. Rao, R. E. Wood, and J. M. Palms, Bull. Am. Phys. Soc. 16, 578 (1971)

116) "Some (n,2n), (n,p), and [(n,np)+(n,pn)+(n,d)] Activation Cross Sections of ^{58}Ni, ^{106}Cd, and ^{112}Sn at 14.4 MeV," R. W. Fink and W. Lu, Bull. Am. Phys. Soc. 15, 1372 (1970)

115) "14.4 MeV Neutron Activation Cross Sections for Naturally-Occurring Heavy Elements," A. K. Hankla, J. H. Hamilton, and R. W. Fink, Bull. Am. Phys. Soc. 15, 1372 (1970)

114) "Applicability of the Constant Nuclear Temperature Approximation in the Statistical Model Analysis of Neutron Cross Sections at 14.4 MeV for Medium-Z Nuclei," W. Lu and R. W. Fink, Phys. Rev. C4, 1173 - 1181 (1971); Bull. Am. Phys. Soc. 15, 1372 (1970)

113) "Observation of the L_1-L_3 Coster-Kronig X-ray for Z = 93 and 96 from ^{241}Am and ^{249}Cf Decays," H. U. Freund, E. Karttunen, and R. W. Fink, Bull. Am. Phys. Soc. 15, 1305 (1970)

112) "Neutron Activation Cross Sections for As, Br, Rb, and Sr Isotopes at 14.4 MeV," P. V. Rao, R. E. Wood, J. M. Palms, and R. W. Fink, Phys. Rev. C3, 629 - 635 (1971)

111) "Electron Capture Decay of ^{181}W: L-Subshell Fluorescence and Coster-Kronig Yields in Ta," S. Mohan, R. W. Fink, R. E. Wood, J. M. Palms, and P. V. Rao, Bull. Am. Phys. Soc. 15, 1304 (1970)

110) "A Multiwire Proportional Counter Measurement of the M/L Orbital Electron Capture Ratio in ^{71}Ge Decay," H. Genz, J. P. Renier, J. G. Pengra, and R. W. Fink, Phys. Rev. C3, 172 - 179 (1971) and Bull. Am.Phys.Soc. 15, 1345 (1970)

109) "Relative K X-ray Transition Probabilities at Z = 96 from ^{249}Cf Decay," J. S. Hansen, H. U. Freund, and R. W. Fink, Nucl. Phys. A153, 465 - 468 (1970) and Bull. Am. Phys. Soc. 15, 1304 (1970)

108) "M-Shell X-ray Fluorescence and Coster-Kronig Yields of Np from ^{241}Am Decay," E. Karttunen, H. U. Freund, and R. W. Fink, Bull.Am.Phys.Soc.15. 796 (1970)

107) "L-Subshell X-ray Fluorescence and Coster-Kronig Yields at Z = 65; Decay Scheme of ^{159}Dy," J. C. McGeorge, H. U. Freund, add R. W. Fink, Nucl. Phys. A154, 526 - 538 (1970) and Bull. Am. Phys. Soc. 15, 1304 (1970)

106) "Activation Cross Sections for (n,p), [(n,np)+(n,pn)+(n,d)], and (n,α) Reactions in the Region of Z = 40 - 58 at 14.4 MeV," W. Lu, N. RanaKumar, and R. W. Fink, Phys. Rev. C1, 358 - 361 (1970)

105) "Precision Determination of the K-Shell Fluorescence Yield of Gallium," H. U. Freund, H. Genz, J. B. Siberts, and R. W. Fink, Nucl. Phys. A138, 200 - 208 (1969)

104) "Relative X-ray Intensities in the K-Shell," J. S. Hansen, H. U. Freund, and R. W. Fink, in Radioactivity in Nuclear Spectroscopy, edited by J. H. Hamilton, et al.(Gordon & Breach Publishers, New York, 1972); pp. 1329 -
103) 1334 (1972) and Nucl. Phys. A142, 604 - 608 (1970)

102) "The Decays of ^{170}Tm and ^{171}Tm: L_2 and L_3 Subshell Fluorescence Yields, Coster-Kronig Transition Probabilities, and K-Shell Conversion Coefficients in Yb," S. Mohan, H. U. Freund, R. W. Fink, and P. V. Rao, Phys. Rev. C1, 254 - 259 (1970)

101) "K-Conversion Coefficients of the 84.3 keV Transition in ^{170}Yb and the 66.7 keV Transition in ^{171}Yb," P. V. Rao, S. Mohan, H. U. Freund, and R. W. Fink in Radioactivity in Nuclear Spectroscopy, edited by J. H. Hamilton, et al (Gordon and Breach Publishers, New York, 1972); pp.1395 - 1399

100) "Proportional Counter Spectrometry at Energies from Zero to 500 eV," H. Genz J. P. Renier, and R. W. Fink, in Radioactivity in Nuc lear Spectroscopy, edited by J. H. Hamilton, et al. (Gordon and Breach Publishers, New York 1972); pp. 1335 - 1342

99) "Photon Spectrometry in the Low Energy Region of 500 eV to 100 keV," H. U. Freund, J.S. Hansen, E. Karttunen, and R. W. Fink (INVITED), in Radioactivity in Nuclear Spectroscopy, edited by J. H. Hamilton, et al (Gordon and Breach Publishers, New York, 1972); pp.623 - 649

98) "Ionization Multiplication: The M-Shell Vacancies Resulting from an Initial L_1-Subshell Vacancy for Z = 83," H. U. Freund and R. W. Fink, Phys. Rev. 183, 1055-1056 (1969); C3, 1701 (1971)

97) "Neutron Capture Cross Sections of ^{204}Pb and ^{205}Pb in High Temperature Reactor Irradiation," J. M. Wampler, J. B. Siberts, and R. W. Fink [ORO-3346-41]

96) "Neutron Activation Cross Sections for (n,2n) Reactions at 14.4 MeV for Elements with Z = 40 to 60," N. RanaKumar, W. Lu, and R. W. Fink, Bull. Am. Phys.Soc. 14, 495 (1969) and "Activation Cross Sections for (n,2n) Reactions at 14.4 MeV in the Region of Z = 40 to 60," W. Lu. N. RanaKumar, and R. W. Fink, Phys. Rev. C1, 350 - 357 (1970)

95) "The K-Fluorescence Yield of Te and the Total- and K-Shell Conversion Coefficients of the 35.48 keV Transition in ^{125}I Decay," E. Karttunen, H. U.Freund, and R. W. Fink, Nucl. Phys. A131, 343 (1969)

94) "Thermal and 14.4 MeV Neutron Activation Cross Sections of Argon," N. RanaKumar E. Karttunen, and R. W. Fink, Nucl. Phys. A128, 333 - 338 (1969)

93) "The M/L Orbital Electron Capture Ratio in ^{109}Cd Decay," R. W. Fink (Review of M/L Capture Ratios), Phys. Rev. 180, 1220 - 1221 (1969)

92) "Total Conversion Coefficient for the 375 keV Transition in ^{199m}Hg Decay," A. K. Hankla, J. H. Hamilton, and R. W. Fink, in Radioactivity in Nuclear Spectroscopy, edited by J. H. Hamilton, et al.(Gordon and Breach Publishers, New York, 1972); pp. 1401 - 1405

91) "K-Shell Conversion Coefficient of the 40.58 keV Transition in ^{99}Mo Decay," N. RanaKumar, R. W. Fink, and P. V. Rao, Nucl. Phys. A127, 683 - 686 (1969)

90) "The K-Conversion Coefficient for the 40.95 keV Transition in the 6.3 min Decay of ^{94m}Nb," K.S.R. Sastry, R. W. Fink, and P. V. Rao, Bull.Am. Phys. Soc. 14, 18 (1969)

89) "Radiochemical Determination of the (n,2n) and [(n,np)+(n,pn)+(n,d)] Cross Sections of ^{106}Cd at 14.4 MeV," W. Lu add R. W. Fink, Radiochim. Acta 12, 62-64 (1969)

88) "14.4 MeV Neutron Activation Cross Sections for Isotopes of Hg, Tl, and Au," A. K. Hankla, J. H. Hamilton, and R. W. Fink, Bull. Am. Phys. Soc. 13, 1421 (1968)

87) "Activation Cross Sections for Reactions of Pd and Cd Isotopes with 14.4 MeV Neutrons," W. Lu and R. W. Fink, Bull.Am.Phys.Soc. 13, 1422 (1968)

86) "Bismuth L-Subshell Fluorescence Yields and Coster-Kronig Transition Probabilities from Decay of ^{210}Pb[RaD]," H. U. Freund and R. W. Fink, Bull. Am.Phys.Soc. 13, 1370 (1968) and Phys. Rev. 178, 1952 - 1960 (1969)

85) "Experimental Aspects and Comparisons with Theory of Orbital Electron Capture Ratios," R. W. Fink, in Electron Capture and Higher Order Processes in Nuclear Decay, edited by D. Bereni (Hungarian Academy of Sciences, Kultura Bookexport, Budapest, 1968); Vol 1, pp. 23 - 44

84) "Electron Capture and Higher Order Processes in Nuclear Decay," Meeting Report B. Crasemann and R. W. Fink, [ORO-3346-27] (1968)

83) "Neutron Activation Cross Sections at 14.4 MeV for Si and Zn Isotopes," N. RanaKumar, E. Kondaiah, and R. W. Fink, Nucl. Phys. A122, 679 - 683 (1968) and Bull. Am. Phys. Soc. 13, 602 (1968)

82) "14.4 MeV Neutron Activation Cross Sections for Kr and Xe Isotopes," E. Kondaiah N. RanaKumar, and R, W. Fink, Nucl. Phys. A120, 337 - 341 (1968) and Bull. Am. Phys. Soc. 13, 602 (1968); 13, 1422 (1969)

81) "Electron Capture Decay of ^{207}Bi: L-Subshell Fluorescence Yields and Coster-Kronig Transition Probabilities of Pb," P. V. Rao, R.E.Wood, J.M. Palms and R. W. Fink, Phys. Rev. 178, 1997 - 2006 (1969)

80) "Thermal Neutron Activation Cross Sections for Kr and Xe Isotopes," E. Kondaiah N. RanaKumar, and R. W. Fink, Nucl. Phys. A120, 329 - 336 (1968) and Bull. Am. Phys. Soc. 13, 1422 (1968);

79) "K-Shell Conversion Coefficient of the 102.7 keV Transition in 57 min ^{81m}Se Decay," P. V. Rao and R. W. Fink, Phys. Lett. 26B, 618 - 619 (1968)

78) "Measurements by Improved Methods of Activation Cross Sections for 14.4 MeV Neutron Reactions," Review, R. W. Fink, Proc. Conf. on Small Accelerators, edited by J.L. Duggan (U.S. Atomic Energy Commission CONF-680411 (1968); pp. 30 - 47

77) "Neutron Cross Sections for Br and Rb and 14.4 MeV," P. V. Rao, R. E. Wood, J.M. Palms, and R. W. Fink, Bull. Am.Phys.Soc. 13, 602 (1968)

76) "Measurement by Two-Dimensional Pulse Analysis of the Time and Energy Distribution of Afterpulses in Proportional Counters," H. Genz, D. S. Harmer, and R. W. Fink, Nucl. Instr. Meth. 60, 195 - 200 (1968)

75) "An Attempt to Determine the L/K Orbital Electron Capture Ratio in ^{7}Be Decay," H. Genz, J. P. Renier, K.W.D. Ledingham, and R. W. Fink, Phys. Rev. 166, 935 (1968) add Bull.Am.Phys.Soc. 12, 1123 (1967)

74) "Gamma rays from the Decay of ^{77}Ge," Anne Ng, R. E. Wood, J.M. Palms, P.V.Rao, and R. W. Fink, Bull. Am. Phys.Soc. 13, 248 (1968)

73) "Gammas from Decay of ^{75}Ge and ^{77}Ge," R.E.Wood, J.M.Palms, P.V.Rao, add R.W.Fink Phys. Rev. 176, 1328 -1338 (1969)

72) "Levels in ^{106}Pd from the Decay of 8.5 day ^{106m}Ag, 24 min ^{106g}Ag, and 30 sec ^{106}Rh," P.V. Rao and R. W. Fink, Nucl. Phys. A103, 385 - 403 (1967)

71) "The M/L Orbital Electron Capture Ratio in ^{37}Ar Decay and the Fraction of K_α X-rays in the K-Series of Chlorine," J.P. Renier, H. Genz, K.W.D. Ledingham,
70) and R. W. Fink, Phys. Rev. 166, 935 - 945 (1968) and Bull.Am.Phys.Soc. 12, 1123 (1967); 11, 825 (1966)

69) "Activation Cross Sections of As for 14.4 MeV Neutrons," W.S. Cook, R.E. Wood, and R. W. Fink [ORO-3346-9 (1967)]

68) "Comparison with Theory of L/K Orbital Electron Capture Ratios for Allowed and First-Forbidden Transitions," R. W. Fink, Nucl. Phys. A110, 379 - 384 (1968)

67) "Nuclides Far Off the Beta Stability Line," G. Andersson and R. W. Fink, Physics Today 20, No. 3, 126 - 129 (1967)

66) "Gamma Decay of ^{73m,g}Se and ^{81m,g}Se Isomeric Pairs," P.V.Rao and R. W. Fink Phys. Rev. 154, 1028 - 1032 (1967) and Bull.Am.Phys.Soc. 11, 824 (1966)

65) "Neutron Reaction Cross Sections of Se and Fe at 14.4 MeV," P.V. Rao and R.W. Fink, Phys. Rev. 154, 1023 (1967); Presented at Int. Conf. on Nuclear Physics (Gatlinburg, Tenn, September, 1966)

64) "Activation Cross Sections of Germanium for 14.4 MeV Neutrons," R.E.Wood, W. S, Cook, J. R. Goodgame, and R. W. Fink, Phys. Rev. 154, 1108 - 1110 (1967) and Bull.Am.Phys.Soc. 11, 808 (1966); Presented at Int. Conf. on Nuclear Physics, Gatlinburg, Tenn. September, 1966

63) "The Reactions $^{14}N(n,\alpha)^{11}B$ and $^{14}N(n,t)^{12}C$ Observed with a Gridded Ionization Chamber," W. Scobel, R. W. Fink, and M. Bormann, Z. Physik 197, 124 - 135 1966)

62) "Comparison of Allowed M/L Orbital Electron Capture Ratios with Theory," R. W. Fink and K. W. D. Ledingham, Bull.Am.Phys.Soc. 11, 352 (1966)

61) "The M/L and L/K Capture Ratios and Transition Energy in ^{109}Cd Decay," R. B. Moler and R. W. Fink, Phys. Rev. 139, B282 - 287 (1965)

60) "Levels in ^{78}Se from Decay of ^{78}As and ^{78}Br," P.V.Rao and R.W.Fink, Bull. Am. Phys. Soc. 13, 1450 (1968)

59) "The M/L Capture Ratio in 30 million year ^{205}Pb Decay," R.W. Fink and R. B. Moler, Int. Conf. Atomic Electrons in Nuclear Transformations, Warsaw, Poland, September, 1963; Vol. 2, pp. 369

58) "Comparison of Recent Precision Results on Orbital EC Ratios with Theory," Int. Conf. Atomic Electrons in Nuclear Transformations, Warsaw, Poland Vol. 2, pp. 365 - 368 (1965)

57) "Atomic Fluorescence Yields," (Review) R. W. Fink, R. C. Jopson, Hans Mark, and C. D. Swift, Revs. Modern Phys. 38, 513 - 540 (1966); UCRL-14327 (1965)

56) "A New Short-Lived Isotope of Gallium (^{63}Ga)," M. Nurmia and R. W. Fink Phys. Lett. 14, 136 (1965)

55) "Delayed Protons following ^{3}He Reactions with Oxygen, Silicon, and Sulfur Targets," T.H. Braid, A.M. Friedman, and R. W. Fink, Bull.Am.Phys.Soc. 10, 120 & erratum (1965) and Arkiv Fys. 36, 471 - 476 (1966)

ORO-3346-281

NUCLEAR CHEMISTRY RESEARCH AND SPECTROSCOPY WITH RADIOACTIVE NUCLEI

24th Annual Progress Report and Final Report
U.S. Department of Energy
Contract DE-AS05-76ERO-3346

R. W. Fink
Professor of Chemistry Emeritus and Principal Investigator

August 31, 1988

GEORGIA INSTITUTE OF TECHNOLOGY
A UNIT OF THE UNIVERSITY SYSTEM OF GEORGIA
SCHOOL OF CHEMISTRY
ATLANTA, GEORGIA 30332