

**ANNUAL REPORT**  
**OF THE**  
**MICHIGAN STATE UNIVERSITY**  
**NATIONAL SUPERCONDUCTING CYCLOTRON LABORATORY**  
**FOR THE PERIOD**  
**JANUARY 1, 1995, TO DECEMBER 31, 1995**

## Preface

This Annual Report describes the activities of the National Superconducting Cyclotron Laboratory (NSCL) from January 1, 1995, to December 31, 1995. Major efforts of the laboratory were focused on:

- operating the NSCL as a national user facility and carrying out a research program in nuclear science, accelerator physics, and related instrumentation R&D,
- continuing vigorously with the construction of the S800 magnetic spectrograph,
- performing R&D for the coupled "K500⊗K1200" cyclotron project.

In 1995, an extension of the high bay, needed as a staging area for the K500⊗K1200 coupled cyclotron project, was constructed with funds provided by Michigan State University. At the same time, work on the superconducting S800 magnetic spectrograph and its high-acceptance beamline continued with high priority; the S800 will be completed this year (1996). Other facility/detector improvements include a pair of  $2 \times 2$  m<sup>2</sup> large position sensitive neutron time-of-flight walls for efficient neutron coincidence experiments and the adaptation of the Miniball/Miniwall charged-particle array into the SuperBall Neutron Multiplicity Meter for simultaneous neutron and charged-particle coverage in  $4\pi$  geometry.

Reliability of the K1200 remained high (90%) -- in spite of two unscheduled shutdowns during the summer caused by shortfalls in liquid helium production. In order to meet the increasing cryogenic needs, the NSCL purchased a used refrigeration plant. The plant has been delivered and is being overhauled and installed this year.

During 1995, the K500⊗K1200 upgrade project received very strong endorsement by the DOE/NSF Nuclear Science Advisory Committee. The April 1995 Interim Report on the Long Range Plan for Nuclear Science strongly recommends "the immediate upgrade of the MSU facility to provide intense beams of radioactive nuclei via fragmentation". In July 1995, the K500⊗K1200 coupled cyclotron project successfully passed a detailed technical review, and it is anticipated that the project will be funded soon by the National Science Foundation.

Pressure for beam time remains high, and the NSCL continues to be oversubscribed; PAC 18 (January 1995) and PAC 19 (July 1995) received combined requests for 8020 hours of beam time; 5248 hours were approved for research. Roughly 3/4 of the approved experiments were collaborations between outside groups and NSCL staff.

During 1995, the research productivity of the NSCL remained high, and a large number of exciting new results in reaction dynamics and in the understanding of nuclei far from stability emerged. Much of this research and of the ongoing technical work is summarized in this annual report.

We welcome advice and suggestions from all readers on how the contents of this Annual Report could be made more useful or what could be done to make the NSCL a more supportive place to do research within the existing severe financial constraints.

C. Konrad Gelbke, Director

## NSCL USERS EXECUTIVE COMMITTEE

Members of the Users Executive Committee serve three-year terms, beginning November 1 (formerly two-year terms beginning October 1). Members are elected each year from the general membership of the Users Group, and a non-voting liaison representative from MSU is appointed by the Director of the NSCL. Committees to date are:

July 1, 1982 - September, 1982

F. Becchetti -- University of Michigan  
A. Galonsky -- Michigan State University  
J. Huizenga -- University of Rochester  
Vic Viola -- Indiana University  
G.M. Crawley -- MSU, Liaison

October 1, 1982 - September 30, 1983

F. Becchetti -- University of Michigan, Chair  
J. Kolata -- Notre Dame University  
V. Viola -- Indiana University  
D. Youngblood -- Texas A&M University  
A. Galonsky -- MSU, Liaison

October 1, 1983 - September 30, 1984

J. Kolata -- Notre Dame University, Chair  
F. Prosser -- University of Kansas  
R. Tickle -- University of Michigan  
D. Youngblood -- Texas A&M University  
A. Galonsky -- MSU, Liaison

October 1, 1984 - October 31, 1985

J. Kolata -- Notre Dame University  
L. Lee -- SUNY, Stony Brook  
F. Prosser -- University of Kansas  
R. Tickle -- University of Michigan, Chair  
A. Galonsky -- MSU, Liaison

November 1, 1985 - October 31, 1986

D. Kovar -- Argonne National Laboratory  
L. Lee -- UNY, Stony Brook  
F. Prosser -- University of Kansas, Chair  
R. Tickle -- University of Michigan  
A. Galonsky -- MSU, Liaison

November 1, 1986 - October 31, 1987

D. Kovar -- Argonne National Lab, Chair  
K. Kwiatkowski -- Indiana University  
L. Lee -- SUNY, Stony Brook  
J. Saladin -- University of Pittsburgh  
A. Galonsky -- MSU, Liaison

November 1, 1987 - October 31, 1988

D. Kovar -- Argonne National Laboratory, Chair  
K. Kwiatkowski -- Indiana University  
J. Saladin -- University of Pittsburgh  
L. Sobotka -- Washington Univ. at St. Louis  
A. Galonsky -- MSU, Liaison

November 1, 1988 - October 31, 1989

T. Awes -- Oak Ridge National Laboratory  
K. Kwiatkowski -- Indiana University  
J. Saladin -- University of Pittsburgh  
L. Sobotka -- Washington Univ. at St. Louis, Chair  
A. Galonsky -- MSU, Liaison

November 1, 1989 - October 31, 1990

T. Awes -- Oak Ridge National Laboratory  
A. Nadasen -- University of Michigan  
L. Sobotka -- Washington Univ. at St. Louis, Chair  
G. Wozniak -- Lawrence Berkeley Lab  
A. Galonsky -- MSU, Liaison

November 1, 1990 - October 31, 1991

T. Awes -- Oak Ridge National Laboratory  
J. Kolata -- Notre Dame  
A. Nadasen -- University of Michigan  
G. Wozniak -- Lawrence Berkeley Lab, Chair  
A. Galonsky -- MSU, Liaison

November 1, 1991 - October 31, 1992

J. Kolata -- Notre Dame  
A. Nadasen -- University of Michigan  
U. Schroeder -- Univ. of Rochester  
G. Wozniak -- Lawrence Berkeley Lab, Chair  
A. Galonsky -- MSU, Liaison

November 1, 1992 - October 31, 1993

F. Bertrand - Oak Ridge National Laboratory  
J. Kolata -- Notre Dame, Chair  
U. Schroeder -- Univ. of Rochester  
R. Vandenbosch - University of Washington  
N. Anantaraman - MSU, Liaison

November 1, 1993 - October 31, 1994

F. Bertrand - Oak Ridge National Laboratory  
U. Schroeder -- Univ. of Rochester, Chair  
R. Vandenbosch - University of Washington  
M. Wiescher - Univ. of Notre Dame  
N. Anantaraman - MSU, Liaison

November 1, 1994 - October 31, 1995

F. Bertrand - Oak Ridge National Laboratory  
R. Boyd - Ohio State University, Chair

R. Vandenbosch - University of Washington  
M. Wiescher - Univ. of Notre Dame  
N. Anantaraman - MSU, Liaison

November 1, 1995 - October 31, 1996

R. Boyd - Ohio State University, Chair  
K. Kemper, Florida State University  
R. Warner, NSCL/Oberlin College  
M. Wiescher - Univ. of Notre Dame  
N. Anantaraman - MSU, Liaison

### MEETINGS AND MEMBERS OF THE NSCL PROGRAM ADVISORY COMMITTEE

PAC-1 February 1982  
PAC-2 September 30, 1983  
PAC-3 July 2, 1984  
PAC-4 January 13-14, 1985  
PAC-5 July 28-29, 1985  
PAC-6 April 6-7, 1986  
PAC-7 October 26-27, 1986  
PAC-8 May 3-4, 1987  
PAC-9 September 18-20, 1988  
PAC-10 April 29-May 1, 1990

PAC-11 March 3-5, 1991  
PAC-12 October 27-29, 1991  
PAC-13 May 3-5, 1992  
PAC-14 November 8-10, 1992  
PAC-15 May 2-4, 1993  
PAC-16 December 5-7, 1993  
PAC-17 June 26-28, 1994  
PAC-18 January 16-17, 1995  
PAC-19 July 24-25, 1995  
PAC-20 January 29, 1996

### PAC MEMBERS

Members serve for about six PAC Meetings with one member leaving the PAC after each meeting. The Director of the NSCL is Convenor of the Committee. PAC Members to date and the meetings at which they have served are:

Britt, H.C.	LANL	1,2
Cline, D.	Rochester	1,2,3,4,5
Koonin, S.E.	Caltech	1,2,3,4,5,6
Paul, P.	Stony Brook	1,2
Scott, D.K.	MSU/NSCL	1,2,3
Cramer, J.	Washington	3,4,5,6,7
Viola, V.	Indiana	3,4,5,6,7,8
Benenson, W.	MSU/NSCL	4,5,6,7,8,9
Siemens, P.	Texas A&M	5,6,7,8,9,10,13
Stephens, F.	LBL	6,7,8,9,
Vary, J.	Iowa State	7,8,9,10,11,12
Young, G.	ORNL	8,9,10,11,12,13
Natowitz, J.	Texas A&M	9,10,11,12,13,14
Hardy, J.	Chalk River	10,11,12,13,14,15
Kashy, E.	MSU/NSCL	10,11,12,13,14,15,16
Randrup, J.	LBL	11,12,14,15,16,17
Haxton, W.	Univ. of Washington	13,14,15,16,18,19
Datz, S.	ORNL	14,15,16,17,18,19
Henning, W.	Argonne	14,15,16,17,18,19,20
Wozniak, G.	LBL	15, 16,17,18,19,20
Mueller, A.	IPN Orsay	16,17,18,19,20
Crawley, G.	MSU/NSCL	17, 18,19,20
Friedman, W.	Univ. of Wisconsin	18,19,20
Nazarewicz, W.	ORNL	20



# TABLE OF CONTENTS

## SECTION 1

### Nuclear Reactions -- Experimental

Cross Comparisons of Nuclear Temperatures Determined from Excited States Populations and Isotope Yields; M.B. Tsang, F.Zhu, W.G. Lynch, A. Aranda, D.R. Bowman, R.T. deSouza, C.K. Gelbke, Y.D. Kim, L. Phair, S. Pratt, C. Williams, H.M. Xu and W.A. Friedman .....	1
Two-Proton Correlations for $^{16}\text{O} + ^{197}\text{Au}$ Collisions at $E/A = 200$ MeV; S.J. Gaff, C.K. Gelbke, W. Bauer, F.C. Daffin, T. Glasmacher, E. Gualtieri, K. Haglin, D.O. Handzy, S. Hannuschke, M.J. Huang, G.J. Kunde, R. Lacey, W.G. Lynch, L. Martin, C.P. Montoya, R. Pak, S. Pratt, N. Stone, M.B. Tsang, A.M. Vander Molen, G.D. Westfall, and J. Yee .....	6
Understanding Proton Emission in Central Heavy-Ion Collisions; D.O. Handzy, W. Bauer, F.C. Daffin, S.J. Gaff, C.K. Gelbke, T. Glasmacher, E. Gualtieri, S. Hannuschke, M.J. Huang, G.J. Kunde, R. Lacey, T. Li, M.A. Lisa, W.J. Llope, W.G. Lynch, L. Martin, C.P. Montoya, R. Pak, G.F. Peaslee, S. Pratt, C. Schwarz, N. Stone, M.B. Tsang, A.M. Vander Molen, G.D. Westfall, J. Yee, and S.J. Yennello .....	10
Mass Dependence of Directed Collective Flow; M.J. Huang, R.C. Lemmon, F. Daffin, W.G. Lynch, C. Schwarz, M.B. Tsang, C. Williams, P. Danielewicz, K. Haglin, W. Bauer, N. Carlin, R.J. Charity, R.T. de Souza, C.K. Gelbke, W.C. Hsi, G.J. Kunde, M-C. Lemaire, M.A. Lisa, U. Lynen, G.F. Peaslee, J. Pochodzalla, H. Sann, L.G. Sobotka, S.R. Souza, and W. Trautmann .....	15
Radial Flow in Intermediate Energy Heavy-Ion Collisions; R. Pak, D. Craig, E.E. Gualtieri, S.A. Hannuschke, R.A. Lacey, J. Lauret, W.J. Llope, N.T.B. Stone, A.M. Vander Molen, G.D. Westfall, and J. Yee .....	20
Multistep Scattering in the 160 MeV $^{208}\text{Pb}(\alpha, \alpha')$ Reaction; M.Thoennessen, E. Ramakrishnan, T. Baumann, A. Azhari, R.A. Kryger, R. Pfaff, S. Yokoyama, J.R. Beene, M.L. Halbert, P.E. Mueller, G. van Buren, R.J. Charity, P-F. Hua, D.G. Sarantites, L.G. Sobotka, M.B. Chadwick, and M. Hussein...	25
Search for the Decay of Non-Compact Geometries; N.T.B. Stone, G.D. Westfall, E.E. Gualtieri, S.A. Hannuschke, R. Lacey, J. Lauret, W.J. Llope, R. Pak, O. Bjarki, A.M. Vander Molen, and J. Yee ...	28
Parametrization of the Memory Effect at Intermediate Energy; R. Pfaff, D.J. Morrissey, W. Benenson, M. Fauerbach, M. Hellström, C.F. Powell, M. Steiner, B.M. Sherrill, and J.A. Winger .....	33
<b><u>Nuclear Reactions -- Theory</u></b>	
Pre-Equilibrium Particle Emission and Critical Exponent Analysis; W. Bauer and A. Botvina .....	37
Radial Flow in Au+Au Collisions from 0.2 to 2 GeV/A; F. Daffin, K. Haglin, W. Bauer .....	39
Nuclear Flow Resulting from Consistent Boltzmann Algorithms; Gerd Kortemeyer, Frank Daffin, and Wolfgang Bauer .....	43
Excess Electron Pairs from Heavy-Ion Collisions at CERN and a More Complete Picture of Thermal Production; K. Haglin .....	46
Finite $\Delta$ Lifetime Effects on Bremsstrahlung from Inelastic Nucleon-Nucleon Reactions; K. Haglin .....	50
Gaussian Wave-Packet Dynamics with and without Correlations; Dieter Kiderlen and Pawel Danielewicz .....	54

Partons in Phase Space; D. Brown and P. Danielewicz .....	59
Excess Dileptons in CERN SPS Data; J. Murray, K. Haglin and W. Bauer .....	63
Dynamical Effects in the Fission of Hot Nuclei; M. Thoennessen .....	65
Influence of Formation Times on Evaporation Residues; M. Thoennessen .....	68

### **Nuclear Structure -- Experimental**

Search for the Ground State of $^{11}\text{N}$ ; A. Azhari, T. Baumann, J.A. Brown, M. Hellström, J.H. Kelley, R.A. Kryger, H. Madani, E. Ramakrishnan, D. Russ, T. Suomijärvi, P. Thirolf, M. Thoennessen, and S. Yokoyama .....	71
Virtual Photon Scattering of $^{11}\text{Be}$ ; N. Gan, J.R. Beene, M.L. Halbert, D.W. Stracener, R.L. Varner, A. Azhari, J.Brown, D.J. Morrissey, N.T.B. Stone, P. Thirolf, M. Thoennessen, G.D. Westfall, and S. Yokoyama .....	74
Measurement of the Reaction Cross Section of $d(^7\text{Be}, ^8\text{B})n$ as a Structure Probe of the $^8\text{B}$ Nucleus; C.F. Powell, D.J. Morrissey, J.A. Brown, B. Davids, M. Fauerbach, J.H. Kelley, R. Pfaff, and B. M. Sherrill ..	76
Limit of the Lifetime of $^{16}\text{B}$ ; R.A. Kryger, A. Azhari, J. Brown, J. Caggiano, M. Hellström, J.H. Kelley, B.M. Sherrill, M. Steiner, and M. Thoennessen.....	79
Ground State of $^{10}\text{Li}$ ; S. Yokoyama, A. Azhari, T. Baumann, J. Brown, A. Galonsky, P.G. Hansen, J. H. Kelley, R.A. Kryger, R. Pfaff, E. Ramakrishnan, R. Thirolf, and M. Thoennessen .....	81
Isvector Spin Strength in $^{40}\text{Ca}$ Measured by the $(^7\text{Li}, ^7\text{Be})$ Reaction; J.S. Winfield, G.M. Crawley, D. Beaumel, S. Danczyk, S. Galès, S.E. Hirzebruch, H. Laurent, I. Lhenry, J.M. Maison, J. C. Stasko, and T. Suomijärvi.....	84
Measurement of the Half-Life of $^{108\text{m}}\text{Ag}$ ; E.B. Morman, E. Browne, A.J. Smith, R.J. McDonald, M. Fauerbach, P.F. Mantica, D.J. Morrissey, R. Pfaff, C.F. Powell, M. Steiner .....	90

### **Nuclear Structure -- Theory**

Proton Halos in the $1s_{0d}$ Shell; B.A. Brown and P.G. Hansen.....	93
The Momentum Content of Single-Nucleon Halos; P.G. Hansen.....	98
Neutron Halos in the Na Isotopes; B.A. Brown and W.A. Richter.....	103
Shell-Model Properties of $^{11}\text{Li}$ ; B.A. Brown .....	108
Low-Energy M1 Strength in the $^7\text{Li}(p, \gamma_0)^8\text{Be}$ Reaction; A. Csótó and S. Karataglidis.....	112
Parity Violation in the $17/2^-$ Isomer of $^{93}\text{Tc}$ ; B.A. Brown .....	117
Global Behavior of Octupole Vibrations in Nuclei; Vladimir Zelevinsky .....	122
Pairing Phase Transition in Individual Wave Functions; Vladimir Zelevinsky, B. Alex Brown and Mihai Horoi.....	125

Assessment of Large Basis Shell Model Wave Functions for the Li Isotopes; S. Karataglidis, B.A. Brown, P.J. Dortmans, and K. Amos .....	129
Strength Functions of Shell Model Basis States; Njema Frazier, B. Alex Brown, and Vladimir Zelevinsky .....	134
Spreading Widths of Simple Shell Model Configurations; Njema Frazier, B. Alex Brown, and Vladimir Zelevinsky .....	138
Plausible Structures of Multiple Semi-Identical Superdeformed Bands in $^{132}\text{Pr}$ ; W.A. Olivier, C.V. Hampton, and Wm. C. McHarris.....	142
<b><u>Operations</u></b>	
K1200 Operating Experience; D.R. Poe, M. Garbek and P.S. Miller.....	145
User Facility Status in 1995; N. Anantaraman .....	147
Recent Developments in ECR Ion Source Technology at the NSCL; R. Harkewicz and D. Cole.....	149
Cryogenic Plant Update; H. Laumer, R. Fontus II, D. Pendell.....	152
Electronic Systems Review; John Vincent, L. Bailey, J. Brandon, B. Drewyor, M. Fiasky, L. Foth, K. Kranz, B. Nurnberger, J. Priller, P. Schreiner, D. Scott, D. Smith.....	154
K500 Operation for Coupled Cyclotron Development; T.L. Grimm, G. Horner, F. Marti, X.Y. Wu and R.C. York.....	157
<b><u>Accelerator Physics and Instrumentation</u></b>	
Overview of the Coupled Cyclotron Project; Richard C. York, H. Blosser, F. Marti, T. Grimm, H. Laumer, D. Lawton, P. Miller D. Morrissey, D. Pudvay, B. Sherrill, X. Wu, J. Vincent, A. Zeller .....	159
K500 to K1200 Coupling Line for Coupled Cyclotron Project; X. Wu, D. Lawton, F. Marti, R.C. York and T. Grimm.....	162
ECR to K500 Injection Line for Coupled Cyclotron Project; X. Wu, D. Lawton, F. Marti, R.C. York and T. Grimm.....	165
Progress on Radiation Safety Issues in the Coupled Cyclotron; R.M. Ronningen and P. Rossi .....	167
An Ion Cyclotron Resonance Accelerator; Chris Ramsell, Terry Grimm, and Richard York .....	170
Study of 1000 MeV, 10 Milliamp, Superconducting Cyclotron to Provide Supplemental Neutrons for Thorium Cycle Power Reactors; H. Blosser and D. Johnson.....	174
Concept for an Internal $^{14}\text{C}$ Detector for an AMS Cyclotron; Jeff Schubert.....	182
Feasibility of a Mini-Cyclotron for Accelerator Mass Spectrometry at the NSCL; Jeff Schubert.....	186
Remainder Differential Algebras for the Study of Long Term Stability; Kyoko Fuchi and Martin Berz.....	191
Computation of Derivatives when all Other Methods Fail; Khodr Shamseddine and Martin Berz .....	194



Use of a Helmholtz Resonator to Verify and Damp Thermal Acoustic Oscillations in the 50 Liter Liquid Helium Cryovessel; Jeff Schubert.....	200
Calculations and Measurements in the K500 Central Region; S.L.Snyder and F. Marti.....	202
K1200 Vacuum Studies; P. Miller, D. Lawton, A. McCartney, F. Marti and D. Poe.....	203
Electrostatic Deflector Development; P. Miller, H. Blosser, T. Grimm, G. Marti, D. Poe and G. Stork..	205
A Liquid Cooled High Voltage Feedthrough for the K1200 Cyclotron; D.J. Pudvay, T.L. Grimm, P.S. Miller, and D.R. Poe.....	208
K500 Extraction System Studies; David A. Johnson and Felix Marti .....	210
Upgrade of the Operator Interface to the Radiation Safety System; R.M. Ronningen and P. Rossi.....	211
Non-Intercepting Capacitive Beam Diagnostic; T.L. Grimm and P.S. Miller.....	212
Barney: New Beamline Control Software for Nuclear Experiments; M. Steiner, D. J. Morrissey.....	215
Status of the Analysis Hall Air-Activation Monitoring System; N.E. Davis, P. Rossi, R.M.Ronningen, and D. Swan .....	217
Bonner Sphere Measurements of Neutrons from Beams of $^4\text{He}$ , $^{12}\text{C}$ , and $^{16}\text{O}$ at 155 MeV/u Stopped in a Hevimet Target; R. M. Ronningen, P. Rossi, L. Heilbronn, and G.I. Britvich .....	219
S800 Progress Report; A. Zeller, S. Alfredson, D. Bazin, S. Bricker, J. Caggiano, J. DeKamp, R. Fontus, D. Harris, H. Hilbert, P. Johnson, H. Laumer, L. Morris, D. Pendell, D. Sanderson, B. Sherrill, R. Swanson, J. Wagner, B. Zhang and R. Zink .....	222
S800 Beamline Magnets and Spectrograph Quads Progress Report; J. Wagner, J. DeKamp, A. Zeller, S. Alfredson, R. Swanson, R. Zink, B. Zhang.....	224
S800 Beamline Quadrupole Triplet Mapping; B. Zhang, P. Johnson, B. Sherrill, A. Zeller, R. Zink ....	229
Aligning the S800 Beamline; D.P. Sanderson.....	234
Automated Data Acquisition System for S800 Dipole Magnetic Field Mapping; J.A. Caggiano, R. Fontus II, and P.H. Johnson.....	237
Data Analysis Techniques for S800 Dipole Magnetic Field Maps; J.A. Caggiano and B.M. Sherrill....	239
Results from Mapping the First S800 Dipole Magnet; J.A. Caggiano and B.M. Sherrill.....	244
Methods for Fringe Field Modeling - Application to the Dipoles for the S800 Spectrograph; D. Bazin and B.M. Sherrill .....	248
Comparison Between Out-Of-Plane Expansion and Measured Field on the First Dipole of the S800 Spectrograph; D. Bazin and B.M. Sherrill .....	252
Heatload Studies of 400 amp Current Leads Conducted in the 50 Liter Liquid Helium Cryovessel; Jeff Schubert.....	257
Upgrades to the $4\pi$ Data Acquisition System; A.M. Vander Molen, R. Fox, and S. Hannuschke .....	260

Development of a Beam Sweeping Dipole; J.J. Kruse, A. Galonsky, C. Snow, J. Wang, P. Zecher.....	261
Construction and First Experiment with a Position Sensitive Photon Detection Array for In-Beam Gamma Ray Spectroscopy of Fast Moving Radioactive Beams; T. Glasmacher, H. Scheit, P. Thirolf, J. Brown, P.D. Cottle, M. Hellström, R. Ibbotson, K. Jewell, K. Kemper, D.J. Morrissey, P. Mantica, M. Steiner, and M. Thoennessen .....	263
Neutron Cross-Talk in the Neutron Walls; J. Wang, F. Deák, A. Galonsky, Á. Horváth, K. Ieki, Y. Iwata, Á. Kiss, J. Kruse, Z. Seres, P. Zecher.....	267
Fabrication of Thin Scintillator Foils; L.W. Weathers and M.B. Tsang .....	270
Fabrication of Thin Polyethylene Foils; C.F. Powell, D.J. Morrissey, P. Askeland, J. A. Brown, and M. Steiner.....	273
A Search Technique for $\gamma$ -Ray Bands Using Segmented FFT Analysis; C.V. Hampton, W.A. Olivier, Wm. C. McHarris .....	274

## SECTION 2

### Publications, Thesis Titles, Outreach, and Visitors

Papers.....	277
Conference Proceedings - Invited Talks .....	284
Conference Proceedings - Contributed Papers.....	285
Abstracts of Contributed Papers .....	287
Books Edited .....	291
Invited Talks.....	291
Thesis Titles.....	296
All-University Outreach Science and Mathematics Challenge for High School Students; E. Kashy, D. J. Morrissey, C. Tsai, Y. Tsai, S.L. Wolfe.....	297
NSCL Physics of Atomic Nuclei Program, Summer 1995; E. Kashy, W. Bauer, B.A. Brown, R. Fox, C.K. Gelbke, A. Galonsky, W. Lynch, D.J. Morrissey, R. Ronningen, and S.L. Wolfe.....	298
Visitors in 1995 .....	299