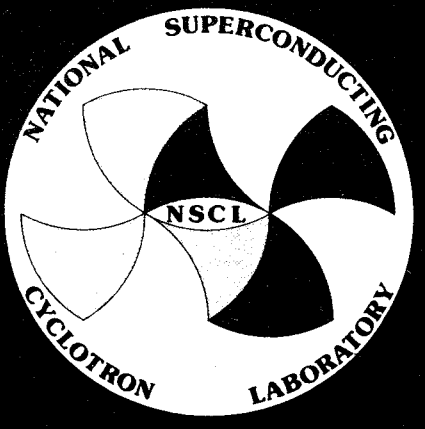
Annual Report

1982-83



Cyclotron Laboratory

Michigan State University

ANNUAL REPORT
OF THE
MICHIGAN STATE UNIVERSITY
NATIONAL SUPERCONDUCTING CYCLOTRON LABORATORY
FOR THE PERIOD
JULY 1, 1982 TO JUNE 30, 1983

BY

PROJECT STAFF

FEBRUARY 1984

EAST LANSING, MICHIGAN

Preface

This Annual Report covers the activities of the National Superconducting Cyclotron Laboratory (NSCL) for the Period July 1, 1982 to June 30, 1983. During this period, on August 31, 1982, the first beam was extracted from the K500 superconducting cyclotron and first experiments were begun shortly thereafter. These occurences marked both the initiation of research with heavy ions at the NSCL and the new status of the Laboratory as a national users facility.

During this first running period, beams were delivered to fourteen of the experiments approved by the first Program Advisory Committee and significant results were obtained for most of them. In the course of the period several experimental devices were brought on-line: the 60 inch scattering chamber which was used for most of the initial experiments; the neutron chamber, a thin walled chamber for experiments involving neutron detection; a general purpose beamline to accomodate apparatus for particular user experiments; and an activation facility for both nuclear and biological experiments. Initial experiments were also performed in the S320 spectrograph. Final debugging of the spectrograph, improvements in the neutron chamber, a general purpose gamma-ray chamber, and the Reaction Product Mass Separator (RPMS) will be completed early in 1984. At this point the complement of NSCL-supplied apparatus for Phase I operation will be complete.

This report contains the first description of work on nucleus-nucleus collisions carried out at the NSCL. Other research reported deals with the experimental and theoretical study of light and heavy ions with nuclei, and with the study of nuclear structure; much of the experimental work was carried out using accelerator facilities at Argonne, BNL, Indiana, LBL, ORNL, Orsay and Saclay. A large part of the report is devoted to descriptions of the development of nuclear instrumentation and accelerator facilities. With the completion of the K500 machine, work on the K800 accelerator is now at the center of the laboratories' effort, looking forward to operation of the coupled facility and the unique beams it will make available.

At this point the K800 effort is directed toward two major milestones--operating tests of the magnet and of the first of the three rf amplifiers. The magnet test requires the yoke, pole tips, main coils, cryostat, main coil power supply and field mapping system to be complete and operating. As with the K500, numerous problems caused by defects in the superconducting wire delayed the coil winding and the magnet operating tests are now expected to start in April. The first version of the rf amplifier operated at full design power at some frequencies but there were difficulties with spurious harmonics at others. Modifications to the anode circuit to eliminate this problem are underway; the revised structure should be ready for testing in March. The design of the extraction system for the K800 has been revised by replacing the second elecrostatic deflector by magnetic elements. This reduces the field strength required in the remaining electrostatic deflector; the deflector voltage difficulties which have been experienced in the K500 should not be a problem with the revised design. First operating tests of the complete cyclotron are expected early in 1986.

In addition to the activities outlined above, several important events took place in 1982-83. From September 26 to October 1, 1982 the first International Conference on Nucleus-Nucleus Collisions was held at MSU, coincident with a ceremony marking the formal inaguration of the National Superconducting Cyclotron Laboratory. The Conference was attended by over 300 scientists from 20 different countries, and aimed to provide a broad overview of the field of nuclear collisions over the whole energy range of current theoretical and experimental investigations. The Proceedings of the Conference, edited by G.F. Bertsch, C.K. Gelbke and D.K. Scott have been published by North Holland as a book: Nucleus-Nucleus Collisions.

On December 16,17, 1982 a Workshop on Phase II Devices was held at MSU. The Workshop recommended consideration of several major experimental devices, in addition to those already underway: a large walk-in scattering chamber, a 4-pi detector sensitive to a wide range of particle energies, a gamma ray multiplicity detector, a streamer chamber with electronic readout, and secondary beam capability. Research and development work, including design and construction of prototypes where appropriate, is now underway.

A number of important personnel changes occurred during the year and in the months immediately after. David Scott became Associate Provost at MSU and Sam Austin has taken on the new post of Research Director. He will have responsibility for all research operations aspects of the laboratory's program, including both the in-house program and the outside- user program, including from December 1983, the operations responsibilities previously handled by Ed Kashy, allowing Ed to fulfill a desire to return to a normal faculty teaching and research assignment. The RF group has also changed, Jack Riedel once again coming out of retirement to take charge of the group, following the decision of Bob Worsham to move to Triumf.

Looking toward the future, we expect to resume the Phase I experimental program in December, following the shutdown for K500 improvements which began at the end of July,1983. The second Program Advisory Committee(PAC II) met at MSU on September 30. Of 4227 hours requested, the Committee approved 2104 hours for 24 experiments, plus 209 hours of reserve time.

On April 30-May 3, 1984, the laboratory will host the Tenth International Conference on Cyclotrons and their Applications. Julie Parker, MSU, should be contacted for details. Shortly thereafter, on May 28-30, 1984 An International Workshop on Interacting Boson-Boson and Boson-Fermion Systems will be held at Gull Lake, Michigan; Olaf Scholten, MSU, should be contacted for details.

During the next year the Laboratory will benefit from the presence of several visiting faculty. On the experimental side, Professor Robert Tickle(University of Michigan) will complete his Sabbatical year here and Prof. Janusz Wilczynski(Swierk)will join us for an extended stay in November. On the theoretical side, Professor David Boal(Simon Fraser University)will spend his Sabbatical year here and Dr. Noboru Takagawa(Tohuku University) will be here for a year.

As in the past, we solicit advice and suggestions from you, not only on the contents of this Annual Report, but also on what we are doing to create a facility suitable and convenient for research.

Sam Austin

Henry Blosser

NSCL User's Executive Committee

Members of the User's Executive Committee serve for two year terms, beginning October 1; two members are elected each year from the general membership of the User's Group and a non-voting Liason representative from MSU is appointed by the Director of the NSCL. The committees serving during the period of this report and the Committee now in place are:

July 1, 1982-September 30, 1982

F. Becchetti	University of Michigan
G.M. Crawley	MSU, Liason
A. Galonsky	MSU
J. Huizenga	University of Rochester, Chair
V. Viola	Indiana University

October 1, 1982-September 30, 1983

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

October 1, 1983-September 30, 1984

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

NSCL Program Advisory Committee

The Program Advisory Committee of the National Superconducting Cyclotron Laboratory consists of five members plus a nonvoting chairman:

W. Benenson	MSU (Chairman, nonvoting)
H. Britt	LANL
D. Cline	University of Rochester
S. Koonin	Caltech
P. Paul	SUNY Stony Brook
D.K. Scott	MSU

The same individuals served for the first two meetings of the PAC, in February, 1982 and on September 30, 1983. However, Dr. Britt has resigned, effective January 1, and will be replaced prior to next PAC meeting following consultation with the User's Executive Committee.

CONTENTS