

ANNUAL REPORT
OF THE
MICHIGAN STATE UNIVERSITY
NATIONAL SUPERCONDUCTING CYCLOTRON LABORATORY
FOR THE PERIOD
JANUARY 1, 1985 TO DECEMBER 31, 1985

ACKNOWLEDGEMENTS

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Preface

This Annual Report describes the activities of the National Superconducting Cyclotron Laboratory (NSCL) from January 1, 1985 to December 31, 1985. During this period the laboratory was occupied with two major activities: routine operation of the K500 superconducting cyclotron as a national users facility and continuing construction of the remaining Phase II facilities.

Perhaps the year's most important event as judged by its effect on future operation of the laboratory was completion of the room temperature Electron Cyclotron Resonance (ECR) ion source. A plasma discharge was observed in the ECR for the first time on July 22 and by the end of August the beam analysis system was completed so that studies of the charge state distributions produced by the source could begin; development of the source continues and has led to world record intensities for some ions. The K500 was shut down on December 23 for installation of the injection line leading to the center of the cyclotron. First injected beam was obtained on March 20 and the first extracted beam (20 MeV/nucleon oxygen) on March 26. The ECR source is now in regular use for experiments scheduled on the K500.

Changes on the K500 aimed at improved reliability and higher particle energies continued, although at a slower pace than in earlier years because of the priority of the Phase II construction program. The machine was shut down for four weeks during 1985, three weeks for improvements in the rf system (new corona rings for the insulators) to allow operation at higher rf voltages and hence higher energies and one week at the end of December, the beginning the three month shut down for installation of the ECR injection line. In addition substantial time was devoted to the diagnosis and amelioration of a problem with blockages in the liquid helium system. These have been shown to result from trace amounts of Neon in the makeup gas. As a result of these improvements and the new ECR source, the beam list for the K500 now includes ^{12}C , ^{14}N and ^{16}O up to 50 MeV/nucleon, ^{20}Ne to 45 MeV/nucleon, ^{36}Ar to 40 MeV/nucleon and ^{84}Kr to 22 MeV/nucleon. Heavier and metallic ions are expected to be available in the near future.

The machine operated for over 3500 hours during 1985, supplying beam to experiments on all existing experimental devices. As in the past the program was divided roughly evenly between experiments aimed at understanding the mechanism and characteristics of nucleus-nucleus collisions and those aimed at a better understanding of nuclear structure. Meetings of PAC-4 (January 13-14, 1985) and PAC-5 (July 28-29, 1985) were held during the report period and allocated over 3200 hours of experimental time. Presently nearly all the approved PAC-4 experiments have been completed, but because of the shutdown for ECR installation most PAC-5 experiments have still to be run. PAC-6 met April 6-7 and allocated a total of 1304 hours of the 3122 hours requested. PAC-7 is scheduled for October 26-27 with proposals due October 3.

During 1985 the Phase II construction project was principally directed at finishing the K800 cyclotron, construction and testing of prototype elements for the superconducting beamline and construction of initial experimental apparatus for Phase II. It now appears the the MSU ECR source will produce sufficiently intense beams of highly charged ions that it will not be necessary to couple the K500 and K800 cyclotrons; rather the ECR source will directly inject into the K800 cyclotron. This facility should be more reliable and easier to operate than a coupled facility. Beams from the K800+ECR facility will first be available in an interim experimental area which will provide access to the 4π detector and the 92" by 120" scattering chamber. While these devices, and possibly the apparatus in the present S320 spectrograph room, are being used for experiments, the remaining part of the experimental area will be reconfigured with Phase II cryogenic beam lines and experimental

apparatus. During this period beams of the lighter ions with energies well above 100 MeV and beams of the heaviest ions with energies well above the coulomb barrier will be available in the interim experimental area for important experimental studies in a new energy regime.

The laboratory will be sponsoring a Conference on Energetic Particles from Nuclear Collisions to be held at Gull Lake, Michigan on May 17 to 20, 1987. The local organizers of this Conference are Walter Benenson, George Bertsch and Alex Brown; they can be contacted for further information in advance of the formal conference circulars.

A new addition to the faculty in nuclear theory is Professor Joe Kapusta who will be joining us in August. Following his Ph.D. at Berkeley, Prof. Kapusta held postdoctoral appointments at LBL and LANL before joining the faculty at the University of Minnesota in 1982. Professor George Bertsch returned from a year's leave at the University of Tennessee and ORNL in August 1985.

As in the past, we solicit advice and suggestions from you, the reader, not only on the contents of this Annual Report, but also on what we are doing and can do to make the NSCL more suitable and convenient for your research.

Sam Austin

Henry Blosser

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:

October 1, 1982 - September 30, 1983

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

October 1, 1983 - September 30, 1984

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

October 1, 1984 - October 31, 1985

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

November 1, 1985 - October 31, 1986

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

NSCL Program Advisory Committee

At present the Program Advisory Committee of the NSCL meets about every six months to review proposals for beam time; the possibility of more frequent meetings is under consideration. There are no oral presentations.

Meetings to date:

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 26-26, 1986

PAC Members:

H.C. Britt (LANL)	1,2
D. Cline (Rochester)	1,2,3,4,5
S.E. Koonin (CalTech)	1,2,3,4,5,6,
P. Paul (Stony Brook)	1,2
D.K. Scott (MSU)	1,2,3
J. Cramer (Washington)	3,4,5,6,7
V. Viola (Indiana)	3,4,5,6,7
W. Benenson (MSU)	4,5,6,7
Non-voting Chair	1,2,3
P. Siemens (Texas A&M)	5,6,7
F. Stephens (LBL)	6,7

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