Introduction
April 1, 2002 - March 31, 2003

This document summarizes the progress in research and operations at the Texas A&M Cyclotron Institute for the period April, 1, 2002 through March 31, 2003. Sections I through IV contain reports from individual research projects. Operation and technical developments are given in Section V. Section VI lists the publications with Cyclotron Institute authors and the Appendix gives additional information including talks presented by members of the Institute during the past year. *Since most of the contributions presented here are truly reports on progress in research, results and conclusions should not be quoted from the report without the consent of the authors.*

In September, 2002, Professor J. Natowitz was appointed to the Cyclotron Institute Bright Chair in Nuclear Science. At that time, Joe indicated that he planned to step down as Director of the Institute by the end of December, 2002. During the past eleven years, Joe was instrumental in developing the scientific program at the Institute. All of us are indebted to him for the outstanding job that he did. Fortunately for us, he has returned to research with much enthusiasm. This Progress in Research is a result of Joe's effort.

With new leadership comes change. This volume of Progress in Research is the first one that will be available solely from our web site (http://cyclotron.tamu.edu). The format of the report also has changed. But the science accomplishments by Institute researchers are as impressive as in the past. Some of the recent achievements are noted here.

(1) First experiments have been carried out with BigSol.

(2) An improved understanding of the Deep Inelastic Transfer (DIT) process and its potential usefulness for producing neutron-rich rare beams is resulting from measurement of projectile fragmentation events detected by FAUST and heavy residues selected in MARS, where higher than expected cross sections for neutron-rich nuclides have been observed.

(3) Experimental and theoretical investigations of reactions of 26, 35 and 47 MeV/A ^{64}Zn projectiles with ^{58}Ni, ^{92}Mo and ^{197}Au provide evidence for a multi-fragmentation process in which a hot gas of nucleons and light clusters co-exists with relatively cold intermediate mass fragments.

(4) Nearly all of the isoscalar dipole resonance strength has been located in several heavy nuclei and the position of the compression-mode peak is in better agreement with calculations that use compressibilities obtained from giant monopole resonance positions.

(5) The first precision measurements have been completed in our program to sharpen the test of CKM unitarity via superallowed nuclear beta decay; these measurements utilized the recently completed "precision on-line decay facility", with which we can currently obtain half-lives accurate to 0.04% and beta branching ratios to 0.2%.

(6) A new way to relate direct stellar proton-capture reactions to cross-section measurements with stable beams has been proposed, which employs asymptotic normalization coefficients and charge symmetry; it was used to obtain the rate for ^{7}Be(p,γ)^{8}B from the ^{13}C(^{7}Li,^{8}Li)^{12}C reaction.

(7) Measurements of cross sections for electron loss by U^{28+} ions, in combination with n-body classical-trajectory Monte Carlo calculations, have been used to assess the vacuum requirements for the planned SIS ring at GSI-Darmstadt.

(8) Maximal fluctuations and apparent critical behavior in the disassembly of A ~ 36 nuclei have been found to occur at an excitation energy of 5.6 +- 0.5 MeV/u and a temperature of 8.3 +- 0.5 MeV.

(9) Coalescence of mini-jet partons with those from the quark-gluon plasma produced in relativistic heavy ion collisions is found to be important in understanding the enhanced production of antiprotons and the elliptic flow of various hadrons at intermediate transverse momenta.

Cyclotron Institute scientists remain active in a number of collaborative research efforts around the world. Major programs include: experiments at TRIUMF laboratory to measure heavy (A > 60) superallowed β decays and a measurement of Michel parameters in normal μ^+ decay; new mass measurements using the Canadian Penning Trap (CPT) at Argonne National Laboratory; and continued work with both the BRAHMS and STAR collaborations at RHIC. It is particularly noteworthy that Institute scientists played key roles in the analysis of the d-Au data from the last RHIC run which verified jet quenching in Au-Au collisions.

The K500 cyclotron continues to serve the broader community through testing of radiation effects on electronics components. This past year a bit over 20% of the scheduled accelerator time was devoted to single-event-upset testing. Both U.S. and foreign companies have utilized our facility this past year.

During the past year, two students have completed PhD's at the Institute. They are Tiegang Di and Changhui Li.

As in the previous years, the contributions of Cathy Heaslet and Y.-W. Lui have been invaluable in putting together this report.

R.E. Tribble
September 3, 2003