Introduction
April 1, 2005 – March 31, 2006

Summarized here is the progress in research and operations at the Texas A&M Cyclotron Institute for the period April, 1, 2005 through March 31, 2006. 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. The full volume of this year's Progress in Research is available solely on our web site (http://cyclotron.tamu.edu). *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.*

This has been a good year for Institute faculty. In the fall of 2004, Dr. Saskia Mioduszewski joined the Physics Department and Cyclotron Institute as an Assistant Professor. She was notified in late January that she had been named an A.P Sloan Foundation Fellow. Dr. John Hardy and Dr. Ian Towner shared the 2006 Bonner Prize for their work on $0^+ \rightarrow 0^+$ β decay. John also won a Texas A&M University Association of Former Students Award for Research this year. Dr. Ralf Rapp was promoted to Associate Professor of Physics with tenure effective September, 2006. Dr. Sherry Yennello was named a Fellow of the American Physical Society at the spring APS meeting. And Dr. Carl Gagliardi was named Deputy Spokesperson for the STAR collaboration.

We are now well into the Upgrade Project at the Institute which will ultimately lead to accelerated radioactive beams at intermediate energy. The progress on the project has been very good—we remain on schedule as of the second quarter of FY06. During the year the K500 cyclotron has continued to perform well and we have had significant pressure on beam time both for testing electronics components and for experiments. The experimental program continues to go very well. Some highlights of work over the past year are given below.

Research highlights:

(1) New on-line Penning-trap measurements of transition Q-values relevant to super-allowed beta decay are leading to better precision for several *ft* values. The first measurement, on ^{46}V, disagreed with a previous reaction-based result and led to concern that all reaction-based measurements might have suffered from previously undiscovered systematic errors. However, subsequent measurements, on ^{26}Al^{m} and ^{42}Sc, have confirmed previous reaction-based results on those transitions.

(2) Measurements of ^{7}Be and ^{8}B elastic scattering have led to an upward revision of the value of the ANC for $^{7}\text{Be} + \text{p} \rightarrow {}^{8}\text{B}$ and increase S_{17} from our ANC measurements by about 5%.

(3) Near Fermi-energy heavy ion collisions have been used to determine the nuclear symmetry energy in a clustered nuclear gas at temperatures and densities comparable to those of the neutrinosphere observed in a supernovae explosion.

(4) New measurements of ^{6}Li inelastic scattering demonstrate that they can be used effectively to study the giant monopole resonance (GMR), thus a ^{6}Li target bombarded by rare ion beams can be used to study the GMR in nuclei far from stability.

(5) Significant insights on the flavor, rapidity and system size dependence of anisotropic flows in relativistic heavy ion collisions have been obtained from a multi-phase transport model.

(6) TWIST completed its first measurement of the muon decay parameter $P_{\mu}\xi$ with a precision a factor of two better than any previous direct measurement.

(7) The ANC method has been used to determine the astrophysical factor for the neutron generating reaction, $^{13}C(\alpha,n)^{16}O$, in AGB stars. The result for the *S* factor is significantly smaller than previous measurements suggest.

(8) Based on the assumption of resonance interactions in the QGP, relativistic Langevin simulations of charm and bottom quarks have been performed for 200 GeV/A Au-Au collisions at RHIC. Including coalescence contributions to the hadronization into D and B mesons, the experimentally observed suppression and elliptic flow in (nonphotonic) single-electron decay spectra can be reasonably well described up to a p_t of about 5 GeV.

(9) Using the isoscaling technique and comparisons between experimental data and statistical multi-fragmentation model calculations, there is evidence that the symmetry energy for excited nuclear material is lower than that for ground states of nuclei.

(10) Fully self-consistent calculations of nuclear response functions for various isoscalar and isovector multipolarities have been completed for a wide range of nuclei. The results lead to a consistent value of the nuclear matter incompressibility coefficient for both relativistic and non-relativistic models, contrary to long standing claims of discrepancies.

As in the past, 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; mass measurements using the Canadian Penning Trap (CPT) at Argonne National Laboratory; and continued work with both the BRAHMS and STAR collaborations at RHIC.

As in the past, I am pleased to acknowledge the effort made by Y.-W. Lui in assembling this report. Once again, he has managed it in a very prompt and efficient manner.

R.E. Tribble
July 19, 2006